CHAPTER 10
CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS

The results from the various studies reflect that the Pulicat Lake is influenced by the natural process and also by the anthropogenic activity. Natural processes include coastal processes, siltation by the rivers and upliftment of the northern block due to the NE-SW trending lineament which traverse almost parallel to Sullurpet to SHAR metal road. Even though the sea level is rising in globally, the Chennai coast is experiencing lowering of sea level due to tectonic activity. Detailed observation on the tide chart for the hundred year period reflect almost 1 meter of sea level is lowered in coastal waters of Chennai. This lowering of sea level further reduces the bathymetry of the lake region. The changes in the configuration of lake reflect almost half of the lake has become dry and shallow in the northern side. Riverine input through Kalangi and Araniar are minimum as these rivers are seasonal. Coastal process activity shifts the bar mouth (inlet) of the lake towards northern direction due to the net longshore sediment transport in the northern direction. This leads to narrowness of the mouth region in peak summer and during the monsoon season it shifts towards south due to southeast monsoon. The shoreline is shifting towards lake in the recent period and playing major role of natural erosion in villages like Koraikuppam. Hence the lake ecosystem by itself is on stress due to the natural processes.

- Recently the developmental activities in the surrounding regions of the lake further influence the stress on the lake ecosystem. In the surrounding regions there is no major polluting industries. Major contribution is coming from the coolant water outfall joining in the backwater channel, which connects Ennore creek and Pulicat Bar mouth region. The temperature difference between intake and outlet water is more than 8 degrees. Due to the high temperature water discharge, small mangrove plants in the region are facing stress.

- All the major aquafarms are active only along the channel regions and the present study show not much impact in the water quality by this activity.

- Overall assessment of the impact of various anthropogenic activities on the water quality, sediment characters and biodiversity show the present level of pollution is in acceptable level. Central part of the lake north of Annamalaichery village is in good condition with limited impact by the developmental activity when compared to the other part of the lake.

- The Ennore shoal which is present 3 m below sea water level and extending in NE-SW direction will restrict the erosional activity in the north of port.

- The results of field measurements before and after the construction of the port were synthesized to understand the cause and effect relationship between the site conditions and shoreline behaviour. The understanding serves as the basis for development of input for models such as hydrodynamic, wave, sediment transport and morphological evolution to predict future changes and to arrive at remedial measures for minimising adverse impacts due to construction of port.

- The following are inferred as impacts of satellite port.

Coastal stretch South of port

- The presence of port has reduced the wave activity along south shore by about 60 % when compared to wave climate prior to construction of port
- The current observations indicate decrease in magnitude to the order 20 % at (location C1) due to presence of breakwater. Offshore currents are less influenced by the port
- Sediment characteristics indicate presence of coarser fractions in nearshore region due to dumping of dredge spoil from Ennore creek and prevailing low currents.

- Beach profiles (Plan form) for different periods indicate accretion of 250 m over period of two years near south breakwater

Coastal stretch North of port

- Wave energy is reduced to an extent of 20 % over shoals and increases in eastern part by 30 % for SE waves. NE waves have negligible influence due to presence of shoals. Coastal stretch at distance of 6 km from north breakwater experiences high waves due to addition of reflected waves and refracted waves from offshore region.
- Comparison of nearshore and offshore currents (W1 and W2) reveals that in the offshore region the currents are unidirectional where as in nearshore they are influenced by waves.
- Sediment characteristics indicate presence of coarser sediment along the offshore boundary of shoal and finer sediments on coastline. This clearly demonstrates that the shoal while interacting with large waves around offshore boundary reduces the energy of the incoming waves resulting in deposition of coarser sediments. Finer fragments of the sediment are carried over the shoal by relatively low energy waves and deposited adjacent to the coastline.
- Beach profiles (Plan form) for different periods indicate erosion of about 50 m over period of two years at distance of 6 km from the north breakwater. The possible reason for the same could be attributed to the beach fill north of north breakwater and reflected waves.

- Near Pulicat Lighthouse, it is observed that erosion is taking place at a rate of 5.70 m per year. Rate of erosion at this location is lesser compared to north of north breakwater because it is located 15 km away. In addition, the presence of Ennore and Pulicat shoals are also acting as barriers reducing the energy of the waves.

- Significant changes have occurred on the foreshore slopes in the accreting zones after the construction of the port. Before the construction, foreshore slopes at south of Ennore creek and south of Ennore port were 1:13 and 1:17 respectively. This has changed drastically after the construction of the port as 1:25 and 1:30 respectively. However foreshore slopes at the eroding zones of north of port and Pulicat region remain more or less same.

- Shoreline survey conducted in the study area has also produced the same results as beach profile survey. Accretion on the southern side of Ennore port and erosion on the northern side of the port have been observed. It has been observed that erosion is taking place at a rate of 40 m per year north of Kattupallikuppam village, 3.5 km north of north breakwater and it may intensify in the near future. Accretion is taking place at Koraikuppam village at present. In the past, before the construction of the port, erosion has taken place in this sensitive location, where the width of the sand bar between the lake and the sea is only 120 m. If accreting trend continues, the sand bar and the village will be saved from erosion.

- Accretion is also taking place at Pulicat mouth region in recent years. This has resulted in the permanent closure of the inlet of the Pulicat Lake. After 1975, the bar mouth of Pulicat Lake has been totally choked during 2001, 2002 and 2003 except monsoon period. On account of this, there is no possibility of exchange of water between the sea and the lake. If this trend continues, there will be a disaster for the brackish water ecosystem of Pulicat Lake.

- Grain size distribution along the coastal region shows that coarser sediments are present along the offshore shoal region and finer sediments along nearshore region. Shoals reduce the incoming wave energy resulting in the deposition of coarser sediments near the shoals. Finer sediments are taken away by the low energy waves bypassing the shoal and settled in the nearshore region. Regarding suspended sediment concentration (SSC) in the coastal waters, higher amount of

SSC has been observed near Ennore creek and immediate north of Ennore port due to dredging and beach fills respectively.

- Simulation of MIKE 21 and LITPACK modeling package using the profile and other data such as wave, tide, current, bathymetry, etc., have also produced the same results. From the simulation it has been predicted that 1000 m of accretion will take place in the next 30 years adjoining the south breakwater. Higher rate of accretion has been obtained at the inlets of Ennore creek and Pulicat Lake in the forthcoming years. Similarly, erosion will occur north of Ennore port.

- Almost equal amount of gross littoral drift of about 1.10 million m^3/year has been obtained in all the four profiles from the simulation studies. The net annual transport rate is in the northern direction at about 0.65 million m^3/year at three locations and it is about 0.572 million m^3/year in the north of north breakwater. This reduction in net transport is due to obstruction of sediment movement during southwest monsoon by the breakwaters.

10.2 RECOMMENDATIONS

From the results of the present study, the following recommendations and suggestions are made.

- Further studies on water quality modelling to know the impact of forthcoming industries due to the introduction of TIDCO Industrial park at Kattupalli will give an idea about the status of lake in the near future due to development.

- To save the eroding coast north of Chennai port, construction of shore connected groyne field along the entire stretch starting from fisheries harbour up to Ennore creek are to be implemented.

- Accretion on the southern side of Ennore port has caused the permanent closure of the mouth of Ennore creek. It is very much essential to keep the mouth open to

draw coolant water to the adjoining thermal power stations and to save the creek ecosystem. In this context the following mitigation measures are suggested:

1. Construction of two parallel jetties one on either side of the mouth
2. Drawal of seawater from inside the port and discharging warm water into creek or
3. Continuous dredging at the inlet to maintain the mouth open.

- Accretion on the southern side of south breakwater is alarming. At the present rate, the entire length of breakwater and the entrance channel will be covered by sand in another 30 years. This will make the Ennore port in-operative. In order to avoid these problems the following alternative methods are suggested:

    1. As a hard measure, construction of groyne fields along the 5 km stretch between south of Ennore creek (near EID Parry factory) and south breakwater is to be undertaken as a series of groynes are capable of interrupting longshore sediment transport.

    2. As a soft measure, to mitigate the problem, accreted sands are to be dredged regularly and dumped on the coast, north of port. Eventhough it will be a recurring one, this will produce good results. Beach nourishment is the only approach that directly addresses the deficit of sand in the system without causing adverse effects on adjacent property. It is the most benign and acceptable approach to beach erosion mitigation.

- Sand by-passing is also the best option for protecting Ennore north coast since it will cause less environmental impacts compared to other measures. A case of Visakhapatnam port is an ideal example since the north coast is stable with this measure.

- Coolant water discharge from North Chennai Thermal Power Station into lake region has to be avoided or otherwise brought within the limits. As an alternative, after maintaining regular standards, coolant water may be discharged in the offshore region.
- Immediate protection measures are to be taken to control erosion along the stretch near Kattupallikuppam village.
- Accretion on the bar mouth region of Pulicat Lake is another alarming problem. This has already resulted in the closure of the inlet during the year 2001, 2002 and 2003. Permanent opening of the mouth is essential to maintain the lake ecosystem. About one lakh fishermen are depending on the lake for their livelihood. In order to keep the inlet open permanently, the following alternatives are suggested:

  1. Construction of two parallel jetties one on either side of the mouth or
  2. Continuous dredging at the inlet

- Pulicat Lake has been identified as an environmentally sensitive ecosystem and as a RAMSAR site. Therefore, rich biodiversity of the lake has to be protected in a sustainable manner.
- Necessary steps should be taken by the government agencies at regional and national levels to save the Pulicat Lake and the local people. At least the new developmental projects coming up in the region have to provide employment to the people as an alternative.
- As the problem of closing of bar mouth of Pulicat Lake has already started, mitigation measures are to be implemented at the earliest. Even though the cost of implementation would be higher, it could be compensated by way of revenue from tourism and recreation planned under ecotourism.
- Integrated Coastal Zone Management(ICZM) seeks to rise to the challenge by coordinated planning and action involving communities, stake holder groups and managers at local, regional and national level as well as both natural and social

scientists. Therefore it is recommended that an Integrated Coastal Zone Management Plan has to be prepared for the entire North Chennai Coast combined with Pulicat Lake to manage the coastal areas.

- As far as Pulicat Lake is concerned, there is no significant pollution as such. Because there are no industries along the border of the lake. But it is essential that there should be a legislation to protect the lake by not allowing any industries in the nearby zone of the Pulicat Lake, atleast 10 km from the lake boundary as a buffer zone to avoid pollution in the future.

- To monitor this vulnerable coast, periodical and regular monitoring of coastal processes is necessary. It has to be undertaken by an integrated group of people involving all the agencies working in the area.