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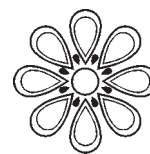
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Occurrence of salinity in Gujarat

J.M. Barot, India

THE STATE OF Gujarat is located in western part of India between 20° 6'N to 24° 4'N latitude and 68° 10'E to 72° 28'E longitude. It is the 9th largest state in the country having an area of 1,06,000 sq.km. The State ranks first in the country for industrial development having more than 16000 working industries, employing over 8 million people.

Shortage of water

Gujarat is one of the worst placed States in the country so far as availability of water is concerned. Having wide variations in the rainfall. Many areas in Kutch - Saurashtra and North Gujarat regions receive on average 400mm of rainfall and at times no rains at all. An area of 2300 sq.km in Kutch is under the effects of desert, where, in addition to scanty rainfall, the ground waters are saline. The districts of North Gujarat particularly Banaskantha and Mehsana are receiving scanty rainfall facing arid to semi-arid conditions. 42 blocks are drought prone in the State. Salient reasons for shortage of water coupled with salinity could be summarized as under:

- Because of the scanty rainfall major dependence is on ground water but ground water is not constant everywhere.
- Drought situation is a recurring phenomenon in these regions. Drought pattern in Gujarat follows the following course:
 - Normal drought - once in 3 to 7 years
 - Severe drought - once in 7 to 10 years
 - Very severe drought - once in 14 to 20 years
 - In the current century, Gujarat has faced 33 droughts so far
 - Since the separate State of Gujarat came into existence in 1960 it has faced 12 droughts.
- There are no more perennial rivers in Gujarat except a few in the south Gujarat. Out of total 185 rivers, 168 rivers are in drought prone areas alone and all of them are non-perennial, and account for less than 20 per cent of ultimate surface water utilization.
- Rainfall is in a short spell of time (about 20 days) during June to September and the length of rivers are so short and with steep slope that all water run away to sea generating floods during monsoon.
- Evaporation of water from open water bodies is also a major problem. Potential evaporation based on pan evaporation measurement for these regions is 300cm/year.

- There is no substantial natural recharge due to erratic and scanty rainfall.
- The major dependence for water is on under ground sources which are neither sufficient in quantity nor acceptable in quality (High salinity, nitrates, fluoride etc.) at many places.
- The state is potentially advanced in agricultural and industrial development resulting in ever increasing water demand.
- The water resources are severely polluted due to industrial effluents at many places.
- Water tables are going down by 4 to 5 mts. every year due to over drawal resulting into deterioration of quality. At many places the ground waters have gone beyond 350 mts.
- Exploration of ground waters to meet the increasing demand of exploding population is causing sea water intrusion the salinity of mainland areas.

Prevalence of salinity

The State is sharing the longest coastal line in the country i.e. 1600kms out of which Kutch and Saurashtra cover about 1125km which has adversely affected the ground waters by ingress of Salinity. Every year on an average 0.5 to 1.0km distance from the coastline is affected by salinity ingress. Thus about 5 to 7.5 km wide strip of the inland area has been rendered saline till now and water quality has been deteriorated to more than 2000ppm of TDS in an area of 100km². The State has got as many as 15 out of total 19 districts with large areas under the effect of salinity where local ground water development is not possible. Total area covered under the effect of salinity in the State is about 35000sq.km. In the districts of Kutch, Banaskantha, Mehsana, Surendranagar, Rajkot and Jamnagar which are lying adjacent to the desert of Kutch, highly saline waters are encountered from the underground sources in many parts. Due to this large number of water supply schemes are affected by salinity in these areas.

At many areas of North Gujarat, the ground water draft is more than ground water recharge. This has resulted in lowering water levels, known as ground water mining.

This decline in water levels has resulted in following impacts:

- Open wells (shallow wells) have gone dry.
- Deep tube wells are required to be drilled at higher cost.
- Quality of ground water has deteriorated and problems of salinity are aggravated.

- Hardness, fluoride and nitrate have increased.
- The natural gradient of water is changed and saline water has intruded in the inland area.
- Pumping of water from deep strata has increased the electricity demand cost of consumption.

As per an estimate 627 villages of Saurashtra and Kutch region are highly affected by salinity ingress.

A press report of an English daily "Times of India". Ahmedabad edition dated 27.10.93 highlighted the effect of salinity coupled with shortage which stated that "Salinity ingress has spread its tentacles far and wide on the 1125 km long Kutch-Saurashtra coastal belt engulfing 779 villages with a population of 13.3 lacs making the life of the people miserable".

Water in 43,178 wells has become totally saline and nearly 10.65 lacs (1,065 million) hectares of agricultural land has become pastures. The gravity of situation can also be gauged from the fact that numbers of "Ghost villages" on the coastal belt has been increasing for the last two decades with the large scale migration of people to the near by towns and cities. Successive droughts in the region have also rendered all preventive measures taken by the Government useless". One more report published in a Gujarat daily "Sandesh" dated 1.5.94 revealed that 2.5 million acre land and 43000 wells in Saurashtra region have turned saline.

Effects on drinking water supply

Major dependence for drinking water supply particularly in villages is from ground water and ground water get seriously affected by salinity due to over exploitation, poor recharge and ingress of salinity. During the survey carried out under Rajiv Gandhi, National Drinking Mission in 1992, there were 1072 villages found affected by salinity in water, (TDS more than 2000 ppm). In the "No Source Criteria" to identify problem villages, there is a provision of clause to assess the quality of water and if it is found unacceptable in chemical quality then also the village is declared as a problem village and alternative safe source is provided. Large number of villages fall under the list of No Source villages mainly due to shortage of yield and quality (Salinity) of water.

A look at the present status of no source villages in the State will give an indication of the gravity of problem.

Out of total 18275 villages in the State as many as 14928 are facing problem of water and are declared as "No Source Villages". At the end of the fifth five year plan, there were 3844 problem villages which have increased to 16357 in 1987-88. In saurashtra about 4543 villages out of a total 4727 were having problem of water.

Combating measures

The Government of Gujarat appointed a high power committee headed by the Chief Secretary of the State in 1976 to examine the problem of salinity and suggest remedial measures to contain salinity ingress. Based on

the outcome of the report of the committee, and knowing the gravity of problem, the State Government prepared a master plan costing Rs3887 million in 1980 to combat salinity. The World Bank supported this project and implementation started through constructing check dams, recharge tanks, tidal regulators, static barriers and recharging of wells as well as afforestation. In the recent past a revised plan of Rs90000 million is prepared and support from the Netherlands Government is under way.

In addition to providing water supply to the no-source villages on priority basis under the minimum needs programme (MNP) of state government supported by accelerated rural water supply programme (ARWSP), high sum of money is spent on providing relief to the scarcity hit villages. The State Government had to spend Rs47 million providing 3.15 million litres of water per day for sixty days through railway tankers to city Rajkot in Saurashtra region during 1986-87. It was for the first time in the country for such a long time water was supplied through Railway tankers. The cost of water came to Rs250 per m3. In spite of spending huge funds the problem of water is not solved on permanent basis as the problem villages are reappearing again and again during subsequent scarcities.

The water supply authorities in the State have developed 290 comprehensive (regional) schemes providing water to about 3000 problem villages in the State. For these villages the local sources are either inadequate or saline and hence water has to be imported through pipeline from distant areas. The Government has to bear the entire cost of providing such schemes and to maintain them. Many of the regional schemes cover more than 100 villages under one scheme. Operation of such schemes become very difficult in view of long distance pipeline.

Rainwater harvesting and recharging

Harvesting of rain water and recharging of ground water is considered to be a promising method to ease out the shortage of water and reduce salinity through dilution. The programme of harvesting rain water, through roof water collection and storage in household tanks, construction of check dams, village ponds and farm ponds are taken up to augment surface water storage. Similarly, percolation tanks, underground checkdams and well recharging techniques are adopted to recharge the underground water strata. This work is mainly undertaken by Non Government Organizations which is supported by the State Government. Priority attention has now been diverted to this aspect and results have started coming in.

Desalination programme in Gujarat

When all other alternatives to supply safe potable water to the community fail, desalination can be adopted as a last resort. There are certain pockets in Gujarat where no other alternative to overcome the problem of salinity is available, desalination is also experimented. Government of India in Ministry of Rural Development has

launched a separate sub-mission on “control of brackishness” under Rajiv Gandhi National Drinking Water Mission, Desalination plants are provided to various states for water supply in saline ones. Gujarat has also received some plants under this project.

Gujarat was perhaps the first State in the country to take lead in installing desalination plants for brackish water conversion in rural areas. Way back in 1985-87, six plants were installed in the State on pilot basis, to experiment the technology at field level in rural conditions. Two of these plants were provided under R&D programme and the rest four under the scarcity relief programme. Eleven more such plants were installed during the scarcity period of 1986-89 under the Technology Mission Programme of Government of India. Twelve more plants were installed during 1989-91. Most of these plants are installed in Kutch and Saurashtra region where the salinity and water problems are maximum. The capacity of such plants varied from $10\text{m}^3/\text{d}$ to $100\text{m}^3/\text{d}$. Except one electrodialysis plant at Adalsar, all other plants are based on reverse osmosis technology for brackish water conversion.

The desalination technology is considerably new for providing drinking water to rural areas. It needs skilled manpower, pre-treatment and energy. There are certain constraints in running such plants in remote rural areas. The State Government has appointed a committee of experts to suggest corrective measures to improve the performance of such plants.

The cost of a desalination plant will depend on many factors and will vary from area to area. The prominent constituents which decide the cost for small sized

desalination plants (Brackish water conversion) experimental in the State are found to be as under.

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