CHAPTER 9

CONCLUSION

The major conclusions derived from this study carried out on Kalpakkam coastal aquifer, southern India are presented in this ultimate chapter.

Groundwater predominantly occurs in the Quaternary sediments, generally flowing from the central part of the area towards the Bay of Bengal and Buckingham Canal. The groundwater quality in this region is good with the maximum EC value of about 1,500 µS/cm. The December 26, 2004 tsunami waves inundated this region up to a distance of 500 m. This has resulted in the salinization of the groundwater that was under potable condition prior to the tsunami.

The major ion concentrations increased at least by seven times. The concentrations of Zn, Br, Li and F in the groundwater of the inundated zone also confirm the degradation of groundwater quality by the tsunami. The causes for the salinization of this aquifer by tsunami were 1) direct contamination of groundwater by entry of sea water through the wells due to inundation, and 2) infiltration of sea water into the aquifer through the unsaturated zone.

The water retained in the unsaturated zone deposits the salts during evaporation, which are flushed into the groundwater zone during subsequent rainfall recharge. The salts in sediments brought by the tsunami might have
also got flushed in by the recharging water. Chloride-bicarbonate ratio and changes in hydrochemical facies confirm the flushing of salts from the unsaturated zone that was deposited due to evaporation. Oxygen-18 and Deuterium relationship in the groundwater also indicates the evaporation process. Thus, the recharge due to rainfall flushed the salts that had been deposited due to the evaporation of sea water in the unsaturated zone. This mechanism was expected to result in the degradation of groundwater quality for few years.

In order to study this effect, numerical modeling of the groundwater flow and transport was carried out, which simulated the effect of tsunami inundation. The simulated results match reasonably with the observed trends. This finite element model forecasts that the chloride concentration of the groundwater of this area will decrease and reach the pre-tsunami level by the end of the year 2007. The study carried out by finite element model, therefore, helped to understand the processes of salinisation and remediation of the aquifer by natural recharge. The present work has demonstrated the application of hydrochemical studies and groundwater modeling to understand the process of salinization of groundwater resources by tsunami. It has also helped to determine the time that it would take for remediation of the aquifer system by rainfall recharge. Such a study can be also carried out in other areas to identify the effect of artificial recharge methods in regions that got seriously affected by the tsunami in order to achieve rapid remediation.