



## Water problems in the Jaffna Peninsula

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THE POPULATION IN the Jaffna Peninsula has always depended on the water stored in the underground miocene limestone and sand aquifers for its drinking water and water for irrigation to agricultural lands. Although there is a small acreage of paddy lands, the majority of the cultivated lands is used for agricultural activity related to short term crops. Water for drinking and for agriculture is obtained from open wells. Even the municipal area in Jaffna is supplied with water pumped from wells located in Kondavil, about 3 miles from Jaffna Town. Open wells are commonly built in villages, one for each household albeit with some of them shared by 3 or 4 neighbouring households who occupants are usually related to one and another. A recent innovation is the sinking of tubewells to obtain water supply for drinking and irrigation to agricultural lands.

### Quality of water and affordable water supply

In the early days, well sweeps or a system of pulleys were used to extract the water from the open wells, both for consumption as drinking water and for irrigation to crops. The fresh water in the aquifers floats in lens formation or varying thickness on saline water found below and has salinity levels depending on its location and distance from the sea. For example, a study on the geomorphology of the Valukkai Aru drainage basin in the Valigamam area showed that the salinity of the ground water in a location is inversely related to its distance from the sea. (Puvanewaran, 1987). The amount of calcium, magnesium bicarbonates and sulphates present in the water contributed to its hardness which varied from moderately hard to hard in terms of calcium carbonate equivalent. Since the rate of extraction of the underground water was relatively slow, the recharge of the wells from the underground reservoir helped to maintain an affordable water supply of satisfactory quality in terms of salinity and hardness.

Ground water recharge has been viewed as a function of effective rainfall. In the Jaffna Peninsula, this occurs only during the annual monsoon rainfall during the period September to January. After losses by direct runoff (about 10-15 percent), and losses by evaporation (about 40-48 percent), only 30 to 32 percent of the rainfall is left over for ground water recharge. In the last three decades, the quality of water in the region has deteriorated due to various reasons. Variability of the rainfall over the region has indirectly contributed to this as rainfall over the

region has indirectly contributed to this as rainfall is the only source of recharge. A sample of rainfall records for the period 1985-1993 given in Table 1 supports the variability of seasonal rainfall. The salinity problem was perceived as a hazard as early as the 1950's and 1960's and this has been attributed to the dry periods identified during these two decades (Puvanewaran, 1985).

A significant factor that has contributed to increased salinity in the well water has been the indiscriminate extraction of water from the underground aquifers. This has been exacerbated by the increase in population in the region and the rapid rate of extraction using pumps, both electric and petrol driven for domestic and agricultural purposes. Because of low fresh water heads in the underground aquifers, large amount of withdrawals from wells cause heads to further decline and the fresh water-salt water Interface to rise resulting in salt intrusions in several areas in the peninsula (Nandakumar, 1983). The Intensive agricultural pattern adopted in the last three decades also led to the increase of salinity in the water. Several wells once used to supply potable water are not in use now due to the increase of salinity (Nandakumar, 1983).

Another factor that has surfaced is the high level of nitrates and nitrites in the drinking water in the peninsula. It is well known that nitrates and nitrites above a certain level in drinking water and soil may cause serious health problems due to their toxicity. It has been reported that if the drinking water contains more than 10 ppm nitrate-nitrogen (45 ppm nitrate), it could affect the health of infants, giving rise to "blue babies" (WHO, 1971). The high level of nitrates and nitrites in the soil and water in the peninsula is attributed to the abundant and indiscriminate use of chemical fertilizers, mainly urea which contains 46 percent nitrogen. The problem has been further accentuated by the improper planning of soakage pits and latrines which leads to serious contamination of the ground water by nitrates.

The recent study of nitrates in the soil and well water (Mageswaran and Mahalingam, 1983) has shown that in several areas in the Jaffna Peninsula, the soil samples have nitrates above the safe level.

In places where there is no agricultural activity, the amount of nitrates in the soil adjoining the well is below 20 ppm in majority of cases, whereas in areas where there is cultivation, the soil adjoining the well seems to have fairly large quantity of nitrates, usually above 30 ppm. The water samples from wells in areas where there is no cultivation such as Jaffna Town, Kopay, Kokuvil, Uduvil,

Nallur, Tellippalai, Mirusivil, Naranthanai and Karaveddy have nitrate - nitrogen less than 18 ppm. The water samples in wells in plots where there is agricultural activity have nitrate - nitrogen levels between 20 to 50 ppm. The villages Kondavil and Urumpirai where there is intense agricultural activity have very high nitrate - nitrogen levels of 30 ppm.

The water samples from the wells in Thirunelvely and Kondavil from which water is drawn from Jaffna Town supply have a high nitrate - nitrogen level of 26 - 33 ppm which is about three times the safe level. The investigations (Mageswaran and Mahalingam, 1983) also indicate that the nitrate - nitrogen levels increase year by year. For example, the nitrate - nitrogen level of Thirunelvely well water increased from 15 ppm in December 1976 to about 22 ppm in December 1980 and to about 27 ppm in May 1982. Similarly, the water in the wells in Kondavil increased from 22 ppm in December 1976 to about 30 ppm in December 1980 and to about 34 ppm in May 1982.

The above study also showed that in parts of Jaffna Town where there is no cultivation, the nitrate - nitrogen level in the well water approaches 20 ppm. This is probably due to the wells in thickly populated areas being closely situated to the soakage pits of toilets. With increasing demand for houses, the local authorities are willing to reduce the maximum distance between wells and septic tanks from 15 to 5 meters. This could cause serious health problems, as the limestone rock is fairly close to the ground surface and sufficient depth of soil soakage, absorption and filtering is not available. A study made of the salinity and nitrate values in the soil and water in selected areas in 1992 (Baskaran, 1992) showed very much more increased values in the soil and water which are of concern to the health authorities. A representative sample of the values is given in Table 2 and 3.

It is evident that in discussing affordable water supply, aspects such as ensuring that the quality of the water supply meets the required health standards and cost involved in doing so have to be considered.

## The economics of affordable water supply

In relevance to the discussion on water quality, in order to ensure that the quality of water in the Jaffna Peninsula is brought up to a satisfactory level and maintained at the level at least in terms of salinity and the nitrate - nitrogen levels, various measures have to be adopted. Amongst them are the following:

- Satisfactory systems of wastewater disposal for the Jaffna town municipal area and other urban areas where the households per acreage is high.
- Promote the use of biofertilizers instead of using chemical fertilizers in agriculture.
- Increase the recharge to the underground fresh water reservoirs in the peninsula.

A satisfactory system of pipe-borne wastewater disposal system for the municipal and urban areas would also involve pipe-borne water supply systems and the related purification and treatment systems. Although plans have been drawn for the Installation of such systems in the Jaffna municipality and urban areas such as, for example, Chavakachcheri, these have not been implemented due to various reasons, an important one of which is the lack of funds. Eventually, when these systems are installed, the cost of these undoubtedly would be passed on the consumers in the form of higher urban taxes.

In the rural areas and areas outside the higher density housing areas and in particular where there is agricultural activity, steps could be initiated to reduce the Nitrate - nitrogen levels in the well water by reverting back to biofertilizers. Before the introduction of chemical fertilizers, the farmers had been using biofertilizers such as biomass (leaves of trees) and cattle waste products, and during that period, the quality of water has remained satisfactory and did not warrant any further treatment before use. Hence, the use of biofertilizers would remove one of principal factors of the increased nitrate - nitrogen level in well water.

It has been shown (Puvaneswaran, 1985) that the salinity of water in underground reservoirs increased when the recharge from the rainfall was reduced. Hence, steps should be taken to increase the recharge to the underground resources by conserving more of the rainwater. In the early days, there existed a large number of ponds and tanks with interconnected channels that helped to conserve a large proportion of the rain water and also to recharge the underground resources by conserving more of the rain water. In the early days, there existed a large number of ponds and tanks with interconnected channels that helped to conserve a large proportion of the rain water and also to recharge the underground reservoirs. However, over a period of time, particularly during the last 3 or 4 decades, with increased pressure for housing, several of these ponds and tanks have disappeared, with development on these locations after the tank and ponds have been filled. At the present moment, the rehabilitation of the remaining tanks and ponds is being actively undertaken.

In order to meet the water needs of the Jaffna Peninsula, a scheme was launched in 1952 by the then Irrigation Department to convert gradually the water in the lagoons in the Peninsula to fresh water by flushing out the salt in the natural manner with the monsoon rains over a period of time. The scheme was almost completed in early 1970's when water in the lagoons had been recognised to be fresh water and the farmers cultivating the lands adjoining the lagoons were deriving the benefits. It was also reported that the wells near the lagoons which had showed salinity earlier were now fresh water wells providing water suitable for drinking and agricultural purposes. Unfortunately, due to poor maintenance of the scheme and vari-

ous other factors, the lagoon scheme had fallen into a deteriorated condition with the water in the lagoon becoming saline and unfit for use. The main advantage of converting the water in the lagoons into fresh water is that it helps to recharge the underground reservoir with fresh water. As a result, the adjoining lands become rid of salinity and suitable for agricultural purposes. In addition, the wells in the area also become less saline.

A recent study to rehabilitate the jaffna Lagoon Scheme and the tanks in the Peninsula suggested that this can be done at an estimated cost of SLR 300 million (US\$ 6 million). In return, the benefit in terms of increased agriculture, increased fodder from grass grown in adjoining lands and the improved health of the population that would result from the consumption of the increased production of milk and milk products was estimated at SLR 152 million (US\$ 3 million) a year, suggesting that the cost would be returned in 2 years. However, what is more important is that the scheme once in operation would continue to provide the Jaffna Peninsula with fresh water.

In conclusion, in order to provide an affordable satisfactory quality water to the population in the Jaffna Peninsula, perhaps the first priority seems to be the rehabilitation of the Jaffna Lagoon Scheme. This could be followed

by the institution of pipe borne water supply and waste disposal systems as funds become available.

## References

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**Table 1: Rainfall records in mm in period October - December**

**Table 2: Salinity and Nitrate values in water in Jaffna Peninsula**

**Table 3: Salinity and nitrate values in soil in the Jaffna Peninsula**