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# DESIGN OF WATER DISTRIBUTION SYSTEM OF LPU CAMPUS USING EPANET

**Chikkala Tharun [1], Katnam Vinay [2], Polgani Teja[3], Alok Sharma[4]**

[123]Undergraduate Students, School of Civil Engineering
Lovely Professional University, Phagwara, Punjab, India
[4]Assistant Professor, School of Civil Engineering
Lovely Professional University, Phagwara, Punjab, India

***Abstract:*** **The very basic need of every living organism is food and water. Hence water plays a very important role as far as the life is concerned. Hence it becomes necessary to conserve water and use water efficiently. If there is shortage of water then it will result in inconvenience to human life as well as it will impact city function and industrial production. Design and analysis of water distribution network is important economic parameter, but also because water plays vital role and is a deciding factor as far as the future is concerned. Hence a formulated water distribution network is required to get optimal discharge. EPANET is a computer-based program which performs extended period simulation of hydraulic as well as water quality analysis. EPANET is designed as a research tool to understand the movement and fate of drinking water constituents in better way. This study represents the role of EPANET software in water distribution network.**

***Index Terms*** **- EPANET, Water distribution network, Hardy cross method, Pipe networks.**

## I. INTRODUCTION

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. It can be used for many different kinds of applications in distribution systems analysis. Sampling program design, hydraulic model calibration, chlorine residual analysis, and consumer exposure assessment are some examples. 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.

## II. OBJECTIVE OF STUDY

- The main purpose of the water distribution network is to supply water at adequate pressure and flow in the performance of urban areas and portable quality of water to the consumers.
- This will show the effective analysis and distribution of network of pipes using EPANET tool as well as the Hardy cross method and Newton-Raphson method. EPANET also provides hydraulic analysis that can handle systems of any size.
- EPANET tracks the flow of water in each pipe, the pressure at each node and height of water in each tank throughout the network.

## III. METHODOLOGY

This report is aimed at study and designing of water distribution system using EPANET software.

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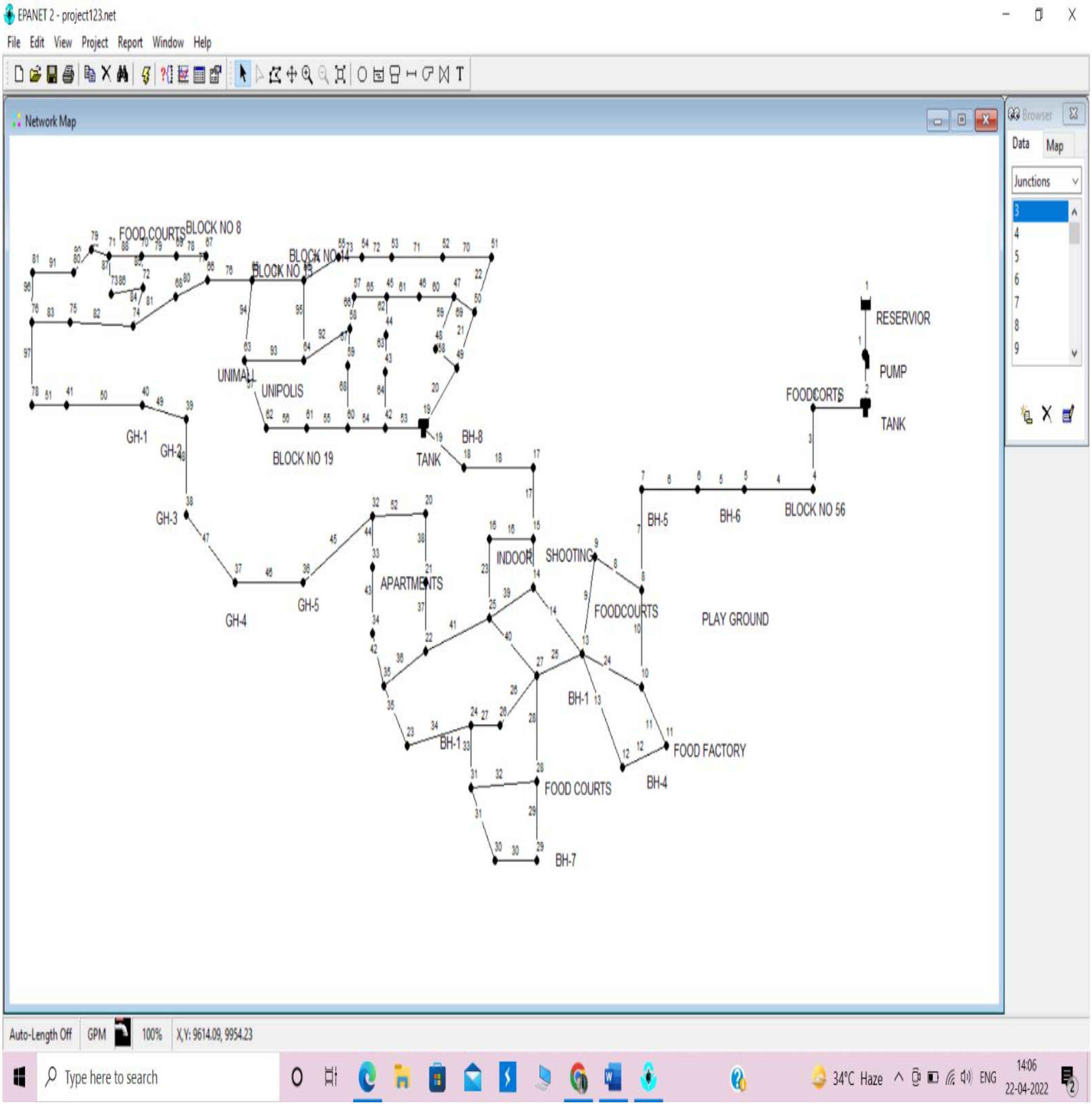
EPANET can help assess alternative management strategies for improving water quality throughout a system. These can include:
• Altering source utilization within multiple source systems

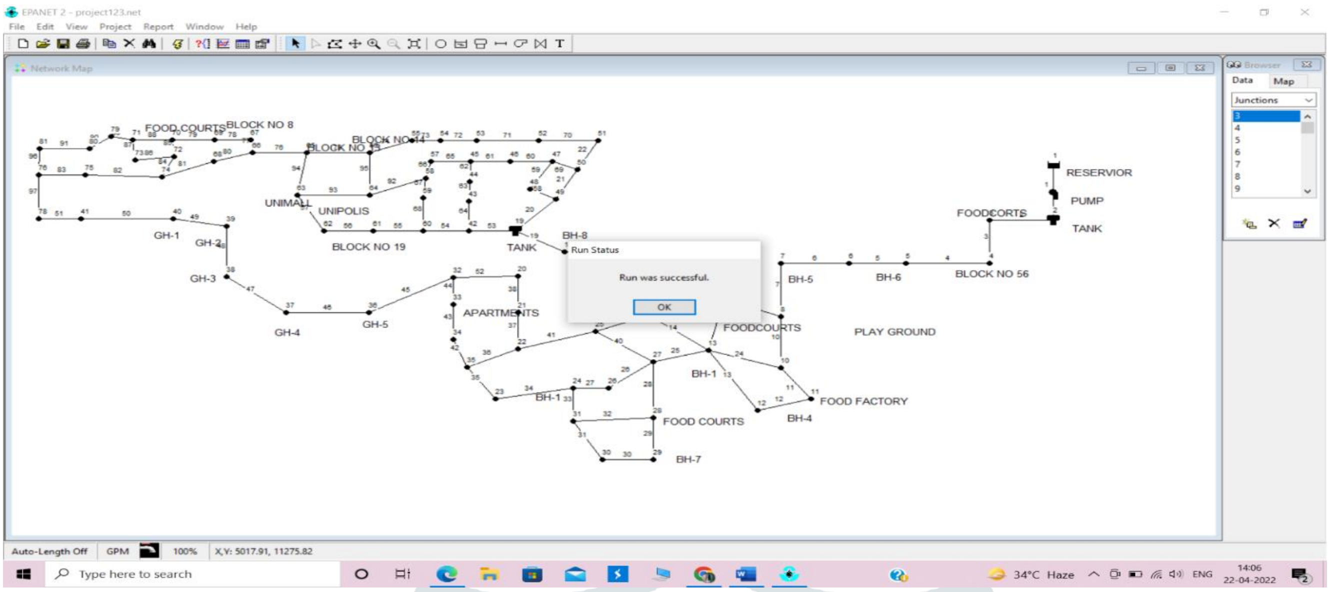
- Altering pumping and tank filling/emptying schedules
- Use of satellite treatment, such as re-chlorination at storage tanks
- Targeted pipe cleaning and replacement

## IV. DISCUSSIONS

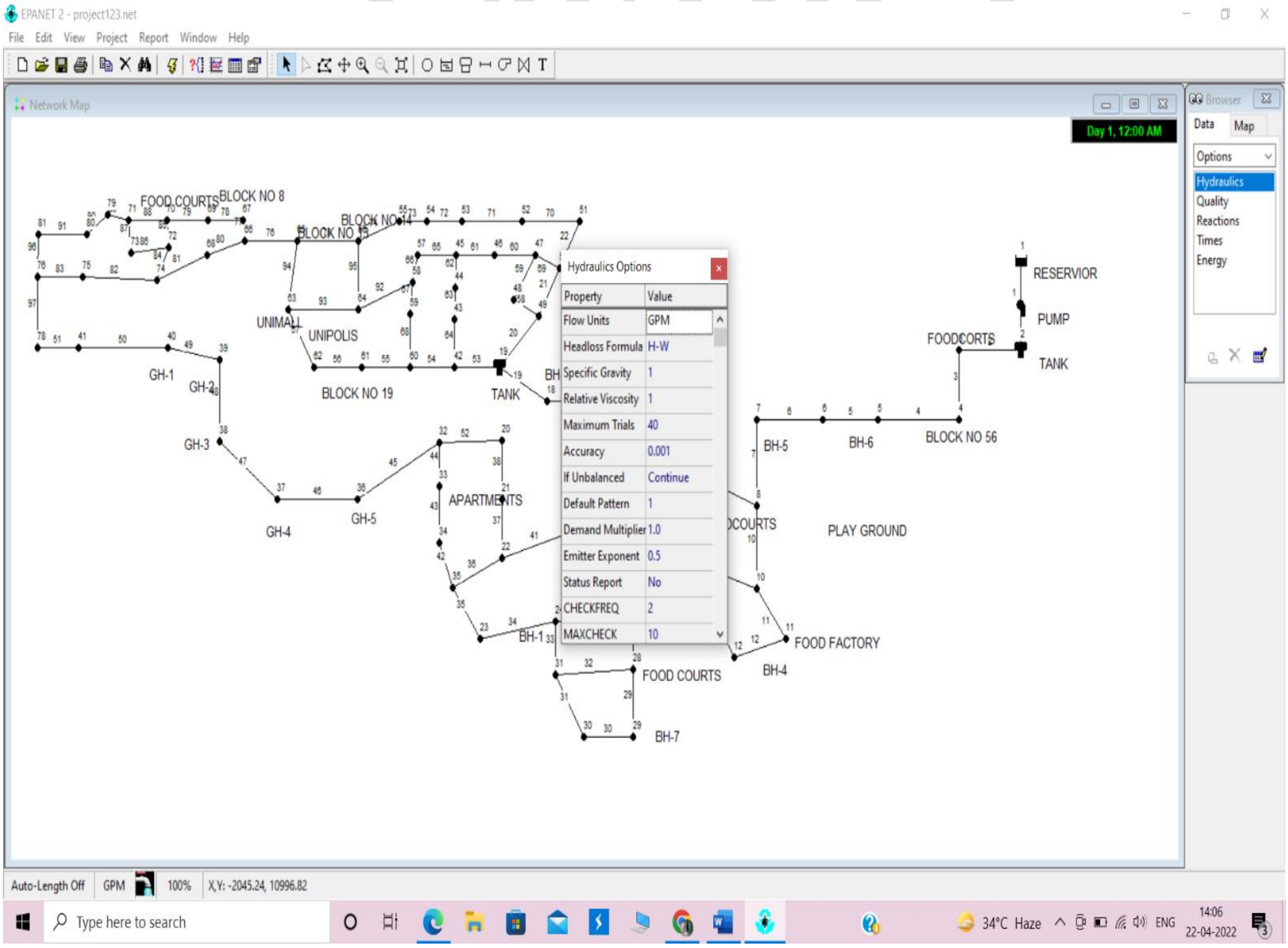
### 1. Plan of water distribution network of LPU campus using EPANET software



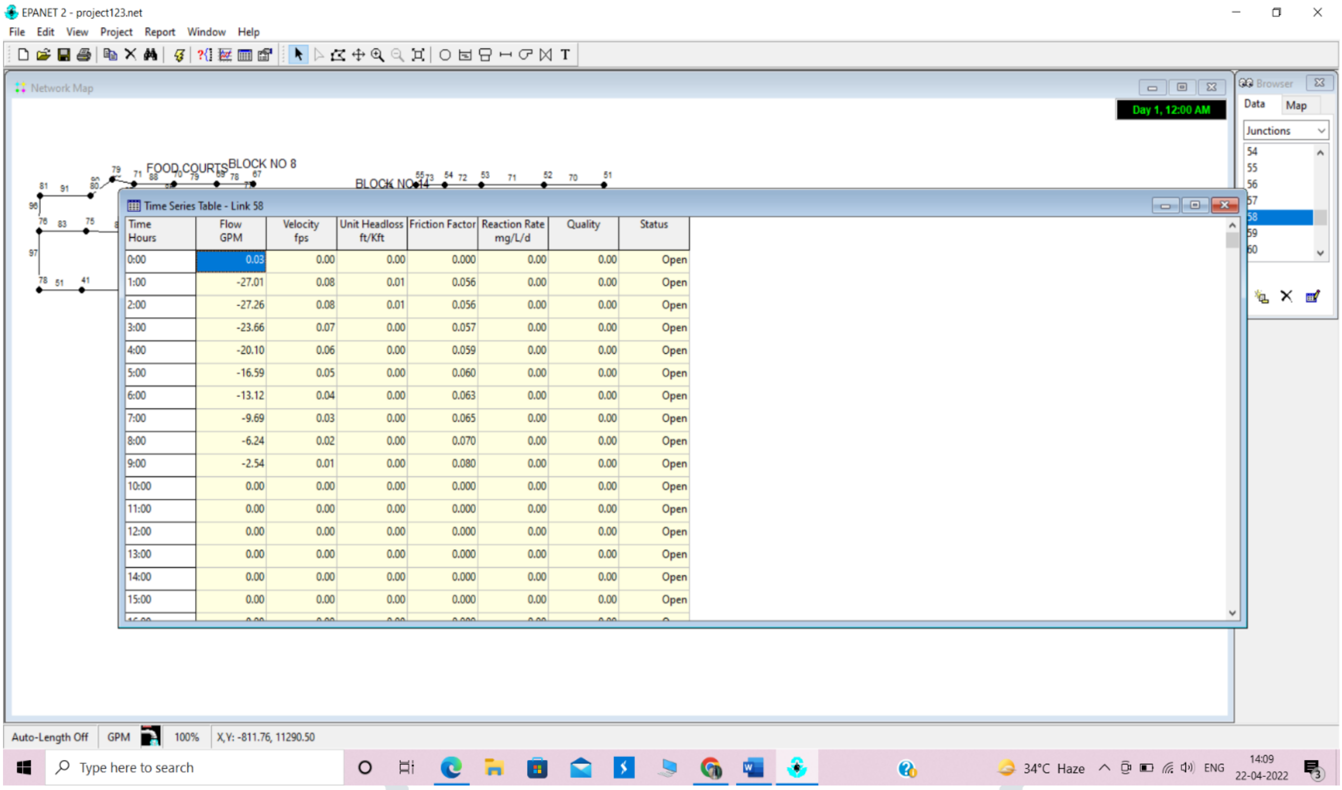
**2. Successful execution of water distribution network diagram**



**3. Hydraulic properties of water distribution system**

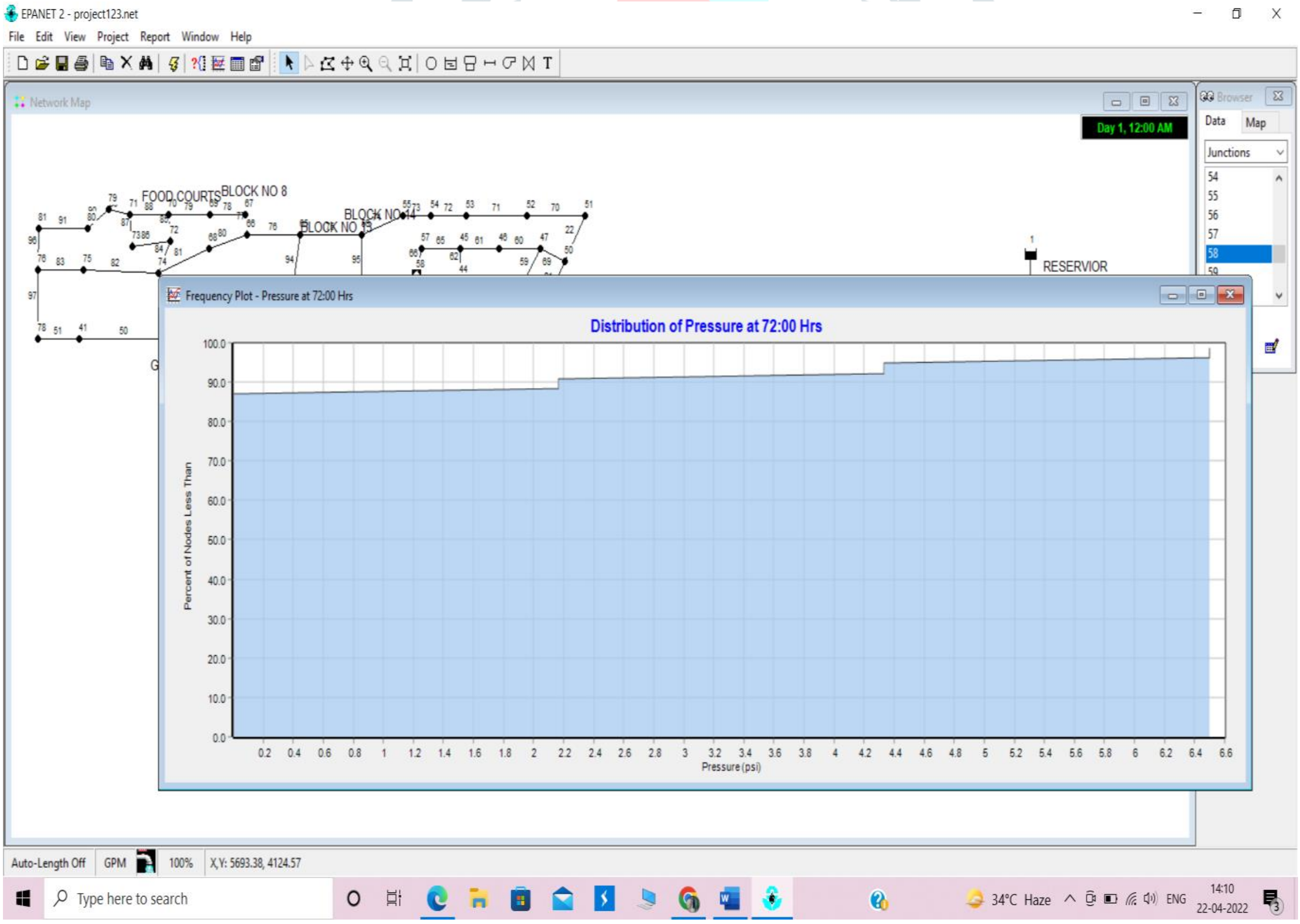


**4. Time series table for this water distribution network diagram**

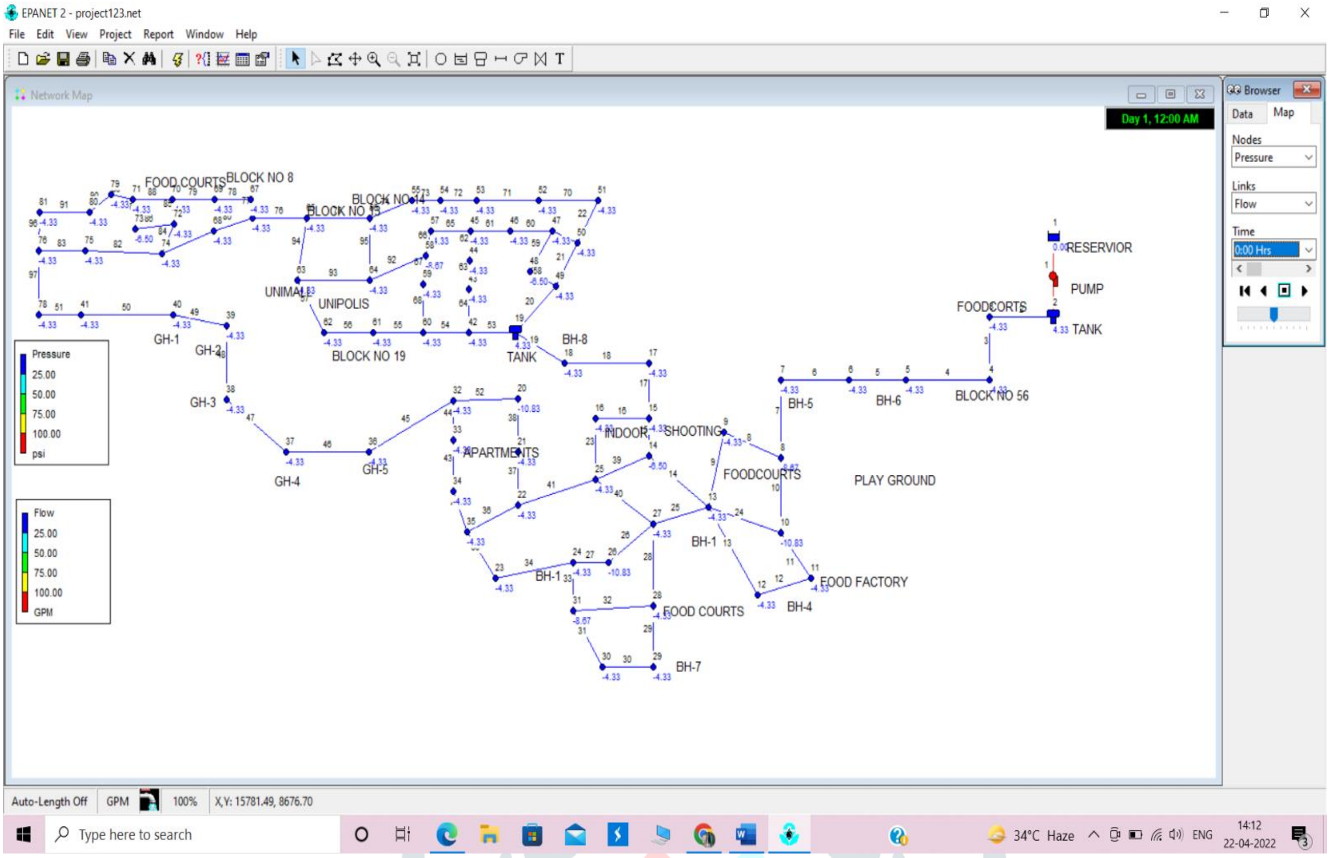



| Time Hours | Flow GPM | Velocity fps | Unit Headloss ft/Kft | Friction Factor | Reaction Rate mg/L/d | Quality | Status |
|---|---|---|---|---|---|---|---|
| 0:00 | 0.03 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |
| 1:00 | -27.01 | 0.08 | 0.01 | 0.056 | 0.00 | 0.00 | Open |
| 2:00 | -27.26 | 0.08 | 0.01 | 0.056 | 0.00 | 0.00 | Open |
| 3:00 | -23.66 | 0.07 | 0.00 | 0.057 | 0.00 | 0.00 | Open |
| 4:00 | -20.10 | 0.06 | 0.00 | 0.059 | 0.00 | 0.00 | Open |
| 5:00 | -16.59 | 0.05 | 0.00 | 0.060 | 0.00 | 0.00 | Open |
| 6:00 | -13.12 | 0.04 | 0.00 | 0.063 | 0.00 | 0.00 | Open |
| 7:00 | -9.69 | 0.03 | 0.00 | 0.065 | 0.00 | 0.00 | Open |
| 8:00 | -6.24 | 0.02 | 0.00 | 0.070 | 0.00 | 0.00 | Open |
| 9:00 | -2.54 | 0.01 | 0.00 | 0.080 | 0.00 | 0.00 | Open |
| 10:00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |
| 11:00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |
| 12:00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |
| 13:00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |
| 14:00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |
| 15:00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00 | 0.00 | Open |

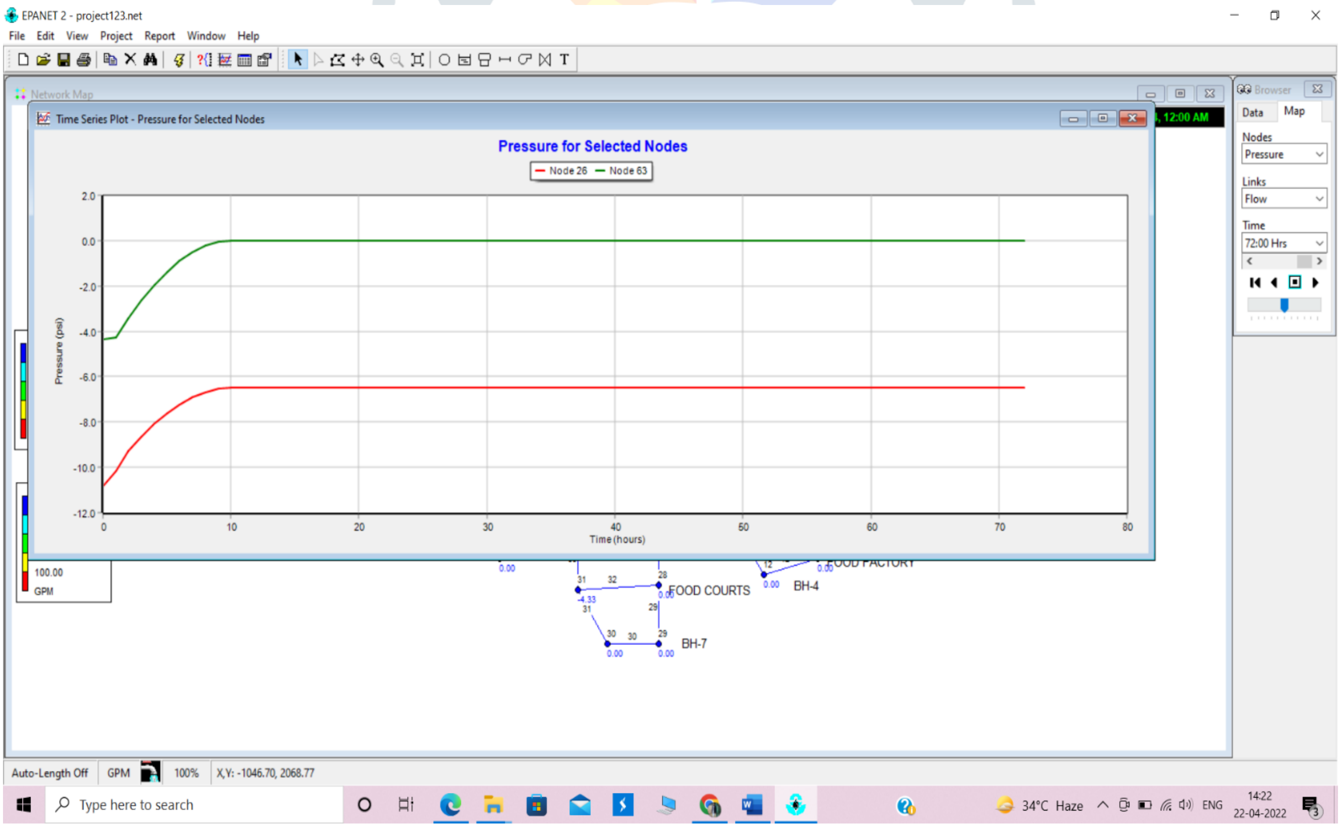
**5. Long term simulation using pressure distribution for 72 hours**



## 6. Pressure vs Flow diagram




## 7. Pressure variation between node26 – node63

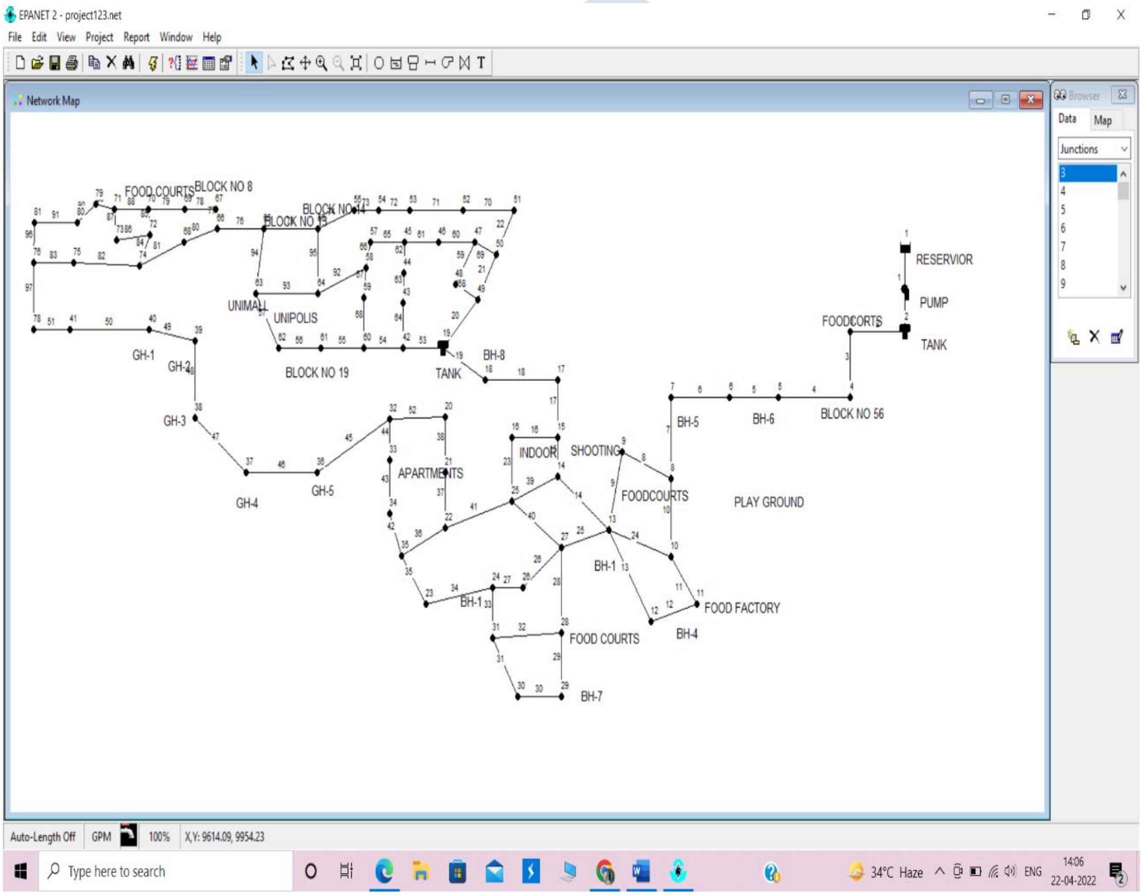


## V. Results and discussion

WATER SYSTEM LOSSES

Losses from a water distribution system consists of Leakage and over – flow from service reservoirs, Leakage from main and service pipe connections, Leakage and losses on customer premises when they get un – metered house hold supply, Under – registration of supply meters and large leakage or wastage from public tabs. In the case of well-maintained and fully metered water distribution system, the losses may hardly exceed 20% of the total consumption. In a system where supply is partly metered and partly – metered the losses may be up to 50% of the total supply.

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. The analysis of any water distribution network includes determining quantities of flow & head losses in the various pipe lines, & resulting in residual pressure at various demands in the network junctions. In this research the distribution network of lpu campus was obtained & analyzed. It consists of 97 pipes, 81 junctions, 2tanks & 1 source reservoir from which water is pumped & distributed to the network, as shown below:




## VI. Conclusion

From above study it was concluded that;

EPANET software is time saving and has no limitation for number of nodes, number of pipes or pumps to be modelled and analyzed in it so complex networks can be easily solved. As the number of iterations increase, the value of head loss becomes closer to zero and to verify the obtained answers, balancing of flows at each point is done. The results obtained using Hardy Cross method and EPANET software are nearly equal. Newton-Raphson method is quite difficult to for the analysis of large network, but it gives acceptable result in a smaller number of iterations.

## VII. Acknowledgment

We would like to express our sincere thanks to our project coordinator, Mr. Alok Sharma, for giving us the opportunity to work on the project and also for helping us to complete it. All in all, we would like to thank everyone involved in this project and helped us with their suggestions to make the project better.

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