IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, January 2023
Impact Factor: 7.301

Analyse and Design of Equitable Water Supply for Rural Water Distribution Network

Miss. Nirmala Dhakal[1], Miss. Snehal Shinde[2], Mr. Kumar Hubale[3], Mr. Nikhil Yadav[4], Mr. Suraj Shinde.[5]
B.Tech Students, Department of Civil Engineering[1,2,3,4]
Assistant Professor, Department of Civil Engineering[5]
Arvind Gavali College of Engineering, Satara, Maharashtra, India

Abstract: *The most important need of all living things is water. Industrial, household, and irrigating uses all involve the use of water. A water distribution system should be created in the most straightforward method possible to accommodate the growing population. Better living conditions can be provided by an adequate installation. The distribution pipe shouldn't allow the water's quality to decline. A good water distribution system uses less loss to deliver enough pressure at each distribution point. A good water distribution system meets customer demand at the appropriate time. Water distribution network planning and analysis could be a challenging procedure. Groundwater and surface water are just two of the many sources of water used by water supply systems. In most cases, the water is then cleansed.chlorinated for disinfection and occasionally fluoridated. Treated water is either gravity-fed or pumped to a reservoir, which may be on the bottom or elevated like a reservoir. The distribution system is subsequently fed with the water. Pipelines, tanks, basins, pumps, valves, and other hydraulic infrastructure components are included in the water distribution system. Distribution mains, arterial mains, storage basins, and system components such as valves, hydrants, mainline metres, service connections, and backflow preventers are all crucial for producing water for consumers. The pipes that make up the distribution complex are known as distribution main. Their function is to deliver water to customers from water sources or water treatment facilities. A service connection joins the distribution system mains to other plumbing systems or a private building. the ocean. A distribution system is made up of a network of pipes, tanks, and other components that transport drinking water while also serving to protect buildings such as houses, schools, hospitals, workplaces, and other structures from fires.*

Keywords: Fluoridated, Backflow Preventers, Hydrants, Basins

I. INTRODUCTION

Water shortage is experienced in different parts of the world in different magnitude. In certain countries, water deficit is a regular phenomenon and in some other countries it happens for a short duration, due to failure of any component in the system. Shortage of water at source can be best tackled by distributing the available water equally among the consumers. This paper deals with the design of water distribution network capable of equitable supply during shortage in addition to the satisfactory performance under non-deficit condition. Performance of a typical water distribution network, with shortage of water at source is illustrated in detail. Head dependent outflow analysis with extended period simulation, is used to determine the actual supply from each node to consumers. Relationship between duration of supply and volume available at source as well as supply from each node are established for understanding the behaviour of network under low supply situation. A term “inequity” which is the maximum difference in supply demand ratio among different consumers is presented. This is based on the actual performance of the network instead of surrogate measures, generally used for reliability. It is illustrated that the maximum “inequity” in supply in a network during the entire duration of supply can be estimated with single analysis. Design of a water distribution network, duly considering equity in addition to the cost minimization and minimum head requirement is presented. Genetic Algorithm is used for solving this multi objective problem. The solution technique is illustrated using two benchmark problems, namely two loop network and Hanoi network. Results show that considerable improvement in equitable supply can be achieved with additional investment on pipes above the least cost solution. Hence it is better to design networks duly considering

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, January 2023
Impact Factor: 7.301

deficit condition for better reliability. It is also illustrated that it will be difficult to improve equity beyond a limit for a given network, through selection of different pipe diameters.

II. LITERATURE REVIEW

Jagtap R. et all [1], This study is based on assessment of existing water distribution network using EPANET 2.0 software. The pipe network and junction network system is simulated to understand its behavior for different inputs using EPANET 2.0. Simulation has been carried out for hydraulic parameters such as head, pressure and flow rate. The results obtained verify that the pressures at all junctions and the flows with their velocities at all pipes are feasible enough to provide adequate water by the network of the study area.

G. ANISHA et all [2], This research is all about the analysis of the existing network and concludes about the reliability on the network for the future. The analysis is carried out based on various public demands, quantities of inflows and out flows of the over-head reservoirs. This analysis provides the information about various demands, losses, and uses of the public. The design of a new network of supply will make the municipality be aware of the new demands, rate of increase in the demands. The design is made keeping in view of the population growth rate, and the developing town. The design brings out an improvement in the existing network.

Dr. G. Venkata Ramana et all [3], This paper highlights only the effective design and distribution of network of pipes using EPANET tool. The residual head at each and every node was found out by having the elevation as input and thereby the corresponding flow quantities were derived like residual head, velocity and nodal demand etc

III. METHODOLOGY

The current population of study area	840
Total no of households in study area	150
No of shops in area	08
No of primary schools in area	01

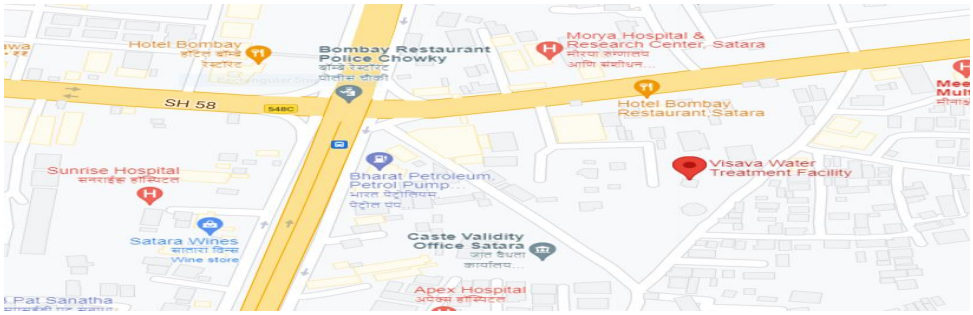
Saigaon Gram panchayat is located in Koregoan tehsil of Satara district. Saigaon gram panchayat has an area of 1.3 sq. Km. Saigaon is located at a distance of 17 km to the southeast of Satara and 14 km south of Koregaon. The study area covers 7 zones of Saigaon village and some eastern parts of Dhamner village attached to Saigaon village.

3.1 Population Forecasting Methods of population forecasting

- Arithmetical increase method.
- Geometrical increase method.
- Incremental increase method.

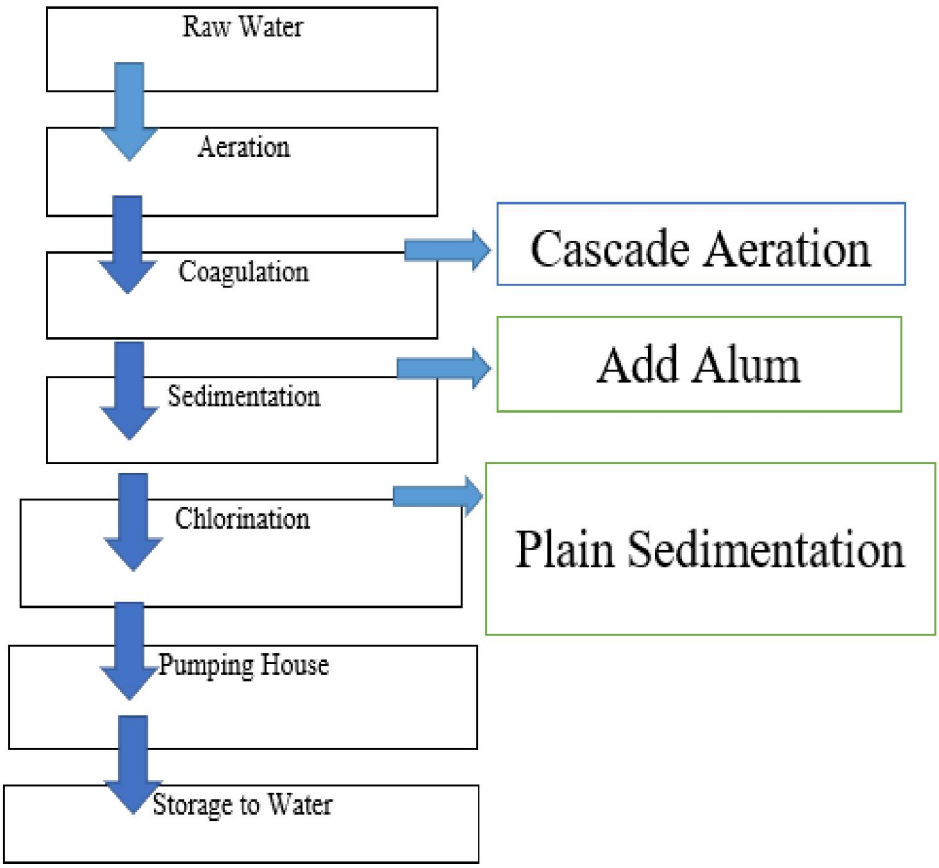
As Saigaon is a small village but the migration rate of population from Karnataka as daily wedge labor is more here. These migrated people work on construction sites or in MIDC AREA near Satara. So here we adopting a method for population forecasting is the “Incremental Increase Method”. The design period for proposed water distribution supply scheme is 30 years. so population forecasting have to be done for the year 2050.

Location: Near NH4 highway at Krishna Nagar, Satara-415015



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, January 2023
Impact Factor: 7.301

3.2 Flow Chart



3.3 Aeration

The water through brought in close contact with air known as Aeration. In this plant used cascade aeration type. In this method, oxygen is absorbed and carbon dioxide is released up to 20%. It removes hydrogen sulphide to remove the odour.

Aeration

In this cascade apparatus having water fall from 3-4 steps made up of cement or mortar. The height of steps about 1-3m while the processes are carried out the falling water. After aeration to remove the bacteria from water add does of alum and TCI with same proportion.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, January 2023
Impact Factor: 7.301

3.4 Coagulation and Flocculation

Coagulation and flocculation may be broadly described as chemical and physical processes that mix coagulating chemicals and flocculation aids with water. The overall purpose is to form particles large enough to be removed by the subsequent settling or filtration processes. Particles in source water that can be removed by coagulation, flocculation, sedimentation, and filtration include colloids, suspended material, bacteria, and other organisms. The size of these particles may vary by several orders of magnitude. Some dissolved material can also be removed through the formation of particles in the coagulation and flocculation processes. Aluminumsulfate salt known as alum [Al2(SO4)3.14H2O] in coagulation involves formation of an assortment of chemical species, called aluminum hydrolysis products, that cause coagulation. These species are formed during and after the time the alum is mixed with the water to be treated. Flocculation is a gentle mixing stage, increases the particle size from submicroscopicmicrofloc to visible suspended particles. The microflocs are brought into contact with each other through the process of slow mixing.

3.5 Sedimentation

Sedimentation is one of the earliest unit operations used in water or wastewater treatment. The sedimentation process, is removal of heavy settleable from turbid water sources to lessen the solids on treatment plant processes. The principals of sedimentation are the same for basins used in either water or wastewater treatment: the equipment and operational methods are also similar. The sedimentation process removes many particles including clay and slit based turbidity, natural organic matter, and other associated impurities.

Sedimentation Tank

In this sedimentation process of treating by plain sedimentation the water is retained in basin so that the suspended particles may down due to gravity force only. In this plant, used radial flow circular tank. The capacity of this tank is MID. The water entering to the tank through the center lintel pipe placed inside the deflection box deflect the water downward side and goes out through the role provided in the bottom side of the deflector box. The water flows radially from the deflector hox towards the circumference of the tank where outlet is provided on the fall. All the suspended particles settle downward the slopy floor.

3.6 Filtration

When sedimentation process removes large percentage of suspended imparities, organic material and small percentage of bacteria. If sedimentation with coagulation is used. Filtration is the process where solids are separated from a liquid. In water treatment, the solids that are not removed by passing the water through beds of sand and gravel. The process of passing the water through the bed of sand layer 18 cm or other granular materials 20 cm.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 2, January 2023
Impact Factor: 7.301

3.7 Filter

When the filters are full of trapped solids, they are backwashed. In this process, clean water and air are pumped backwashed up the filter to dislodge the trapped impurities, and the water carrying the dirt is pumped into the sewerage system, if there is one. Alternatively, it may be discharged back into the source river after a settlement Stage in a sedimentation tank to remove solids.

3.8 Efficiency of Slow Sand Filter

- **Bacterial Load:** The slow sand filter is highly efficient in the removal of Bacterial load from warez. It is expressed that may remove about 98-99 % of bacteria from raw water.
- **Colour:** The slow sand filter has less efficiency the removal of colour of raw water. It removes 20-25 % colour of raw water.
- **Turbidity:** The slow sand filters are less efficient in the removal of turbidity of the extend of about 50ppm for units having greater turbidity 50 ppm.
- **Chlorination:** The process of adding chlorine compound such as sodium hydrochloride to water. This method is used to kill bacteria and other microbes in top water.

In this plant, used gas chlorination process to removal of bacteria. The doses of chloride gas are depending upon the turbidity of water. In plant, the turbidity of water count by the site laboratory. This process is automatically run on the site when chlorine gas may first be dissolved in the small quantity of water and the solution is prepared to point. After completing the chlorination, this water pump house. In this plant, pumps are goes to used.

Horse Power	Head (ml)	Horse Discharge
150	95	2630000
150	95	2630000
270	83	2634000
270	83	634000
135	91	262800
135	91	262800
30	66	24200
30	66	24000

The total capacity of storage of clear water is 28.5 MLD. In this plant, capacity of and plant is 10 lakh liters and in Satara new plant's capacity is 18 lakhs. With the help of pump, this water is distributed in satara city, small villages like khindwadi, shahupu

REFERENCES

[1]. Rushikesh Jagtap, Rakesh Gawali, Vinayak Kanade, SanketThite, Prof P R Gayake, "A Review Paper On Design And Analysis Of Water Distribution System Of ADYPU Campus", International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 05 May 2020.

[2]. G. Anisha, A. Kumar, J. Ashok Kumar, P. Suvarna Raju, "Analysis and Design of Water Distribution Network Using EPANET for Chirala Municipality in Prakasam District of Andhra Pradesh", International Journal of Engineering and Applied Sciences (IJEAS), Volume-3, Issue-4, April 2016.

[3]. Dr. G. Venkata Ramana, Ch. V. S. S. Sudheer, B. Rajasekhar, "Network Analysis Of Water Distribution System In Rural Areas Using EPANET", 13th Computer Control for Water Industry Conference, CCWI 2015

[4]. Athulya.T and Anjali.K.Ullas , "Design of Water Distribution Network Using EPANET Software", International Research Journal of Engineering and Technology (IRJET),

[5]. Kakadiya Shital, MavaniKrunali, Darshan Mehta, Vipin Yadav, "Simulation of Existing Water Distribution Networkby Using Epanet : A Class Study of Surat City", Global Research And Development Journal for Engineering, March 2016