ADDITIONAL STUDIES

7.0 CONCEPT OF RISK ASSESSMENT:

The concept of Risk assessment and its engineering application has been well acclaimed since more than a decade. A variety of major accidents have focused attention on the dangers of risk exposure for human health and environment.

Risk analysis provides numerical measures of the risk that a particular facility posses to the public. It begins with identification of potential risk involving events and determination of the impact of each event. The consequences of each event are than calculated for numerous combinations of weather conditions and wind directions these consequence predictions are combined to provide numerical measure soft the risk for the entire facility.

Risk for a particular facility is based on the following variables:

- Multiple accident outcomes
- Population disturbance
- Site-specific meteorological data

"Risk analysis is a tool which helps to translate hindsight (accidents) into foresight (planning), showing ways and means (improved engineering, procedure and supervision) to prevent the calculated accident from happening.

7.1 Oil Spill

An oil spill is the release of a liquid petroleum hydrocarbon into the environment especially marine areas due to human activity and is a form of pollution. Oil spills may be due to releases of crude oil from tankers, offshore platforms, drilling rigs and wells as well as spills of refined petroleum products and their by-products, heavier fuels used by large ships such as bunker fuel, or the spill of any oily refuse or waste oil.

7.2 MARINE POLLUTION CONTROL CELL

Chennai Port Trust was the first port in the country to start a Marine Pollution Control Cell on 01.11.1982 and has been looking after the waterfront areas of the port with a dedicated craft, Oil Spill Response equipments to meet the requirements as per MARPOL Regulations

under the aegis of the International Maritime Organisation (IMO). It was decided to acquire additional equipments recommended by Coast Guard to meet Tier I Oil Spill response capabilities funded by M/s. Chennai Petroleum Corporation Limited, M/s. Indian Oil Corporation, M/s. Bharat Petroleum Corporation, M/s. Hindustan Petroleum Corporation, M/s. Thirumalai Chemicals and M/s. IMC Limited, the oil companies operating at Chennai Port. Chennai Port Trust and the above oil companies operating at Chennai Port Oil Terminals, signed a MoU on 09.12.2003 with the Chennai Petroleum Corporation Limited and other Oil Companies operating at the Chennai Port. As recommended by the Coast Guard for Tier I Oil spill combating facilities, Chennai Port co-ordinated with CPCL in procuring the following Oil Spill Response Equipments. These new equipments procured by the Oil Companies were installed onboard the crafts of the Chennai Port.

As recommended by the Coast Guard for Tier I Oil spill combating facilities, Chennai Port co-ordinated with CPCL in procuring the following Oil Spill Response Equipments. These new equipments procured by the Oil Companies were installed onboard the crafts of the Chennai Port. The Marine Pollution Control Cell of the Chennai Port is looking after the operation and maintenance of the Oil Spill Response equipment's. The cell is functioning round the clock (24 x 7) with technical and trained laborers to attend to any oil spills and for regular monitoring and upkeep of the water front area of the Port.

7.2.1 List of Oil spill Response Equipments procured by MoU with oil companies

1. Permanent Boom – 600m
2. Inflatable Pneumatic boom – 400m
3. Boom storage reel for inflatable boom with power pack to operate the boom reel and inflation and deflation of booms – 2 Nos. – One each mounted on tugs Sundaranar and Sekkizhar
4. Spill Spray Unit with spray arms of 6 metres length on both sides - installed on ORV ANNAM
5. Oil Skimmer with power pack – 1 No.
6. Oil Spill dispersant – 2000 litres
7. Oil Absorbent pads – 1000 Nos.

7.2.2 Pollution Control Equipments Presently Available with Chennai Port:

a. Vessels:

- Oil Recovery Vessel "ANNAM" for collection of garbage / oil floating on the harbour waters
- Multi Purpose Harbour Vessel "PRESTIGE"

b. Containment Equipment's:

- 100 metre inflatable boom in reel with power pack available in MPHV Prestige
- Permanent boom – 600 metres deployed in the oil terminals
- Inflatable Pneumatic boom – 400 metres (200 metres in boom reel each fitted on board the tugs Sundaranar and Sekkizhar)

c. Recovery Equipments:

- Drum Skimmer of capacity 7 KL / hr with power pack.
- Weir type skimmer of capacity 30 KL / hr
- Skimmer with interchangeable drum / disc / brush module of capacity 20 KL / hr

d. Storage Facility for Oil collected from the spill:

- 100 ton capacity in Multi Purpose Harbour Vessel PRESTIGE
- 50 ton capacity in Oil Recovery Vessel ANNAM

e. Dispersant Spray System:

- Spill Spray Unit with spray arms of 6 metres length on both sides - installed on ORV ANNAM.
- Power sprayer – 1 No.
- Hand sprayer - 1 No.

f. Oily waste reception Facility:

- 10 KL capacity mobile tanker trailer to receive oily waste from the ships

7.3 MARPOL:

MARPOL is the International Convention for the prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. MARPOL is one of the most important international marine environmental conventions. It was designed to minimize pollution of the seas, including dumping, oil and exhaust pollution. Its stated object is to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances.

7.4 ACTIVITES TO COMPLY WITH MARPOL REGULATIONS AND DG GUIDELINES:

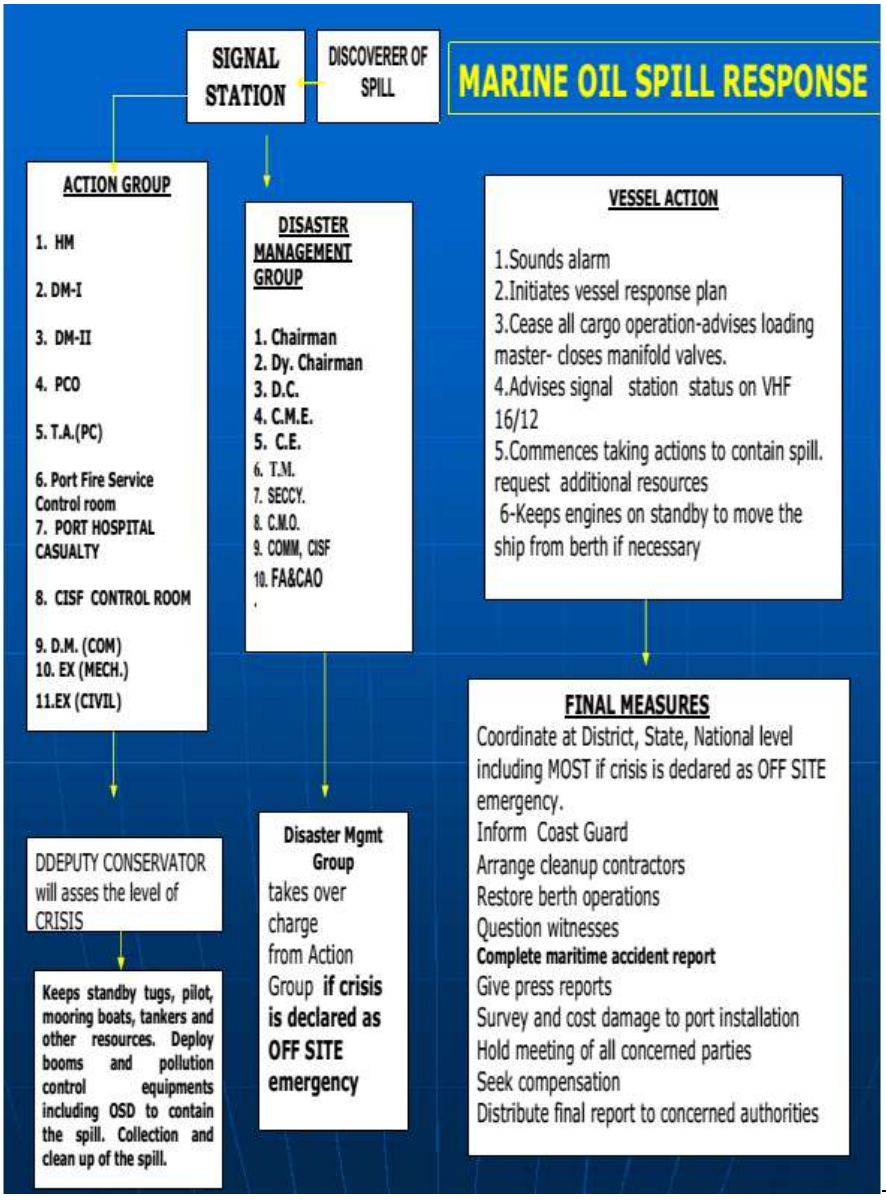
- Daily inspection of the waterfront and collection / removal of garbage's floating on the harbour waters using ORV ANNAM.
- Removal of oil traces if any using skimmer/oil dispersant from the waterfront
- License has been issued for collection of segregated garbage from the ships
- Providing reception facilities for collection of oily wastes from the ships requesting for such facilities through empanelled waste oil recyclers authorized by Central / State Pollution Control Boards
- Arranging through Ship's Agents for receiving sewage as and when required by vessels through Municipal Corporation approved agencies.
- Random inspection of vessels is carried out for Pollution Control measures

7.5 HIGHLIGHTS

- MoU has been signed with oil companies in the year 2003 for augmenting the oil spill response facilities and equipments have been procured by the funding of oil companies which are operated and maintained by the Pollution Control Cell of the port
- When the crude oil pipeline collapsed at BD in the year 2006 Pollution Control Cell responded immediately and deployed booms and collected 250 Kl of spilled oil without any external assistance.

- Joint Exercise "SPARKLING SEAS" with Coast Guard for Level II Oil Spill Response was carried out on 27th October 2010 off Chennai for which the Pollution Control cell of the Chennai Port was commended by Indian Coast Guard.
- Joint Exercise was conducted by Indian Coast Guard with Japanese Coast Guard off Chennai Coast during which an exercise was also conducted for Oil Spill Response and the Chennai Port Pollution Control team also participated. Tug Sundaranar with Oil booms and Disc Skimmer were used by Chennai Port in the Exercise.

7.6 CONTINGENCY PLAN



7.6.1 Risk Assessment and Disaster Management Plan

Risk Assessment is a method that has proven its value as an all-round tool for improving the safety standards prevalent in every hazardous industry. Risk Assessment is a structured safety assessment tools designed for high hazard industries such as chemical, petrochemical, pesticides, pharmaceuticals, sea ports, etc., supplementing other safety systems tools such as HAZOP, safety audit, and regular incident analysis to identify the potential for incidents (near-misses, unsafe conditions) and to evaluate the necessary control measures.

The objectives of the Risk Assessment can be summarized as follows:

- Assessing risk levels due to the operations of the facility
- Identification of the risk mitigation measures to bring the potential risk within acceptable range
- To suggest general safety improvement measures.
- To help generate accident free hours
- To identify emergency scenarios and suggest mitigation measures.

The underlying basis of Risk Assessment is simple in concept. It offers methods to answer the following five questions:

1. What are the risks?
2. What are the causes of risks?
3. What are the consequences of risks?
4. What is the probability of the risk causing events?
5. Whether the risk is socially acceptable?

7.6.2 Philosophy behind Risk Assessment

Risk is the unwanted consequence of an event or series of events. Risk occurs when multiple risk causing factors occur at the same time causing an accident manifesting in an event like a fire or explosion. Certain risks are generally accepted as part of the industrial operations, while other low-frequency, high consequence risks attract statutory attention and are regarded unacceptable to local public.

The need for communicating acceptable risks is very important. Though setting acceptable criterion for use in Quantitative Risk Assessments may often lead to disagreement between parties, nevertheless sound techniques and methods have led to the definition of acceptable levels of risks taking into account the need of people to feel safe in their day-to-day activities.

A Risk Assessment should therefore, be seen as an important component of any or all on-going preventive actions aimed at minimizing and thus hopefully, avoiding accidents. Re-assessments should therefore follow at regular intervals, and/or after any changes that could alter the hazard, so contributing to the overall prevention programme and disaster management plan of the project.

7.6.3 Disaster Management Plan:

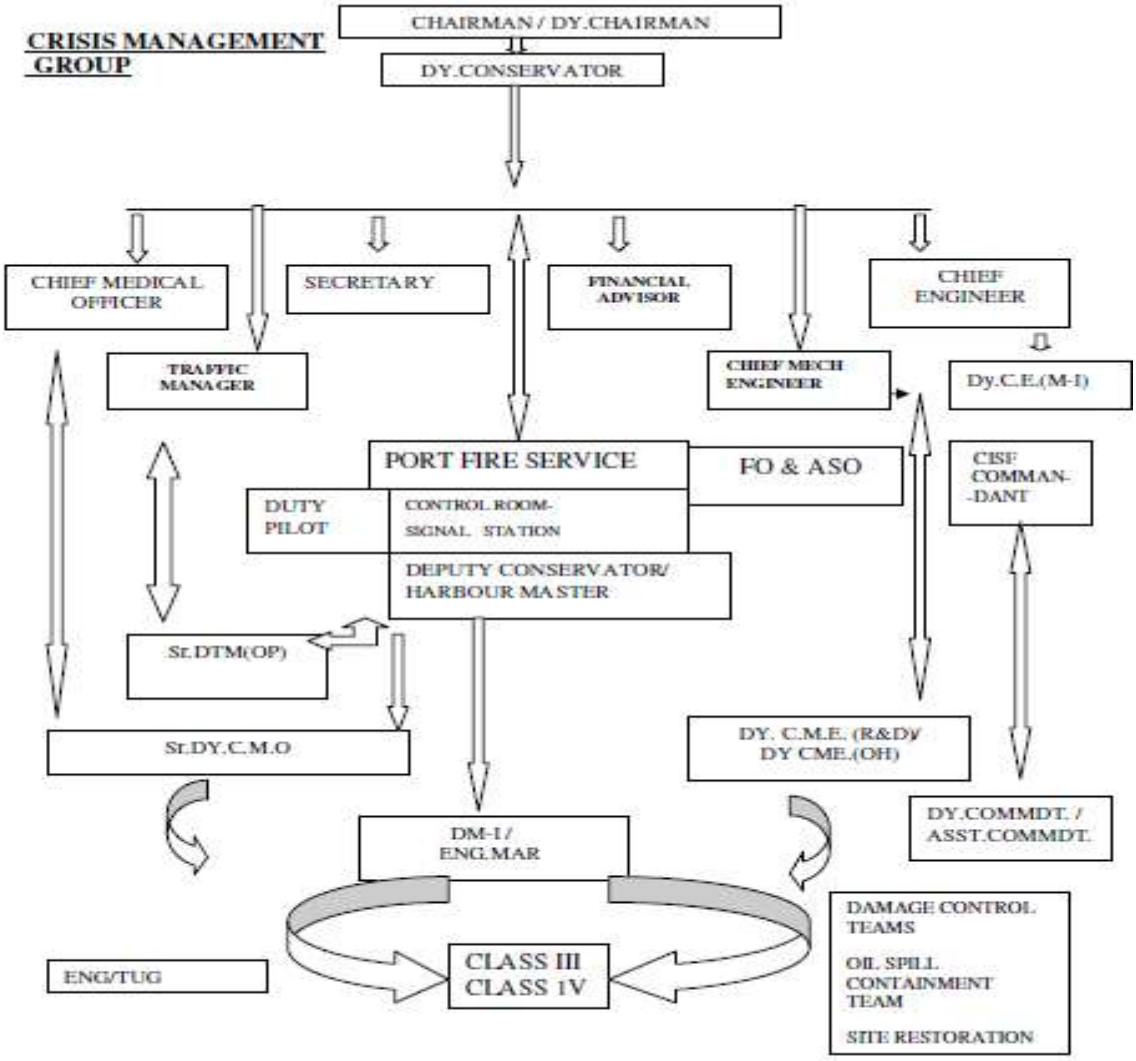
Chennai Port represents a complex interface, between land and sea, between human activities and the natural environment and between different modes of transport. Chennai Port has prepared Crisis management and disaster management plan covering the man made situations.
The emergency DMP for onsite and offsite location will be inter-related.
The objectives of Disaster Management are given below.

7.6.4 Objectives of Disaster Management

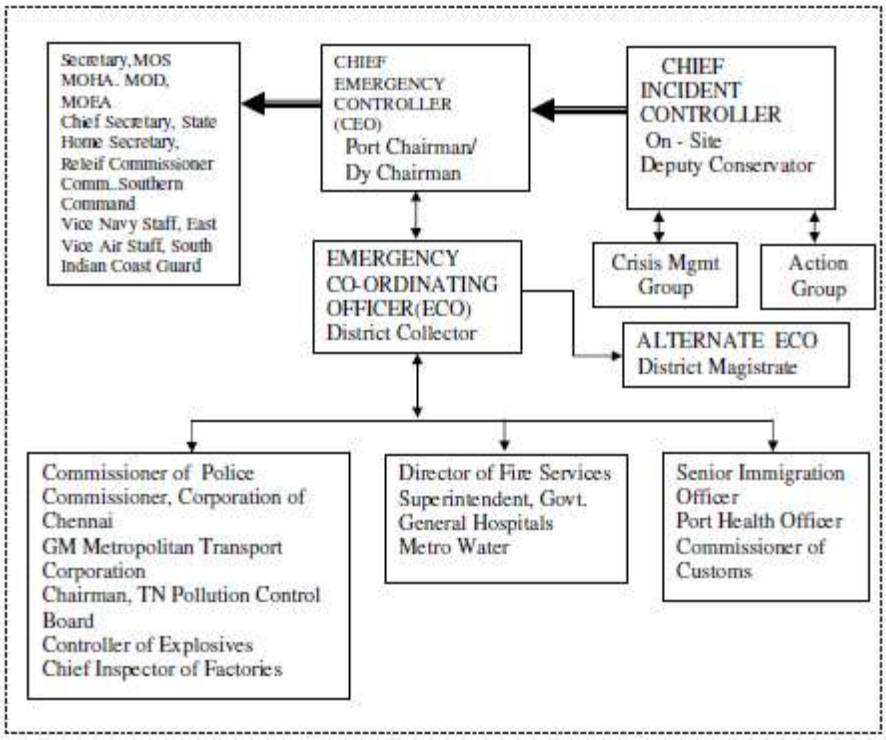
- To minimize the effect on local population and property
- To localize the emergency and control it at the earliest
- To minimize the adverse impact on environment
- To ensure effective rescue operations and treatment of causalities.
- To train the employees to act swiftly and effectively with confidence in an emergency
- To preserve relevant records and exhibits for future investigations into the causilities and circumstances leading to the emergency
- To restore normality of the plant and operations at the earliest.

In order to co-ordinate during any disaster Chennai Port is having Crisis Management Group, Action group and alternative to action group involving all the department of port. The organization chart of onsite and offsite disaster management is given below:

Figure 7.1 Onsite Emergency Management Organization Inter relationship



7.2 Off-Site Organizational Chart



7.7 ONSITE EMERGENCY PLAN

Assessing the adequacy of available resources to take care of emergencies as identified in the risk analysis study. Providing recommendations on the infrastructure, communication system and other facilities such as first aid, security, firefighting etc in view of effective handling of the emergencies identified. Specifying the roles and relationship amongst personnel from the facility and outside agencies for effective handling of the emergencies.

Identification of assembly points and escapes routes for evacuation. The stages of On-site emergency plan include:

1. Outline Emergency Response Team
    - Designated person in charge
    - Key responsibility of each individual
    - Telephone numbers for key people
2. Risk Evaluation on preliminary hazards
    - Type, Quantity and storage method of hazardous materials used at site along with MSDS
    - Location of possible Hazards (Process, storage-yard, Transfer, piping etc)/Type of accidents.
    - Special handling requirements, firefighting procedures as per MSDS
    - Safety measures to be taken and installed if any
3. Details regarding
    - Location of Key-personals
    - Emergency control room, if provided
    - Emergency Telephone numbers
    - First-aid Kit and Fire Extinguishers locations
    - Warning alarm, safety and security
    - Precautions during design and engineering
    - Continuous surveillance
    - Details of hospital and fire-brigade facility
    - Procedures for notifying family members of injured employees
    - Procedure for reporting emergencies

4. Awareness amongst workers for
    - Knowledge of Chemicals used (property, toxicity, handling methods etc)
    - Use of fire-fighting equipment and first aid
    - Mock-drill for hazards and disasters
    - Use of personal protective equipment
    - Procedure for reporting emergency
    - Knowledge of alarm systems
    - Manual for each operating system
5. Control Plans
    - Emergency control plans
    - Safe tome to resume work after an emergency
    - Control measures for any spillage, leakage, explosion etc

7.8 LIFE SAVING APPLIANCES AND ARRANGEMENTS

It is one of the important aspects towards the mitigative measures to be adopted on the craft. It is also recommended to have safety appliances and arrangements even at ship terminal facility, in case of emergency for the craft during its navigation.

The major issues to be tackled for the lifesaving or rescue operations will be during any eventualities arising out of collision or submergence of the vessel. In case of such eventualities various lifesaving appliances such as embarkation ladder, float free launching pads, spaces for laundry emersion suit inflammable appliances shall be made available on the vessel. In addition to this like saving appliances an effective ladder communication system shall be made available on the vessels.

- In the event of noting such event at the marine terminal, control room to allowing lifesaving appliances kept ready.
- Rescue boat, which is design to rescue person in distress and to marshal survival craft.
- Life buoys compiling with the requirement and regulation shall be kept ready and accessible during emergency life jackets etc shall be accessible
- Trained personnel with experience of rescue operation shall be provided on board on rescue boat.

- In case of addition to the rescue boat craft with all novel life saving appliances it is recommended that to take help of coast guards and also naval helicopters to search the exact site of accident.

7.9 OCCUPATIONAL HEALTH AND SAFETY

Specific occupational health and safety issues relevant to proposed project primarily include the following:

1. Physical hazards
2. Chemical hazards
3. Exposure to organic & inorganic dust
4. Exposure to noise

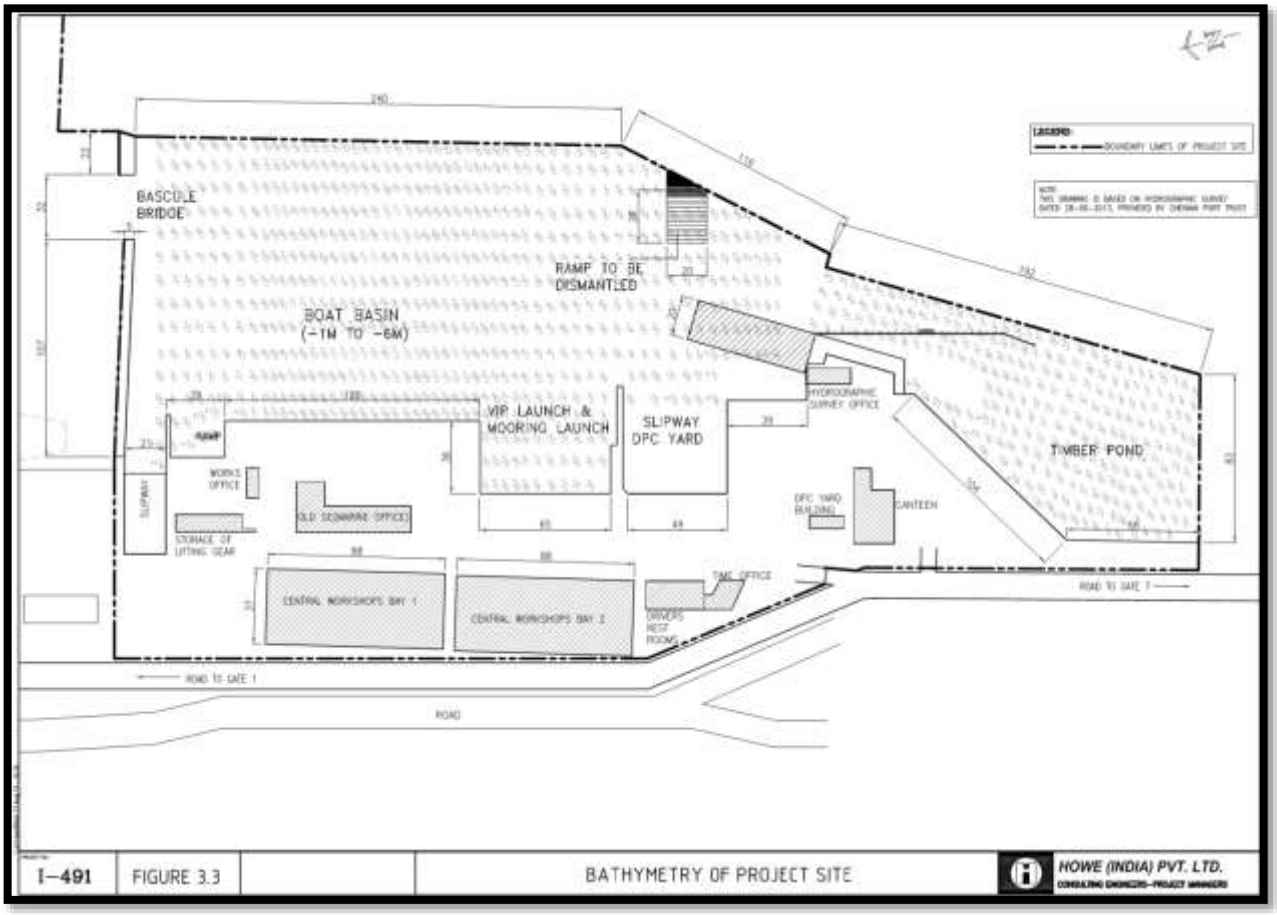
The main sources of physical hazards at ports are associated with cargo handling and use of associated machinery and vehicles. However this shall be taken care of by applying all the terminal related norms and standards. The workers and vehicles passageway shall be kept separate. Avoiding entry of workers as far as possible in the area of ship loading and unloading activity and areas where grab is operational.

The chemical hazards are related to inhalation of fumes during fueling refueling or other emissions from the cargo. This can be eliminated by providing adequate personal protective equipments to the workers working in such areas of exposure.

Noise pollution can cause due to one of the various activities at the terminal or parking facility. However, proper mitigative measures are out-lined for control of noise at the facility. Onsite medical facility will be provided in case of any hazard or casualty during the operational phase. Fire safety measures shall be incorporated and implemented. Periodic health check-up of all the workers shall be carried out.

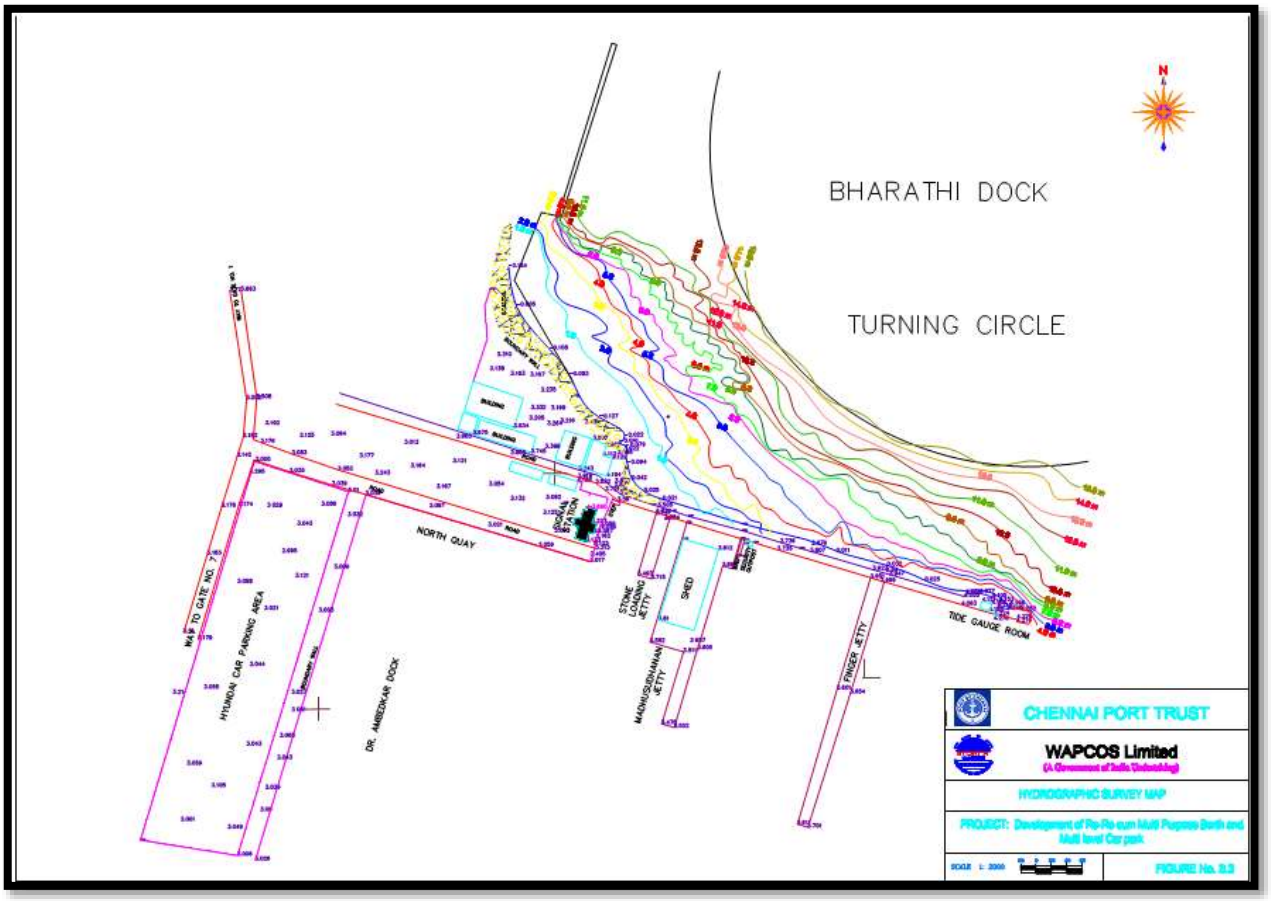
7.10 BATHYMETRY STUDY:

The Chennai Port Trust made available a copy of bathymetry chart of boat basin and timber pond based on bathymetric survey carried out on 5th April, 2013 & 27th May 2013 respectively. The chart indicates that the boat basin has a depth varying from 2.0m to 8.0m below chart datum. Similarly the timber pond has depth varying from 0.2m m to 4.0m below chart datum. The entrance to boat basin has depths in the range of 6.0m below chart datum.



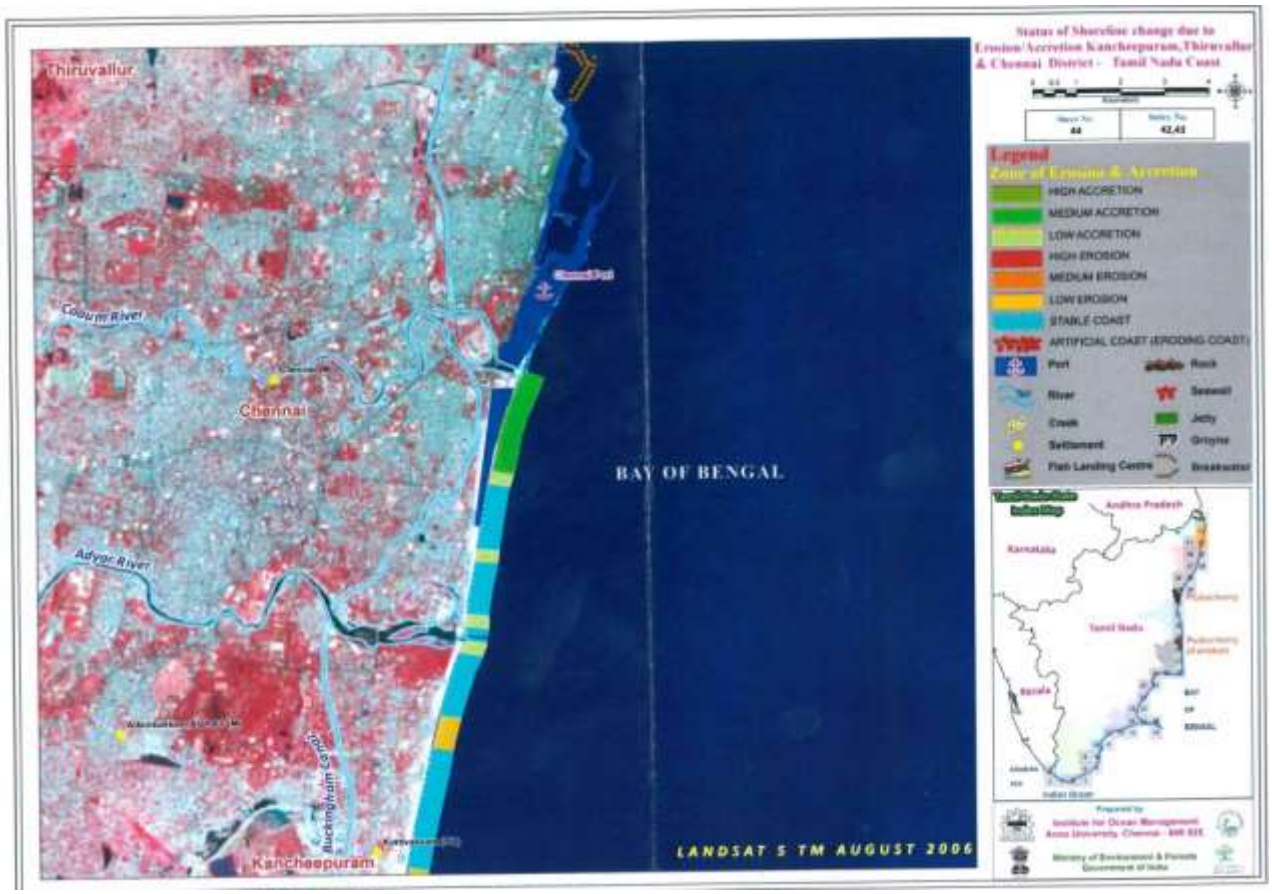
7.10.1 Bathymetry study at multilevel car parking:

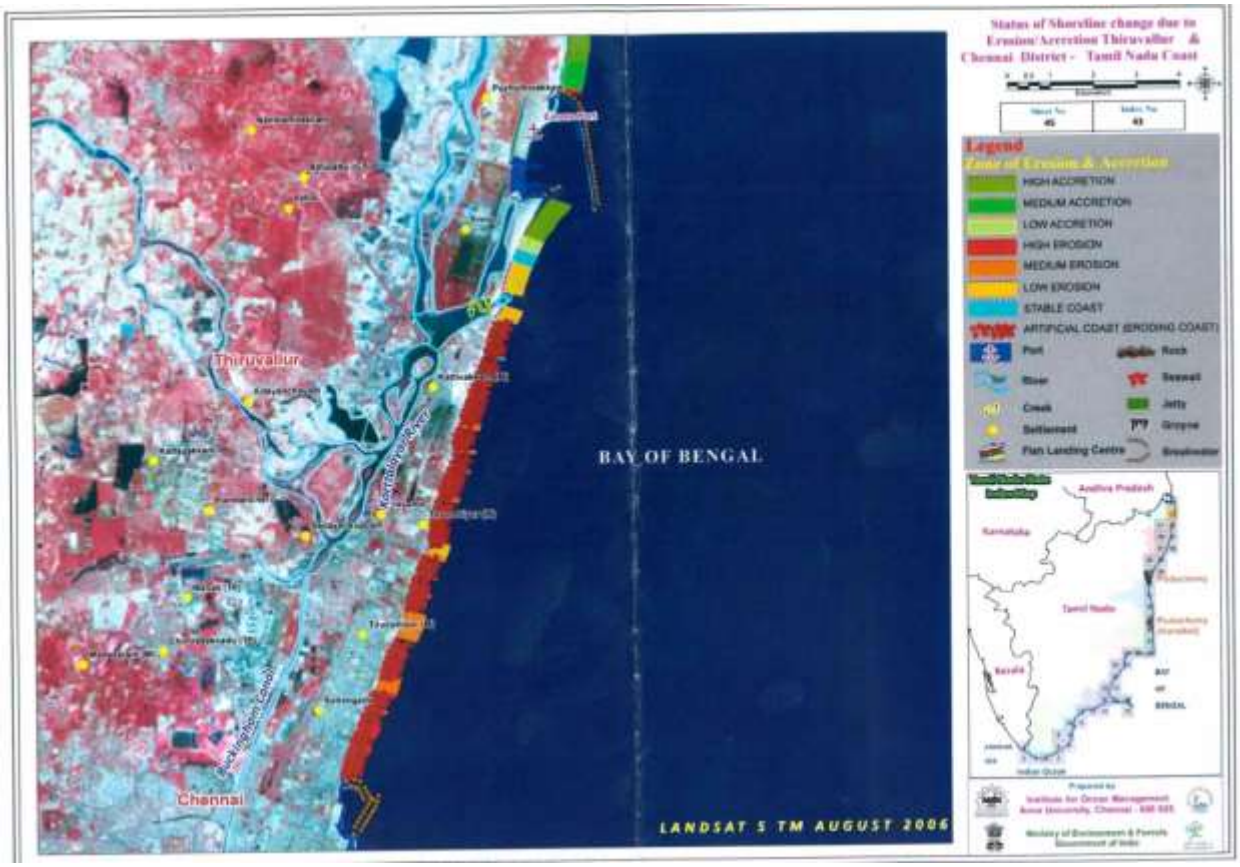
The survey shows that the bed slope is fairly flat. Shallow depths prevail near the proposed berth. The draft nearer to the proposed berth is varying from -1m to -4m.



7.11 SHORE LINE CHANGES:

Sediment inputs to the Chennai port depends on the geomorphology of the coast and man-made interventions made on adjacent coast. Ever since the Chennai Harbour was constructed, the coast north of the harbor has been experiencing erosion at the rate of 8 meters per year. It is estimated that 500m of beach has been lost between 1876 and 1975 and another 200 meters between 1978 and 1995.





Shore line changes of Chennai District

7.12 Mathematical Model Studies for Relocation of Sand Trap:

Chennai Port Trust has had done mathematical modelling studies for "Relocation of Sand Trap to reduce siltation in the approach channel at Chennai Port" through Central water and Power Research Station (CWPRS). In present study mathematical models such as littoral drift, hydrodynamics, wave transformation and sediment transport models were used for relocation of sand trap. Tidal levels were taken from admiralty chat and tide observations were used in model simulation. In modelling LITPACK, MIK21 software were used and conclusions of the report are given below.

1. The width of the cross shore transport zone observed on the south of Outer Arm (South Breakwater) in the simulation is of the order of 150 m to 600 m from High Water Line. The maximum sediment transport occurs in the region of 75 m to 400 m.

2. Based on the literature cited in the report, the width of the sand trap would be 150 m at the minimum and 300 m maximum. The optimum depth of the sand trap would be 19 m at the minimum and 24 m maximum.

3. Two alternative locations for the Sand trap have been initially suggested. These locations were examined in detail and Alternative – I was shortlisted for testing in the model for the trapping efficiency and safe dredging operations.

4. 2- Dimensional Integrated Flexible mesh (FN) mathematical model studies are carried out at CWPRS to assess the effectiveness of the proposed Alternative – I for the relocation of Sand trap. The optimum size for the Sand trap at Chennai Port based on assessment of litoral drift works out to 250 m X 500 m dredged to a depth of ((-) 22 m below CD.

5. The south of sand screen, at Cooum river mouth, sand mining is reported and no bypassing is done to the north coastline therefore, under the present circumstances, no significant sedimentation is seen in the approach channel. If the sand mining is stopped or banned, sediment will be bypassed and expected to reach the southern arm and approach channel.

6. Sediments intercepted by the Sand trap will have to be bypassed at regular interval to the northern coastline which has been affected by severe erosion and now partially stabilized by a Groyne field.

7. Location of the Sand trap will not have any impact on the present conditions and the berths and terminal areas will be well protected. In case the Outer Harbour proposal is implemented the Alternative – I location of Sand Trap can be retained with some additional modifications in the extended part of Breakwater and providing shelter to Sand Trap using a detached breakwater.

8. No significant loss to marine life is expected due to proposed Sand Trap. The dredging activity may cause temporary turbid conditions which will be prevailing for a very short duration. Ambient conditions will be restored in a reasonably short time.

The detailed report of CWPRS is given in annexure IX.