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A Case Study of Water Treatment Plant at Navsari- Problems, Solutions and Upgradation

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Abstract--The main goal of this project was to make the water treatment plant at Navsari more efficient in terms of quality of water supplied, operation & maintenance of the plant, and minimizing water losses in distribution. Navsari Nagarpalika is supplying water to Navsari city after passing it through the plant. It provides daily 30 MLD water supplies presently. The main source of raw water for the plant is Dudhiya Talav. The main problem of the plant is that it receives raw water supply 15 days a monthfrom the Kakrapar Dam which is insufficient. Also the plant lacks automation and metering facilities. Further, the electric motors and submersible pumps installed in the plant are inefficient and causing electrical losses to the organization. The findings of the present work would help to overcome the problems and provide appropriate solutions in order to run the plant efficiently. As the water demand is increasing day by day in the city, these solutions will help the plant to operate at its optimum level - 36 MLD per day- and meet the water demands of the Navsari Town.

Keywords: MLD, Water Treatment Plant

1. INTRODUCTION

Water is essential for life and a vital natural resource for all the economic activities. Throughout the history, cities have survived or failed because of water. The water supply in the city is the vital life blood that keeps a city going. So water is an important resource available to humans and fresh water is even more important because of its limited availability and erratic distribution over space and time. India roughly accounts for 4.5% of the world's fresh water resources, while at the same time it accounts for 2.5% of the total land mass and 16% of the total population.

Urban water supply plays a critical role in urban prosperity and environmental sustainability. It has strong links with the productivity of urban economics and hence with their growth, poverty reduction and environmental health. Urban areas presently face severe concerns emerging from the gap between the demand and supply of urban services due to inadequate finances and ineffective governance. Urban water supply financing requirement far outweighs the limited resources available from the government resources.
Navsari city is a vibrant area in southern Gujarat, situated on the bank of Purna River, within a few kilometers of river's delta, which is west of city and empties into the Gulf of Khambhat. The town is located on Mumbai-Ahmedabad western railway corridor. The textiles, sugar industry, agro& food processing, paper, and chemicals are some of the key business sectors in Navsari. A diamond industry is also a key business in Navsari as it is located near Surat. The weather is sunny from September to May, and rainy from June to August. The average maximum and minimum temperatures are 40ºc and 18ºc respectively. Navsari is located in high rainfall agro-climatic zone. The annual rainfall for last 20 year is 1618mm.
The source of water for the citizens of Navsari till the year 1999 was ground water only. Water was never good quality potable as ground water is mixed with saline water. After 1999, the municipality has constructed treatment plant with design capacity of 36 MLD installed at Dudhiya Talav. The raw water for this plant is obtained from the Kakrapar project canal. This water is stored in an open reservoir known as Dudhiya Talav and an intake well is installed in this reservoir.
This study was conducted with a view to improve the performance of the water treatment plant at Navsari with the following objectives:

(i) To review the present water supply status of the city and to find out the existing financial and operational status of the system.
(ii) To study the present problems of raw water input system of the plant and provide necessary solutions.
(iii) To study the pump's efficiency used in the plant presently and to take necessary steps for up-grading the plant using more efficient pumps as per the requirement.

(iv) To study the performance of valves, their operation maintenance and providing automation in their operation using SCADA (Supervisory Control and Data Acquisition) system.
(v) To study the metering system of water in the plant and providing an efficient Metering system.

Table 1 showing estimated parameter of pipe

Sr. No.	Stage	Arithmetical Increase Method	Geometrical Increase Method	Incremental increase Method	Average
1.	2021	182411	194417	185294	187374
2.	2031	203881	388833	212531	268415
3.	2041	225351	583250	242652	350418

Table 2 showing Average Population as per methods for Navsari

Diameter	1600 mm
Class	NP2
Thickness	25mm
Approximate length of each pipe	2 to 2.5m
Pressure capacity	2 kg
Weight	Heavy
Roughness co-efficient	0.011
Corrosion resistance	Subject to H2Scorrosion due to acids.

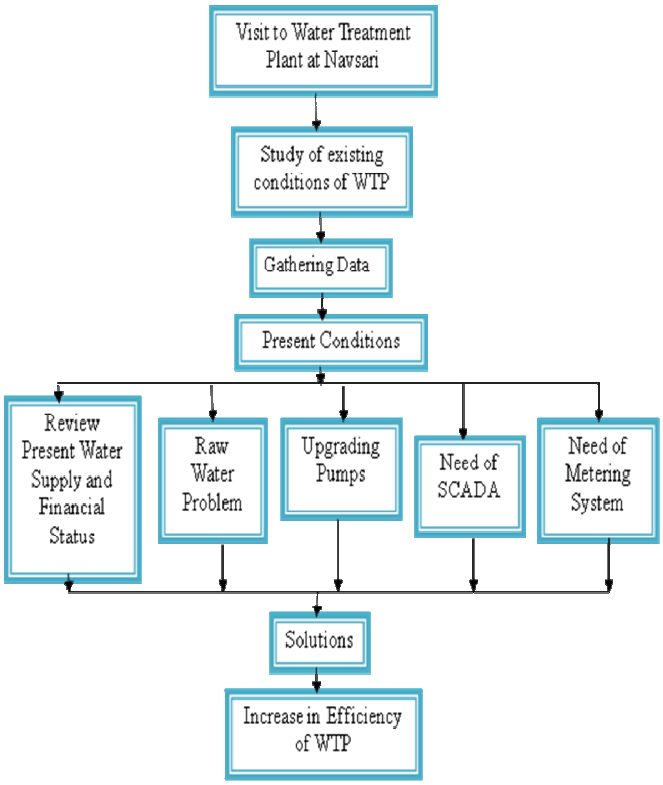
2. METHODS & MATERIALS

The plant was visited for knowing the status of functioning of the plant and also for finding out the problems faced in operation, maintenance and supply of water to the consumers. For this, information was collected from the plant officers and workers along with personal plant observations. Some key financial observations taken during the study are as given below:

- Energy charges are single largest element of annual recurring expenditure which is about 49% of the total expenditure
- Raw water is the second l;argest expenditure component in water supply
- Navsari was able to recover only about 24% of the total expenditure in 2007-08.
- Per capita water loss in water saupply was Rs 113 in 2012-13.

The plant receives water for 15 days only from the canal and hence it does not work at full efficiency. It was also noticed that to improve the efficiency of the Water Treatment Plant emphasis should be given on need of improved metering system because Navsari Nagarpalika has 27 water and drainage pumping stations presently.

The methodology adopted in this project has been shown below through the flowchart.



3. RESULTS AND DISCUSSION

After visiting the plant and collecting the required information about the plant's working, problems faced in operation and maintenance, quality of water supplied and losses incur in water supply metering, the data were analyzed and suitable solutions were sought. Following solutions were suggested to the respective problems faced by the plant in order to improve the performance of the water plant at Navsari:

Inadequate raw water received by the plant:
As the water treatment plant receives raw water from the canal for 15 days only, it faces water shortage for the next

15 days every month. To overcome this problem, a parallel water supply pipeline should be installed from the main canal to the plant to receive full water. Thus the plant will be able to run at full capacity.

Future water requirement of the Navsari polulation:
In order to meet the water requirement of the rising population of Navsari in the times to come, the water requirement of Navsari Nagarpalika up to the year 2041 was estimated which came to about 47 MLD against the present capacity of 36 MLD. for meeting that requirement, the plant's capacity will have to be increased. However, the present plant capacity will be able to supply full water up to the year 2021.

Size of the plant, pipeline and cost for future water supply:
In order to meet the future water requirement of the Navsari population beyond 2021, the plant's capacity would be required to be raised to 47 MLD against the present capacity of 36 MLD. However, in the absence of a new plant with higher capacity, the present plant can be operated by up-grading to supply increased amount of water. For supplying increased amount of water in future, the size of the proposed parallel pipeline can be kept as 1600 mm which would incur a cost of about Rs 9.40 crores.

Requirement of SCADA:
For improving the overall performance of the plant, the SCADA (Supervisory Control and Data Acquisition by means of panels of meters, lights and strip chat recorders) system was suggested to install in the plant. SCADA (Supervisory Control and Data Acquisition) refers to the combination of telemetry and data acquisition.by means of panels of meters, lights and strip chart recorders. SCADA encompasses the collecting of the information, transferring it back to the central site, carrying out any necessary analysis and control and then displaying that information on a number of operator screens or displays. The required control actions are then conveyed back to the process.

Need of efficient water metering system:
Presently Navsari Water Treatment plant is performing better in nearly all indicators when compared to class average or overall average of Gujarat state. However, despite high values of indicators, the service delivery on ground was found to be below satisfactory. The main problems were poor metering of water, low pressure in pipe lines and losses of water in distribution. It was suggested to install new water metering system for minimizing the water losses in the distribution system. For this electromagnetic flow meter was suggested to be installed. By providing efficient Metering and data recording system intake of water treatment plant would be measured more accurately. We would be able study about inter stage losses and would also have required and more precise data regarding the pressure during the supply hours.

Up-gradation of the plant and pumps:
In order to supply the water to the increasing population of the Navsari in the times to come and also in the absence of new plant installed, the plant as well as its pumps need to be up-graded for supplying the required amount of water. Pumps installed in the plants are quite old and worn-out consuming more power and delivering low efficiency. For this, it was suggested to install new pumps in place of very old pumps and measures to take to improve the efficiency of other pumps which are working satisfactorily.

4. CONCLUSION
Presently the plant is not working efficiently. It is receiving less water and there are many losses occurring in the plant. With the new proposed pipeline for supplying raw water, the plant would receive 36 MLD water and the plant would run at its optimum level of 36 MLD. Secondly with the implementation of SCADA system operators would have greater control over all the processes of plant. Accurate data about water intake losses at various stages and pressure during supply will be available and exact amount of water treated within specific time will be known. After the implementation of upgraded pumps, electrical efficiency of the plant will be increased and less power will be consumed. In order to meet the future water requirement, some addition to the plant capacity will be required.

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