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Transforming an Intermittent into 24x7 Water Supply System: A Case Study

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Abstract - *The concept of 24x7 water supply to the city is not new thing but was in practice in late seventies but limited to some confined area. It deals with the fact that if the pipeline supplying water to the consumer is full for nearly 24 hrs, the tendency of the consumer to store the water more than their requirement is curbed. It further helps the maintenance engineer to detect leakages in the system and there by measure the quantity of water put into the system. The details like actual quantity of water consumed, water billed and the losses in the system can be ascertained easily.*

The C-14 zone (Ajmera) at present receives water supply from Pimpri Chinchwad Municipal Corporation at a rate of 150lit/capita/day. Although the said area is well planned but there are certain problems reported by the consumers while maintaining the water supply scheme over the years. In order to tackle these problems PCMC decided to implement 24x7 concept in the said existing water supply scheme.

This study reveals the modifications required in existing water supply network to make it suitable for continuous water supply. The main aim is transforming an intermittent into 24x7 water supply system in C-14 zone (Ajmera) of PCMC. Data required for study is collected from Water Treatment Plant, and from field surveys & visits. Existing network is hydraulically modelled using WaterGems software. Modifications required such as pressure reducing valves, parallel lines, isolation valves are identified and rectified accordingly.

Key Words*: *Existing Water Supply System, 24x7 Water Supply System, Pressure, WaterGEMS.

1. INTRODUCTION

1.1 Introduction of Project

PCMC : Pimpri Chinchwad Muncipal Corporation (PCMC) is located on Mumbai Pune highway, covers an area of about 181square km. PCMC is considered as richest and one of the fastest growing Municipal Corporations in Maharashtra. PCMC takes many efforts to provide reliable services to the citizens. Water supply is major part of it. It provides quality water to every citizen at optimal cost. Sector no.21 is currently provided with 24x7 water supply. PCMC has taken the work of converting intermittent to 24x7 water supply in 40% area of it.

C-14 at present receives water 2hrs a day. Although area is well planned there are certain problem reported by consumer and in order to tackle these problems PCMC decided to implement 24x7 concept in the said existing water supply scheme.

1.2 Types of Water Supply Systems

1.2.1 Intermittent Water Supply System:

- In this system water is supplied to the users for less than 24 hrs. for specified period.
- Generally water is supplied at peak hours i.e. in morning 6 am to 9 am and evening 5 pm to 8 pm.
- In India this system is generally followed by many cities.
- In this system consumer needs to store water during supply hours.

1.2.2 Continuous Water Supply System:

- In this system water is supplied to the users 24 hrs. a day and 7 days a week.
- The water is adequately pressurized to reach consumers end.
- Consumer need not to store the water.
- Wasting of water is avoided.

1.3 Advantages of 24x7 Water Supply Scheme

- 24x7 system reduces contamination level as the pipes are under positive pressure and entry of contaminants into the pipes is restricted.
- Steady pressure in the pipe increases life of pipe distribution network.
- A better demand management is possible due to metering system and effective leakage control. It is also easy to calculate water charges based on consumed volume.

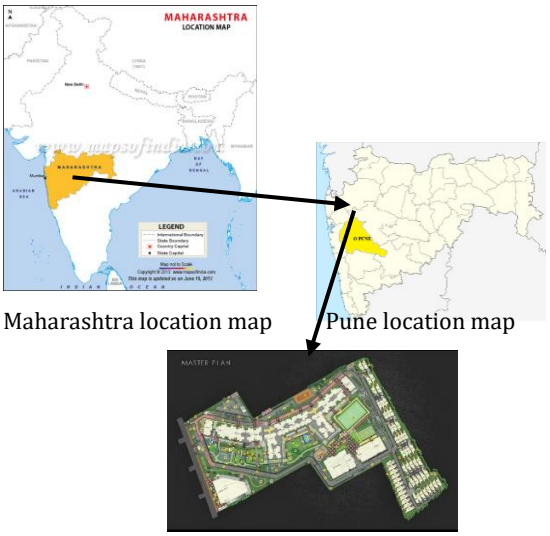
- Reduction in consumption due to change in habit from storing of water to non-storing, also generates excellent consumer satisfaction.
- People can manage their time effectively, they can allot more time for rewarding activities.
- Due to fully metered system easy to carry out water tariff.

1.4 Selection of Pilot Zone

The pilot zone is selected on the basis of following criteria:

- The major reason for selection of C-14 zone is that, it is included in the 40% of the sanctioned areas for transforming existing intermittent water supply system into 24x7 water supply system.
- The zone is easy to isolate.

1.4.1 Location of Study Area



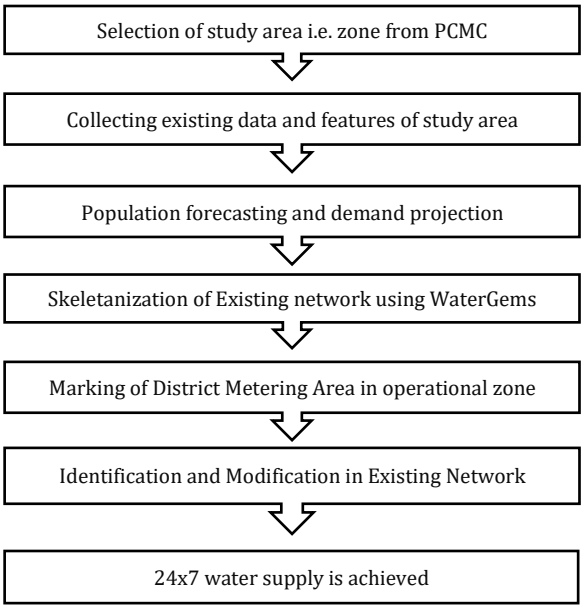
Maharashtra location map Pune location map

Fig-1: Location map of study area

1.5 Introduction of WaterGEMS

WaterGEMS provides with a comprehensive yet easy-to-use decision-support tool for water distribution networks. The software helps improve your knowledge of how infrastructure behaves as a system, how it reacts to operational strategies, and how it should grow as population and demands increase. From fire flow and water quality simulations, to criticality and energy cost analysis, WaterGEMS has everything you need in a flexible multi-platform environment. (As per software developer)

2. METHODOLOGY OF PROJECT



3. DATA INPUTS TO SOFTWARE

3.1 ESR Details:

Table-1: Pipes Details

Ajmera ESR 1	
Ground Level (m)	588.465
LSL(m)	599.465
FSL (m)	603.465
Capacity	1.5 ML
Staging Height. (m)	11
Tank Height. (m)	4
Diameter (m)	22
water level (m)	3.8

Water Supply Timings at ESR 1	
Inlet	1 pm to 2 am
Outlet 1	5:30 am to 7.30 am

3.2 Pipes Details: (C values are taken from CPHEEO Manual)

Table-2: Pipes Details

Label	Length M	Diameter M	Material	Hazen Williams C
P-1	133.82	300	DI	120
P-2	12.96	300	DI	120
P-3	64.15	300	DI	120
P-4	134.88	300	DI	120
P-5	26.33	300	DI	120

3.3 Junction Details:

(Nodal Demand is calculated by Thiessen polygon in WaterGEMS)

Label	Elevation M	Demand L/min
J-1	578.851	0.63
J-2	578.07	1.92
J-3	578.665	1.74
J-4	580.616	3.04
J-5	586.681	0.11

Table-3: Junction Details

3.4 Population Forecasting

There are many mathematical methods of population forecasting. This mathematical methods uses the data of increase in population of past few decades. But as the area is almost developed hence there will not be constant increase in population for design period of 30 years (i.e. up to 2046). Use of mathematical methods will not give correct figure, to avoid this Area Density method is one of the best approach of forecasting.

4 Marking Existing Network

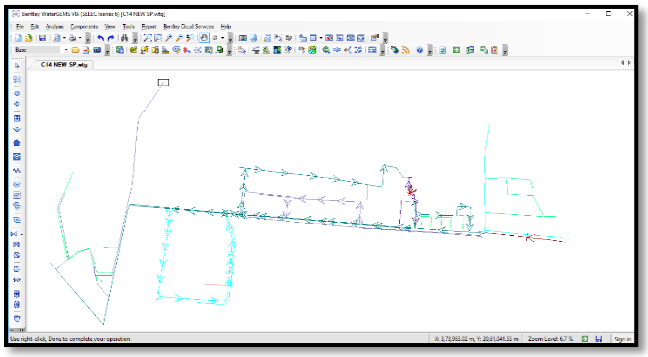


Fig-2: Marking of Existing network of C-14 Zone

5 Modeling of Existing Network

In existing water supply network there is high pressure region (i.e. Pressure greater than 21m H_2O, as shown in fig-3). Pressure shown by red color is pressure above range.

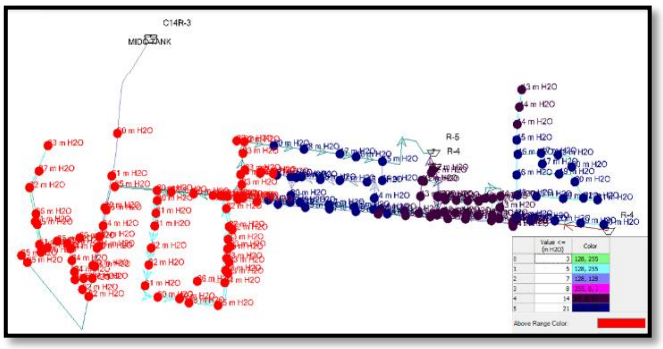


Fig-3: Existing Scenario of C-14 Zone

6 Marking of District Metering Areas (DMA)

Each DMA is hydraulically discrete (isolable) from adjoining area (as shown in fig-4). It is fed with water from single point, the flow and pressures at key locations are continuously metered and measured which then give indication of the extent of leakages as well as high flow rates.

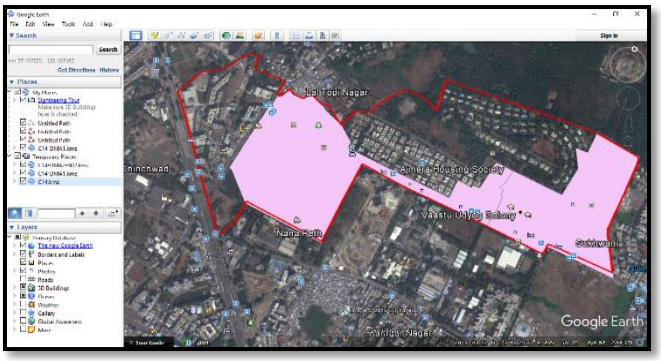


Fig-4: Marking of DMAs

7 Introducing Pressure Reducing Valve

Pressure reducing valves are introduced at low lying areas (i.e. areas having low elevation). Two PRVs of 300mm dia. each (as shown in fig-5) is introduced which reduced pressure from 27m H_2O to 14m H_2O.

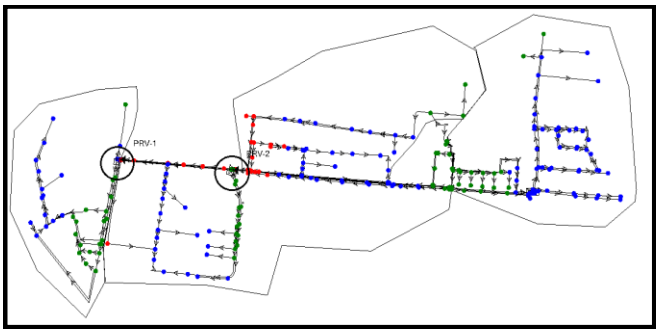


Fig-5: Introducing Pressure Reducing Valve

8 Implementing Required Pipes:

There was a requirement of new pipes in some patrs of the zone (shown in fig-6), accordingly new pipes of 4822.18m length is introduced.

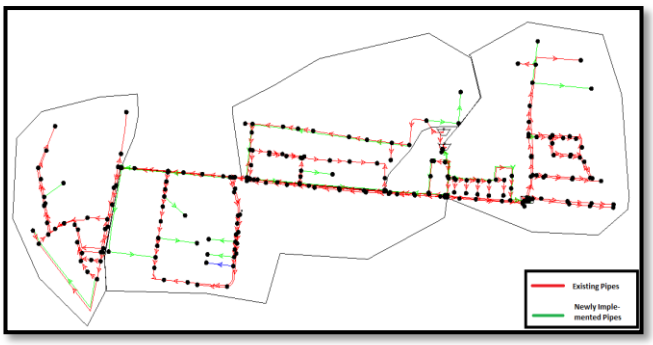


Fig-6: New Pipes Requirement

9 Proposed Scenario of 24x7 WSS

From existing system water use from MIDC tank is completely eliminated in proposed system. Also the lines of more than 200mm in dia. using as feeder and having tapings are kept as a supply line and separate parallel feeder mains are introduced. Fig-7 shows final proposed pressure scenario. With pressure range of 7m H_2O to 21 m H_2O.

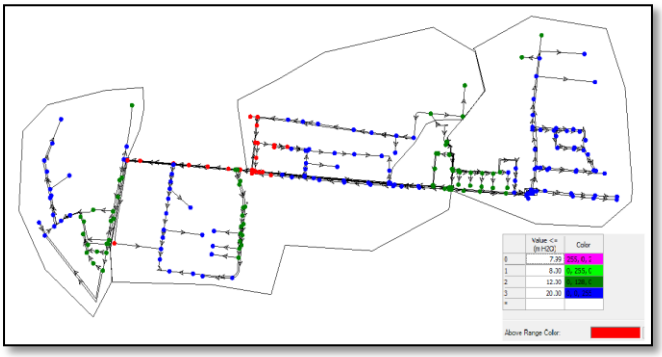


Fig-7: Proposed Scenario of C-14 zone (Pressure)

10 SUGGESTIONS

- For implementing 24x7 water supply system, divide the area into different parts (i.e. DMAs) depending on topography of the area i.e. roads, rivers, streams, nallahs, etc.
- Allocate different feeder mains to different parts.
- Introduce pressure reducing valves at points having lower elevations.
- The pipelines of diameter 200 mm and more used as feeder main and having tapings on it, keep as a supply line and introduce separate parallel feeder mains.
- Use isolation valves to control water supply distribution system.

11 CONCLUSIONS

- The water provided by PCMC to whole area is of good quality and meets safe permissible limit.
- In C-14 zone existing network is modified, by implementing pressure reducing valves, isolation valves, required pipe network and feeder mains.
- To maintain the pressure between 7m H_2O to 21m H_2O maintain head equal to 1/3 tank height.
- Dividing zone into DMAs helps to maintain pressure in a range and better operation of system.
- For efficient working of water supply system, to prevent water loss public participation and awareness is must.

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