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WATER, ENVIRONMENT AND MANAGEMENT

Management of intermittent supplies

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INTRODUCTION

Intermittent water supplies have become common rather than an exception in developing countries. A case in point is the situation in Indian cities where barring a few small cities, the supplies are intermittent. These cities are rapidly growing and are unable to meet their water demand and generally the reason is paucity of funds. Data for a few Indian cities is given in Table 1. In general, with the exception of Delhi and Calicut the prevalent flow rates in the distribution system are more than the estimated peak rates of flow for continuous supplies.

The low demand satisfaction results in inequity of supply. The consumers who are hydraulically better placed tend to draw more water. The pressures in the system also tend to be far below the desired pressures. This also causes considerable hardship to the people particularly those living in higher floors. Majority of service areas have pressure less than 5M, the worst being Madras where handpumps on the service connections are used to draw water on the ground floor. The restriction in hours of supply and low pressures help in reduced leakage losses, which otherwise could be quite high.

Strengthening and zoning of distribution systems are commonly adopted practices for management of intermittent water supplies. This paper highlights a new methodology for leak detection and control of distribution systems.

STRENGTHENING OF DISTRIBUTION SYSTEM

As the rate of flow increases and pressure decreases there is a tendency to strengthen the network to improve the pressure. This results in improved pressures but also results in increased flow rates, thereby necessitating the duration of supply to be cut down.

TABLE 1: DATA ON INDIAN CITIES

CITY	POPULATION (MILLION)	APPROXIMATE TOTAL SUPPLY (MLD)	HOURS OF SUPPLY	AVERAGE FLOW RATE (LPCH)	ESTIMATED 24-HOUR PEAK DEMAND FLOW RATE (LPCH)
AHMEDABAD	2.85	450	4.5	35	27
BARODA	1.00	180	1.5	144	27
BOMBAY	10.7	2800	ABOUT 6	44	33
CALICUT	0.42	35	6 to 9	12	25
DELHI	7.00	1870	VARIABLE (GENERALLY 8)	33	43
HYDERABAD	3.00	475	3	53	27
MADRAS	4.00	280	3 (ALTERNATE DAY)	47	16

Engineers managing these water supplies generally prefer to have small duration supplies with good pressures, as the satisfaction level is better in comparison to supplies with longer hours but poorer pressures. Low pressures result in greater inequity in supplies. In most cities in India, the systems were originally designed for supply to first and second floors, but they attempt now to supply only to ground floor. People who can afford it have built ground level tanks and installed pumps, to have satisfactory supplies within their premises. The construction of these tanks increases the system capacity and hours of supply get further reduced. Some controls are introduced to try and have a via-media between duration of supply and pressure and an attempt is made to provide equity in supply to different consumers.

ZONING OF DISTRIBUTION COMMAND AREAS

Another way of improving the equity is to divide the distribution command area into several zones and supply these zones simultaneously or sequentially. Zoning improves equity in supply. In case of sequential supply the supply hours cannot be increased beyond a certain limit. In case of simultaneous supply, the problem is with zoning itself. It may not be possible to find different outlets to different zones and as a result the problem of inequity in supply may remain. Even where zoning is resorted to, controls as indicated later will improve the situation considerably.

LEAKAGE CONTROL

Any attempt at improvement in hours of supply and pressure would result in considerably increased leakage losses in the distribution system. It is therefore necessary to reduce leakage losses and improve the maintenance of the system. The methods of identification of leak points is quite well established for continuous water supplies. However attempts to use this technology has not been successful because of inability to sustain continuous supply even in small areas of cities which normally have intermittent supplies. Isolating small areas by valves and stop taps and providing a special supply during non-supply hours has been attempted on pilot scale in different cities. It has been possible to assess leakage levels using this method on pilot basis but large scale attempt to reduce leakage levels has not been feasible due to difficulties in arranging special supplies and large amount of wastage of water in attempting to do so.

Recently Tata Consulting Engineers has used water tanker and pumping arrangement to pressurise small isolated areas, which has made it possible to carry out leak detection during non-supply hours. For distribution systems, the method involves segregating a small test area from neighbouring distribution system by isolation of mains and supplying the segregated system from mobile tanker through a water meter. The water passing through the meter, after stable condition is achieved, is the leakage flow rate. The leakage assessment is done at different pressures and leaks are identified using electronic instruments. Repairs are then carried out for the identified leak points. Retests are performed to confirm the efficacy of repairs.

CONTROLLING OF DISTRIBUTION SYSTEM

Each consumer has a defined capacity to draw water with respect to pressure on the main, from where the connection has been taken. Each node in a distribution network is governed by an 'H-Q' relationship. For a particular head at the source point, a unique flow will satisfy all these 'H-Q' relationships at the nodes. In other words a 'H-Q' relationship can be developed for the source point. Comparing the nodal flows obtained from analysis vis-a-vis allocations, limiting pressures at nodes can be assessed. It is desirable to introduce minimum controls. Accordingly it is essential to carry out sensitivity analysis of introducing various controls on the system at large. It will be appreciated that theoretically flows can be fully controlled if each connection is controlled but it is found in a number of examples that 80% equity can be achieved with few controls. However determining these controls require complete system data and in-depth analysis. Controls would tend to

increase the hours of supply as well as pressure and cost much less in comparison to strengthening a network.

ROLE OF ACCURATE DATA

The knowledge of the distribution system, particularly of the small size is generally with the operator of the system. Invariably maps are either not at all available or are old and require updating. The number and sizes of connections between two junctions are also not easily available. Any attempt to design or control is solely based on staff's intuition, backed up by knowledge gained over years of operating the system. This is not very satisfactory. A systematic approach is possible, as indicated, using computers to decide controls, strengthening and zones that would be effective, but good maps and adequate data is an essential pre-requisite.

CONCLUSION

There are following specific requirements for better management of intermittent supplies:

i) Leakage control
ii) Flow/pressure control

Control is better than strengthening but requires complete system data and in-depth analysis. Accurate record keeping is a pre-requisite.

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