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Design and Analysis of Chandi Group of Water Distribution Network Using Water GEMS Software

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ABSTRACT: Contemporary issue related to water distribution system (WDS) about its design is complicated. The basic crucial amenity for a healthy living is Safe Potable Water Supply. Water is life for all living being on the earth as it is essential element required for the edibles of life. Water supply network are expensive infrastructure designed with a goal of minimizing the overall cost, while meeting the water demand needs in the sufficient quantity, quality and at satisfactory pressure. As present scenario of Chandi group of villages in Madhya Pradesh has increasing population thereby increase in the demand, so to fulfil it efficient designing of water distribution network is must. For design of Chandi group of water distribution network study of present population, with forecasted population of three decades, daily water demand, and its detailed survey carried out by Auto level. Survey map with detail of elevation and its length of pipeline required for the villages calculated. WaterGEMS software which adopts algorithm based on Gradient method gives optimum solution for the design of water supply network. The system of pipeline network containing of one source node and several demand notes is considered to optimize geometrical design, which delivers the demand from source to consumer for long interval. WaterGEMS involves variable decisions that are pipe diameters, reservoir elevation & its capacity with a primary variable. The result obtained is represented by using various colour coding of pipe dia., tables and graphs which helps to discover what better can be adopted. WaterGEMS also track the flow of water, pressure at each node, each pipe and height of water in tank during simulation.

KEYWORDS: Demand, Google Earth Pro, Water supply network, WaterGEMS, AutoCAD, (Overhead tank) OHT

I. INTRODUCTION

The Chandi group of water supply scheme has been design for the 15 villages in Chapara block, Seoni District, Madhya Pradesh which comes under the category of urban water supply scheme. It is sited at 22° 23' 29.63" North & 79° 37' 55.54" East.

The water supply of the concern village in Seoni district of Madhya Pradesh is based on groundwater, but the ground water condition in this area is not suitable. Due to this reason, the area is facing acute shortage of drinking water, especially during summer season. Hence the scheme has been prepared. The villages of the project area are expanding at a faster rate.

Water is essential requirement. Provision of adequate and safe drinking water to the burgeoning urban inhabitants continues to be one of the foremost challenging tasks. Shortage of safe drinking water could weaken the health and wellbeing of the people, mainly the urban poor and economically weaker sections.

Chandi group of village scheme is to be designed for two decades i.e. Base year as 2023 and ultimate year as 2043.

II. OBJECTIVES

The objectives of project are:

- 1) To design Chandi group of water supply scheme of urban drinking water supply to be implemented in Chapara block of Madhya Pradesh.
- 2) To make Chandi group of villages reliable on water supply network for 24 hours.
- 3) To minimize the overall cost of project by using WaterGEMS software.
- 4) To provide the most economical project design and best utilisation of resources.
- 5) It ensures that there is no intrusion of population in the distribution system does ensuring quality of water distributed.

6) To provide a high level of consumer satisfaction.

7) To save from sustainable indirect cost on local storage and purification/ disinfection equipment to be provided at consumer end by the consumers.

III. ABOUT SOFTWARE

WaterGEMS software uses gradient method through which optimal solution for Chandi group of village's network can be obtained. Network is marked using Modelbuilder and AutoCAD. Elevation is loaded by using Trex tool. Demand, is loaded using demand centre. After loading the demand, the software is run and analysis, which gives design of network. The various parameters obtained from result give economical diameter optimum cost, minimum headloss, and pressure within the range. WaterGEMS uses equation of Darcy-Weisbach for calculating headloss. Various diameter pipes obtained by result are compared with Jaltantra software and are fixed as per economical.

IV. METHODOLOGY

The following steps are to be followed

1. Detailed survey of Chandi group of water supply scheme is carried out, to obtain elevation data of site and road network.
2. Data collected consist of topography map, and population of past four decades as per censuses.
3. Population is forecasted for future two decades i.e. for year 2023 & 2043, by using Increase in decades, Incremental increase method, Rate of growth, Geometric progression, Arithmetical progression.
4. Demand is calculated by taking extra 5% institutional demand, 5% fire demand, and 15% losses all together comes to be gross demand.
5. Marking of pipeline network using AutoCAD software using Google Earth and survey drawing as reference.
6. Now the hydraulic modelling is being carried out using following steps
 - a) Creating new model using WaterGEMS model.
 - b) Creating shapefiles and bringing it to WaterGEMS software bring pipeline network in model. Reservoir network is then drawn using connection of pipe and junction for different area, with the help of toolbar present in top ribbon. by assigning node number, length and C-value.
 - b) Finalizing the position of OTH, such that it has highest elevation and space available for construction is easily available.
 - c) Particular staging is allotted to respective OHT so that there is no water hammer in pipe network and flow is through gravity.
 - d) Respective elevation for junction is loaded by using Trex tool, in background Bingmap is kept for reference.
 - e) Respective OHT demand is entered by using demand centre.
 - f) Model is computed and analysed with various parameters.
 - g) Drawing are sets in ArcGIS Map.

V. RESULTS

The results obtained after running Bentley WaterGEMS software which is then compared with Jaltantra software gives economical diameter and efficient staging height. The design of Clear Water Rising Mains, Raw Water Rising Mains, and Gravity Mains are obtained with pipe table, junction table, and tank table. With the help of software, most economical diameter of pipe is selected taking into account that it is readily available. Fig (a) Population sheet (b) Demand sheet (c) AutoCAD Drawing with Google Earth in background. (d) Key plan (e) Gravity Mains (f) Distribution WaterGEMS Models. (g) Pipe table (h) Junction table (i) tank table of chandi group of villages. Fig (j) Jaltantra software window (k) Main input file (l) output file.

Fig (a)

(b)

(c)

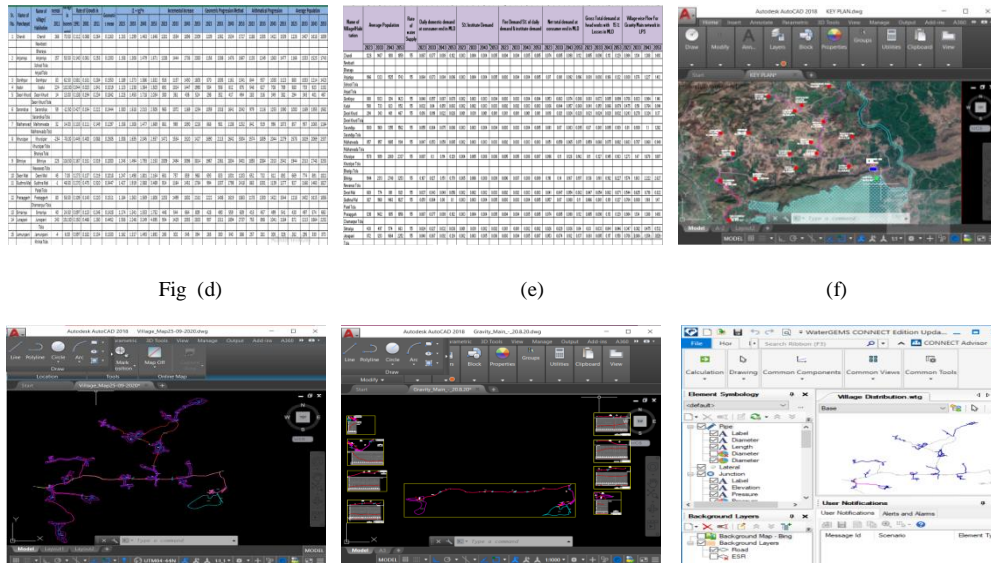


Fig. 1. Software based images (a)Population sheet (b) Demand sheet(c)AutoCAD Drawing with Google Earth in background (d) key plan (e) Gravity Mains (f) Distribution WaterGEMS Models.

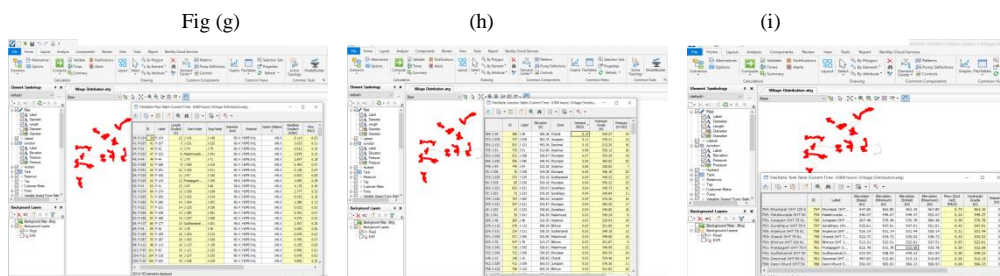


Fig. 2.Output tables obtained from Water GEMS (g) Pipe table (h) Junction table (i) Tank table.

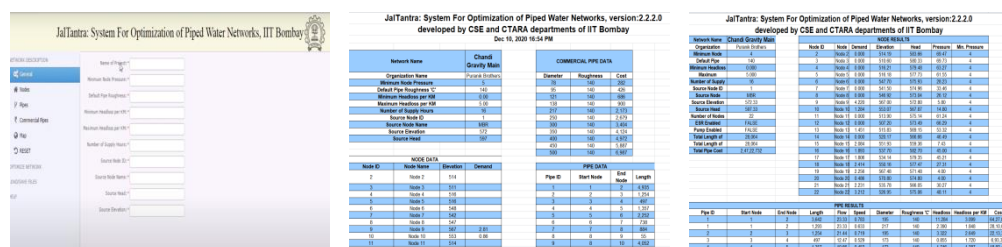


Fig. 3 Output obtained from Jaltantra software (j) Jaltantra window (k) Input file (l) Output file

VI. CONCLUSION

Chandi group of water supply scheme designed by using WaterGEMS Software gives optimal solution. The result obtained gives economical diameter, with minimum headloss and frictional losses. The scheme is designed for 20 yearsfor 24*7 water facilities.The result obtained is comparative from Bently WaterGEMS and Jaltantra.



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