

FINAL REPORT

**RAPID ENVIRONMENTAL IMPACT ASSESSMENT (REIA) STUDIES
AND PREPARATION OF EMP
FOR THE PROPOSED
THANGASSERY PORT, KERALA**



Submitted to

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Chapter 1

Introduction

Kerala State, which has one of the highest densities of population in India, has high concentration of population in its coastal zone. A number of vital industries such as mineral factories, coir factories, seafood processing units etc. are situated in the coastal zone, employing millions. A number of minor ports in addition to the major port of Cochin, and fishing harbours are situated in the coastal zone. It can be seen from the above that, the coastal line has helped the State in establishing a number of minor ports, in addition to maintaining a flourishing fishing industry. Development of port facilities makes significant contribution to the economic development and the growth of maritime transport. At the same time it may also create adverse impacts on the surrounding environment. Port development may create a wide range of impacts on the environment by construction work, dredging, reclamation, landfills, discharges from ships and waterfront industries, cargo operations, and other port related activities. The potential adverse effects of port development encompass air pollution, noise and vibration, visual pollution, beach erosion, ground water pollution, sea water pollution, contamination of bottom sediment, loss of bottom habitat, damage to marine ecology and fisheries, current pattern change, waste disposal, oil leakage and spillage, hazardous material emissions and other unhealthy socio-cultural impacts. Port development and operation should, therefore, be planned with careful consideration of their environmental impacts. To minimize these adverse effects that may be created by the port development projects the techniques of Environmental Impact Assessment (EIA) become indispensable. With these in mind the Ministry of Environment and Forests (MoEF), Government of India, issued an "Environmental Impact Assessment Manual" (rev. 2005) and also "Environmental Guidelines for Ports and Harbour Projects" (1989). The present study was undertaken following the above-mentioned aspects.

Minor ports are placed in the Concurrent list of the Constitution and are administered under the Indian ports Act, 1908. The Act defines the jurisdiction of Central and State government over ports. It lays down rules for safety of shipping and conservation of ports. It regulates matters pertaining to the administration of port dues, pilotage fees and other charges. At the State level, the department in charge of ports is responsible for formulation of water front development policies and plans, regulating and overseeing the management of State ports, attracting private investment in the development of State ports, enforcing environmental protection standards, etc.

Environmental Regulations

At the national level, the environmental clearance to the project is subject to compliance with the stipulated safeguards under the provisions of Environment (Protection) Act, 1986; Forest (Conservation) Act, 1980; The Wildlife (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Water (Prevention and Control of Pollution) Rules, 1975; The Water (Prevention and Control Pollution) Cess Act, 1977; The Water (Prevention and Control of Pollution) Cess Rule, 1978; The Water (Prevention and Control of Pollution) Act, 1981; and other rules and regulations in force. Land use on the coastline will be subject to regulation as per the Coastal Regulation Zone (CRZ) Notification issued by the Ministry of Environment and Forests (MoEF), Government of India in 1991 and subsequent amendments under the Environmental Protection Act. This notification is administered by the State Department of Environment and Forests.

Environmental Impact Assessment

Environmental Impact Assessment (EIA) is an exercise that aims to identify, predict, interpret and communicate the impact of legislative proposals, policies, programmes, projects and operational procedures on the natural environment and human health and well being. It intends to improve decision-making and ensure environmentally and socially sound and sustainable development. The MoEF promulgated an Environmental Impact Assessment Notification on 27 January 1994, under the Environmental (Protection) Act 1986, declaring EIA a mandatory requirement for development projects. Ports and Harbours are listed at Sl. No.3 of Schedule – I, List of Projects requiring environmental clearance and the EIA Notification, 2006 has done away with the exemption available earlier under the EIA Notification 1994 to Port projects. The Ports and Harbors with cargo handling capacity ≥ 5 million TPA of cargo handling capacity (excluding fishing harbors) are classified as category-A projects and with cargo handling capacity < 5 million TPA and/or ≥ 10000 TPA of fish handling capacity are classified as category-B projects, subject to the applicability of General Conditions as stipulated in the EIA Notification, 2006.

Environmental Appraisal Procedure

MoEF is the nodal agency for environmental clearance. The Environment Division plays a key role, but the Forest and Wildlife Divisions are consulted when projects involve diversion of forestland or the alignment of roads and highways along or within the wildlife areas. The project proponents of new projects must submit an application to the Secretary, Ministry of Environment and Forests, New Delhi in the standard proforma specified in the EIA Notification. The application should be accompanied by a Feasibility/ Project report, including:

1. Environmental Appraisal Questionnaire developed by MoEF
2. Environmental Impact Assessment Report
3. Environmental Management Plan
4. Details of Public Hearing as in Schedule IV (wherever necessary)
5. Rehabilitation Plans (wherever necessary)

6. Forest Clearance Certificate (wherever necessary)

7. No objection Certificate from State Pollution Control Board

The application is evaluated and assessed by the Impact Assessment Agency (IAA). The IAA may consult a Committee of Experts constituted by it or other body authorised by it in this regard, if necessary. The Committee has full right of entry and inspection of the site or factory premises before, during or after the project commences. The IAA prepares a set of recommendations based on technical assessment of documents and data, furnished by the project authorities or collected during visits to sites or factories and details of public hearing.

It is to be ensured that none of the activities planned by the project proponents during the investigations/construction/operational phase of the project violates the provisions of the CRZ Notification, 1991; EIA Notification, 1994; Manufacture, Storage and Import of Hazardous Chemical Rules, 1989; the Forest (Conservation) Act, 1980; The Wildlife (Protection) Act, 1972; Environment (Protection) Act, 1986; and their subsequent amendments and other relevant Acts/Rules issued by the Central/ State Government.

Objectives of the Present Study

To carry out a Rapid Environmental Impact Assessment of the Proposed Thangassery Port, and to prepare an Environment Management Plan.

Specific Objectives

- 1 To analyze the project based on the components and identify activities that can have considerable effect on the local environment - be it positive or negative.
- 2 To foresee and quantify the magnitude and intensity of the impacts of the various project components on the local environment.
- 3 To carry out an appraisal of the present environmental settings in the area with regard to parameters like land, water quality, biodiversity of the region, socio-economic conditions of the people, infrastructure capabilities of the area, etc.
- 4 To suggest mitigative / control measures for the major impacts of the Port on the area and also to prepare an Environmental Management Plan for the Port area.

Methods

To assess the likely impact of the proposed Port project on the surrounding area, an integrated multidisciplinary survey was conducted. The optimum sites for Port amenities like roads, sewage and sanitation facilities etc. were identified. The impact of the Port construction on flora and fauna of the area was also studied.

Chapter 2

Description of the Environment

Physical Environment

Location

Thangassery is situated in Kollam District about 70 km north of Thiruvananthapuram and 150 km south of Kochi (Latitude of 8° 52' 35" N and Longitude of 76° 34' E). The bay lying east of the Thangassery point is the site for the Port. The comparatively deeper hydrography of the Thangassery area along with the flourishing economic activity the old Kollam town made Thangassery an important Port along the west coast of India in older times. The land side of the Port area is within the limits of Kollam Corporation, which has an area of 57.31 km² with a population of 361,441 (Census 2001) in 78,182 households.

Geology and Topography

Laterite formations extending to the sea are noticed at the Thangassery and nearby areas predominantly on the northern side. A shallow stretch of rocky formation extending southwards as a groyne is also reported. In general, sand with shell contents is noticed above the hard stratum, with slight clay content.

The general topography of Kollam Corporation area is flat with a moderate slope and the altitude varies from 0 to 10 m above Mean Sea Level (MSL). The gradually sloping terrain towards west favors natural drainage. The coastal plain below the 7.5 m contour and is characterized by marine landforms of beach ridges, beaches, swamps and lagoons.

Climate

The climate of the region is tropical humid, with an oppressive summer and plentiful seasonal rainfall. The hot season, lasting from March to May, is followed by the south west monsoon from June to September. The north east monsoon occurs from October to November. The rest of the year is generally dry. The average annual atmospheric temperature of the area is 27° C, and the annual temperature range is 27.8° to 33° C as a maximum and a range of 22.3 to 26.1° C as a minimum. The South-West monsoon provides heavy and reliable rainfall with the average annual rainfall about 3100 mm, within an average of 115 rainy days. The monthly mean value of relative humidity varies from 75-96% in the morning (08:30 hrs) to 65-91% in the afternoon (17:30 hrs). Winds from North West prevail during November to January and South East winds during May to August. Excessive rain during June to August causes frequent floods in the rivers and canals in the area, submerging low-lying areas.

Water Environment

The major source of drinking water is through piped distribution network of Kerala Water Authority (KWA) and from wells. The pipe network suffers from heavy leakages due to aged piping. Also a number of un-authorized and inadequate carrying capacity of the network itself to satisfy the needs of development put strain on the system. The present per capita availability of water to Kollam is about 40 lpcd.

Ashtamudi Lake, the second largest wetland of Kerala recognized under Ramsar International Treaty for Wetland Protection, is the nearest surface water source about 5 km from the Port location. It is a brackish water lake connected to Lakshadweep Sea and the movement of water is influenced by the tidal action.

Ground water in the Corporation area occurs under confined and semi confined conditions. The course, porous and permeable layers of laterite form aquifer system. The main recharge to groundwater takes place from precipitation. There are number of open wells exists around the site and these open wells are mainly used for domestic purpose. Depth of ground water level ranges between 1.50m to 6.20m below the ground level. The directional flow of ground water is mainly from west to east. The Ground Water Quality of Kollam Corporation studied as part of Kerala Sustainable Urban Development Project (KSUDP) is given in Table 2.1.

Table 2.1 Ground Water Quality of Kollam Corporation Area

Characteristics	Observed Value (mg/l)	Standard (mg/l)
pH	4.5	6.5 – 8.5
Total Hardness (as CaCO ₃)	110	300
Chlorides	166.60	250
Dissolved solids	480	500
Phenolic compounds (as C ₆ H ₅ OH)	ND	0.001
Sulphate (as SO ₄)	Trace	200
Zinc	0.56	5
Arsenic	---	0.05
Cadmium	ND	0.01
Chromium	ND	0.05
Copper	ND	0.05
Cyanide	---	0.05
Lead	ND	0.05
Mercury	ND	0.001
Nickel	---	---
Total Nitrogen (as NO ₃)	7.10	45
Iron	0.05	0.30

Source: KSUDP ; ND- Not detected

Air Environment

The air environment of Thangassery region is very clean and pleasant because there are not many influencing factors. The number of industries as well as that of vehicles is considerably small. The Ambient Air Quality data for Kollam City during 2006 is given in Table 2.2. and it is found that Sulphur dioxide (SO₂), Oxides of Nitrogen (NO_x) and Suspended Particulate Matter (SPM) levels of the City is much below the stipulated limit.

Table 2.2 Ambient Air Quality data for Kollam City during 2006

Parameter	Standard (µg/m ³)	Observed value (µg/m ³)			
		North	West	South	East
Sulphur dioxide (SO ₂)	120	19	14	18	26
Oxides of Nitrogen (NO _x)	120	6.5	6.0	10.5	7.5
Suspended Particulate Matter (SPM)	500	28.75	20.04	42.50	82.45

Source: KSUDP

Noise

The major source of sound pollution in the city is the vehicles and indiscriminate use of loud speakers. The noise level of the Kollam city is given in Table 2.3. The sound level was found to be below the limits prescribed for Commercial category all over the city area. Ambient noise level in the Kollam city region is relatively higher than the limits prescribed for residential area by the Central Pollution Control Board.

Table 2.3 Noise Level at Kollam City

	Observed Value in dB(A)	
	Day Time	Night Time
Observed Locations		
North side	48.8	42.0
West side	47.0	46.5
South side	58.0	53.0
East side	55.6	50.0
Standard (as per CPCB, India)		
Industrial (I)	75	70
Commercial (C)	65	55
Residential (R)	55	45
Silence (S)	50	40

Source: KSUDP

Land Environment

The study area consists of mainly three land use types – Residential built up land, Coconut plantations, and areas with coconut and other mixed crops, with a few vacant lands. There are some patches of vegetable cultivated land. The land use pattern of Kollam Corporation for 2000 is given in Table 2.4. Major use of urban land is classified under residential use, which includes not only the area occupied by the houses, but also the coconut gardens around the house as well.

Table 2.4 Land use of Kollam City

Type of Land Use	Area in Km²	% of Total Area
Residential	34.69	71.53
Public and Semi Public	1.74	3.59
Commercial	0.69	1.42
Industrial – Major	1.13	2.33
Parks and Open Spaces	0.34	0.70
Transportation	2.22	4.58
Paddy Fields	4.94	10.19
Water Bodies	2.75	5.67

Source: Development Plan for Kollam (2011), Kollam Development Authority (July, 2000)

Ecological Resources

Coastal Environment

The 590km length Kerala coast faces the Arabian Sea. The coastline of Kerala is more or less straight trending in NNW-SSE direction from north till the Thangassery headland near Kollam. The coastline orientation south of Thangassery is in the NW-SE direction. The offshore continental shelf bathymetry is steeper to the south.

Terrestrial Environment

No forest, wild life sanctuaries or other environmentally sensitive area is near to the project site and no rare or endangered species have been reported from the region. No mangrove or wet land or turtle nesting sites is observed at or near to the site. Cultivated plants like *Cocos nucifera*, *Mangifera indica*, *Thespesia populnea*, *Tamarindus indica*, *Artocarpus heterophyllus*, *Casuarina equisetifolia*, etc., are very common around the site. Although Kollam retains extensive backwater systems its wetlands have been extensively damaged by reclamation for coconut growing and foreshore developments. Consequently, Kollam has the lowest proportion of mangroves in the State's dwindling wetland resources.

No endangered or endemic plant species were recorded in the region. The project site is not situated within or adjacent to any cultural heritage sites, protected areas, buffer zones of protected areas, or special areas for protecting biodiversity.

Socioeconomic Environment

The main activity in the region is fishery and most income is generated by fishing activities. One-third of the State's fish catch is from Kollam region. Assessment of city economic development and urban growth indicates a decadal population growth rate of 4.45 percent, which is lower than the State's urban population growth rate (1991-2001).

Tourism

Thangassery region is aesthetically beautiful and culturally rich with few famous churches. Thangassery is a place of historical importance situated 5 km away from Kollam town. The Churches here are pretty old, having been established in the 18th century. The vast silent stretch of windy beach shore is an attraction of Thangassery region. The chief attraction of the place is the light house, built in 1902. The 144 ft. light house stands as a sentinel, warning seamen of the treacherous reefs of Thangassery. Thangassery was an enclave of the Portuguese, Dutch and British in succession and the remnants of the Portuguese and Dutch forts still exist. The Portuguese fort is believed to be built in 1517 and only one wall of this fort remains now. Tourists visiting Kollam are often attracted towards the beaches. The average tourist arrivals are to the tune of 85,000 domestic tourists and 15,000 foreign tourists (Source: District Tourism Promotion Council, Kollam).

Transportation and Communication

The nearest Airport is at Thiruvananthapuram (Thiruvananthapuram International Airport) which is about 75 km south of Thangassery. The region is connected by rail, the nearest Railway Station being at Kollam, only 5 km from the Port site. Kollam Corporation has an estimated 347 km of road network, with a road density of 6 per km². Kollam city is a major intercity junction for road, rail and water transport networks from Thiruvananthapuram, Ernakulam and Shencotta. The central part of the city, known as the Chinnakada area, is the junction for all these transport networks. State Transport buses and private buses operate in the area from various nearby towns. Taxis, Auto-rickshaws and other private vehicles are also available. The area has a good network of communication with STD facilities and mobile telephone services.

Chapter 3

Project Description

Existing Thangassery Fishery Harbour

Based on Hydraulic model studies conducted by CWPRS, Pune and EIA study by Centre for Environment and Development, Thiruvananthapuram; a fishery harbor for traditional fishermen was sanctioned at Thangassery with 50% Central assistance. Thangassery fishery harbour was partially commissioned during March 2001. The existing facilities at the fishery harbour are:

- a) Main Breakwater (2100 m)
- b) Leeward Breakwater (550 m)
- c) Auction Hall (4 Numbers) have been completed
- d) An Overhead water tank of capacity 50,000 litres
- e) An underground water tank of 50,000 litres
- f) Parking area and Loading Area
- g) Canteen
- h) Locker Rooms
- i) Community Hall
- j) Workshop
- k) Lavatory Block
- l) Inspection Bungalow
- m) Compound wall

About Thangassery Port

Thangasseri was once a favourite settlement of the Portuguese, the Dutch and the English in succession, and was one of the oldest and most important port for international cashew and spice trade on the Malabar Coast. No history of “anchor dragging” even in foul weather from this port was reported. This ancient natural Port was very active up to 1970 and the Port activities and Cargo operations were shifted to the fishing cum Cargo Harbour at Neendakara from 1970 onwards.

It has decided to develop the existing port of Thangassery to all weather commercial port for handling large vessels. The plan is to create cargo handling and other related facilities within the existing Thangassery fishing harbour. During the Eleventh Plan period, Thangassery is further planned to be developed as a Port capable of handling coastal shipping vessels up to 15000 Tones DWT, Bulk Carriers of up to 50000 Tones DWT, Container feeder vessels up to 2000 TEUS, as well as bunkering berth facility of vessels up to 12 meters draft. For this Port Department

proposes renovation of office and godown, construction of tug and barges, capital repairs of Tug Padmasree, 4 barges and equity contribution to SPV.

The provision is for meeting expenditure in connection with the development of Thangassery Port through PPP, preparation of Project reports, share capital contribution to SPV and stage payment for the replacement of Tug Illminate Development of Thangassery Cargo Harbour to accommodate cargo vessels as well as passenger liners is also envisaged in the scheme. Balance work of the construction of transit shed, water supply arrangements, electrification, land acquisition, yard levelling, navigational aids and maintenance dredging are included in the annual plan proposals.

Coastal Regulation Zone (CRZ)

Restrictions were imposed on developmental activities on coastal areas by introducing the Coastal Regulation Zone Notification in 1991 under the authority of the Environment (Protection) Act 1986. Coastal stretches of sea between the Low Tide Lines and High Tide Lines and up to 500 meters on the landward side from High Tide line and up to 50 meters from the bank or width of the creek, river or backwater whichever is less will come under the regulated zone. For imposing restriction, the coastal area is classified into four zones viz:

- 1) CRZ I – Areas that are ecologically sensitive and in the area between High Tide Line and Low Tide Line;
- 2) CRZ II – Areas that have already been developed up to or close to the shoreline;
- 3) CRZ III – Areas that are relatively undisturbed which does not fall under CRZ I or CRZ II; and
- 4) CRZ IV – Coastal stretches in the Andaman & Nicobar, Lakshadweep and small islands.

According to the notification, Coastal Zone Management Plan for Kerala was prepared demarcating the Coastal Regulation Zone in the State, which was approved in 1996. Under the approved Coastal Zone Management Plan, coastal stretches of all the Corporations of the State fall under CRZ II and developments in CRZs require the approval of the Central / State Coastal Zone Management Authority.

Port Layout

The development of the Thangassery port is divided in the following three phases, Viz., Phase I – (till 2025), Phase II – (from 2025 to 2035) and Phase III – (2035 onwards). In Phase I, the focus is to best use the existing facilities already developed by the State Government to its optimum capacity. This would call for the strengthening of the existing berth. Only when the cargo traffic is nearing the 3 million tonnes per annum figure that the Phase -II would be developed, the construction work for phase II may commence in 2023 and the facilities may be ready by 2025. Phase III is provisional

The layout plan of Thangassery port is shown in Fig 3.1

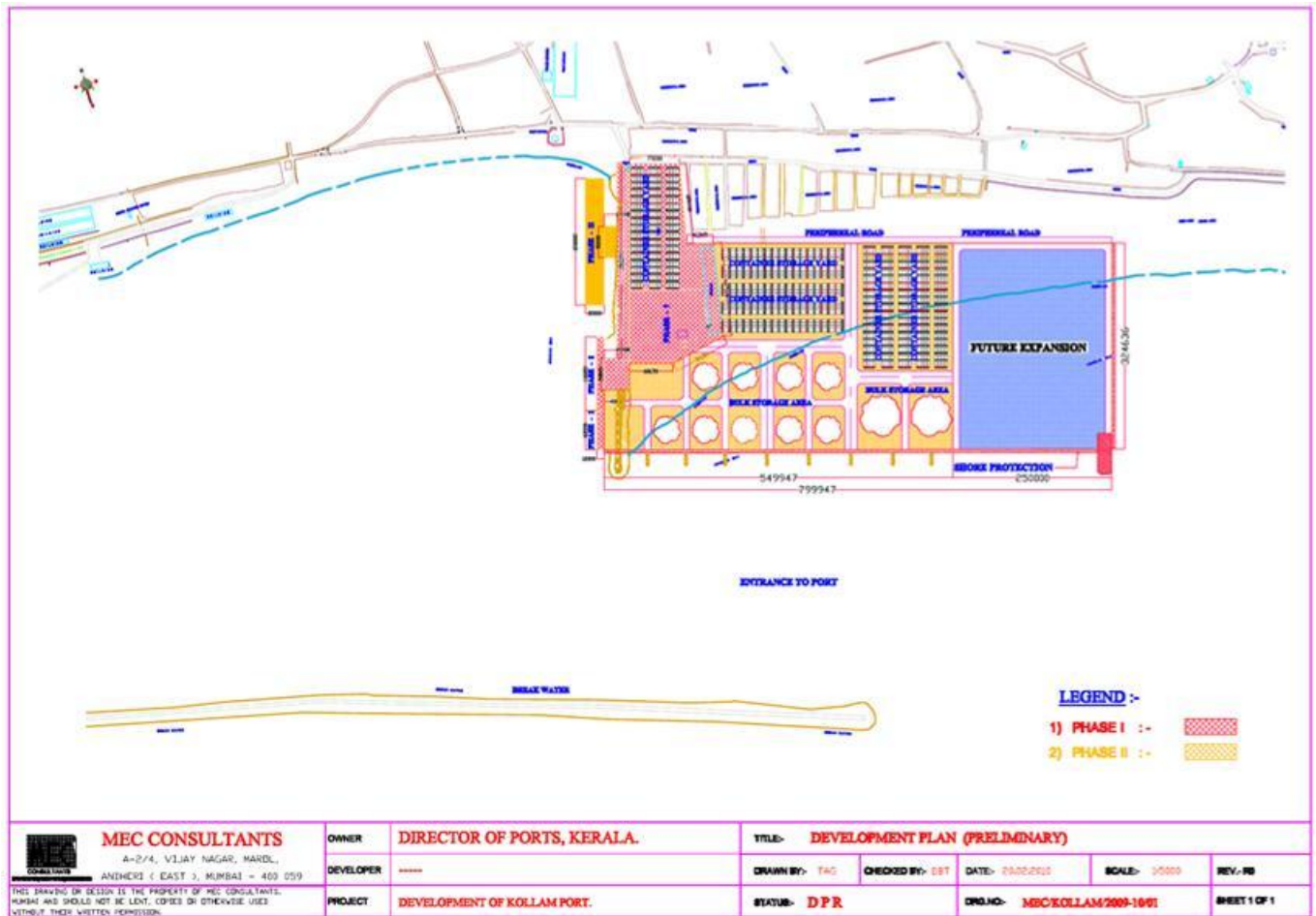


Fig 3.1 The layout plan of Thangassery port

The existing breakwaters of the fishery harbour, seaward breakwater (2100 m long) and leeward breakwater (500 m long) will be used for the port. The port layout at full build-out comprises a wharf on leeward breakwater. The existing wharf on Leeward breakwater (116 m long) will be used and a further 62 m extension is proposed. A 16,000 m² of concrete storage yard has been prepared for storing containers, 260 m away from the berth. Construction of two transits sheds of area 64 m X 20 m is proposed adjacent to the concrete yard. Construction of one Ground Level Sump of capacity 230000 litres and an Over Head Tank of capacity 200000 litres are proposed. An existing Godown of area 44 m X 33 m at Pallithottam will also be utilized for the Port.

Project Components

Steps involved in the present EIA are: identification and recording of all major activities of the project during the construction and operation phases and their possible effect on the environment, impact analysis and formulation of the Environment Management Plan. The following major activities are identified in various phases of the project.

Construction Phase

i) Construction of roads: The Thangassery region has already a well-developed road network consisting of major and minor roads with ample width. So no major construction is required. The only requirement is the maintenance of the existing roads for making them fit for the transportation of the materials arriving at the port. An approach road connecting the Port to the NH is initiated.

ii) Material transport: The raw materials for the construction activities are to be transported to the site of the port. This transportation requires maintenance of the existing roads and considerable vehicular movement is expected in this phase.

iii) Land acquisition and site clearing: Harbour Engineering Department owns the proposed site and hence no land acquisition is required. The proposed site has a shore extent up to high tide line and no significant vegetation is found in this area.

iv) Breakwaters: The existing breakwaters of the fishery harbour, Seaward breakwater (2100 m long) and leeward breakwater (500 m long) will be used for the port and there is no need for any construction

v) Construction of wharf: the existing wharf on Leeward breakwater (116 m long) will be used and a further 62 m extension is proposed. The wharf is designed to take a load of 35 kilo N/m².

vi) Dredging: The existing draft is around -6.5 to -7.0 m and the draft designed in front of the berth is 10 m.

vii) Construction of yard: A 16,000 m² of concrete storage yard has been prepared for storing containers. This yard is 260 m away from the berth.

vii) Transit sheds: Construction of two transits sheds of area 64 m X 20 m is proposed adjacent to the concrete yard.

viii) Water supply: Water is another major infrastructure for the functioning of the port. Construction of one Ground Level Sump of capacity 230000 litres and an Over Head Tank of capacity 200000 litres are proposed.

ix) Construction of Godown: An existing Godown of area 44 m X 33 m at Pallithottam will be utilized for the Port.

Operation phase

i) Anchoring of vessels: The vessels will be anchored for loading and unloading the cargo. Facilities should be provided for safe anchoring of vessels.

The cargo expected to be handled at the Port is clean cargo. The major cargo commodity that is expected to be handled at the Port is in containerized format. Bulk of the commodity expected is timber logs and sand.

Future Scenario

- Continuous Dredging
- Urbanization
- Immigration
- Settlements

Sensitive Issues

- Dredging and reclamation
- Water pollution
- Noise pollution
- Loss of biodiversity
- Loss of aesthetic values
- Loss of shoreline stability

Chapter 4

Environment Examination and Environment Risk Assessment

Data Collection

The present study was carried out through both primary as well as secondary data collection. A team of multidisciplinary experts of CED carried out primary data collection. The following details were collected during field visits.

Study of Flora and Fauna: No endangered or endemic plant species were recorded in the region during the field survey. The area situated in the coastline of Kollam District. The area is not rich in flora or fauna as is already a constructed area. The project site is not situated within or adjacent to any cultural heritage sites, protected areas, buffer zones of protected areas, or special areas for protecting biodiversity.

Socio-Economic Aspects: To evaluate the socio-economic aspects of the local fishing community, a informal consultations were carried out covering all the fishermen hamlets in the area. The survey results indicate that the majority of local community strongly favours the construction of a Port. A few people expressed their apprehension over sharing of the resources of the fishing harbour. The survey also shows that more than 90 % of the local men were involved in fishing activities and women were involved in fish selling. In some areas coir retting activities are also going well even though at a minor level. Many women are involved in fish drying also.

The construction of multistory housing complexes to relocate the fishing families in the area is in progress.

Transportation of Raw Materials: The raw materials need to be brought in from quarries far away from the site and extractions of the stones have to be done in the quarries through blasting. The transportation of the raw materials has importance in that it may create noise and air pollution though for a limited period only.

Employment Generation: A number of direct and indirect employment opportunities will be generated at various stages of the Port construction, which will benefit the local community.

Secondary Data Collection

The study team collected secondary data available with various departments and agencies including Port Department, Harbour Engineering Department, etc.

Impact Prediction and Assessment

Construction Phase

a. Terrestrial Ecology

The Project component includes land clearing and preparation entailing the loss of vegetation. However, since this area is not a significant habitat of valuable flora or fauna, adverse impacts on the ecological environment are considered to be minor.

b. Marine Environment

The Project component includes dredging and reclamation work. The work methods during dredging will be of such a nature that will cause minimal disturbance to the marine environment.

c. Air and Noise

Some construction work like piling and demolition may generate dust, noise, and vibration. However, since these temporary works will be confined to the port area and there are few residences near it, disturbance to local people will be minimal.

Also, the temporary traffic generated by the Project is expected to be relatively low, and environmental impacts by traffic will be insignificant.

d. Social Impacts

It is estimated that about --- persons on average will be employed during the construction period. Also, the construction activities will provide some business opportunities for suppliers of materials and transportation, and for traders to cater to the employees' requirements such as food, daily needs, and medical care.

Table 4.1 summarises the potential impact during construction phase.

Dredging - Direct impact: The proposed construction of Port at Thangassery involves dredging of substrate. The main impacts associated with dredging and disposal activities relate to direct loss of habitat of aquatic biota. Secondary effects are related to the formation of sediment plumes, which may affect fish or benthos because of the smothering and clogging effect of highly turbid waters on the gills of bivalves or fish, inability to detect predators or the limiting of the photosynthetic process in plants. Nets placed in very silty areas tend to accumulate fine mud particles on their weave, and fish can see the net and avoid it or they slide easily off the net instead of becoming entangled in its mesh.

Table 4.1 Project Activities and its impact – Construction Phase

Activities Impact on	Dredging	Excavation and Sediment Dispersal	Wharf construction	Construction of yards	Construction of transit sheds	Construction of Godown	Transportation of Raw materials	Power supply	Water supply
Landscape	N	N	N	N	N	N	0	N	N
Ground water	0	0	0	0	0	0	0	0	0
Surface water	N	N	N	N	N	0	0	0	N
Air quality	N	N	N	N	N	N	N	0	0
Noise quality	N	N	N	N	N	N	N	0	0
Flora	N	N	N	N	N	N	0	0	N
Fauna	N	N	N	N	0	N	0	0	0
Settlements	0	N	N	0	0	0	0	N	P
Transportation	0	0	0	0	0	0	N	0	0
Economy	P	P	P	P	P	P	0	P	P
Tourism	N	N	N	N	N	N	0	P	P
Culture	0	0	0	0	0	0	0	0	0
Employment	P	P	P	P	P	P	P	P	P
Aesthetic	N	N	N	N	N	N	0	N	N
Hazard	N	N	0	0	0	0	0	N	N

N = Negative, P = Positive, 0 = Nil

Excavation and Sediment Dispersal: The rotary action of the dredger and the dragging of the suction pipe along the bottom will disturb the substrate and place sediments into suspension. These suspended sediments may then smother nearby bottom-living flora and fauna as and when they settle. The effect will be significant in areas with fine sediments, which are more easily placed into suspension. The suspension of sediments would be minimised to the extent that the powerful suction pumps on the dredgers are able to suck up these materials out of the water column.

Water Turbidity: The suspension of fine sediments in the water column creates turbidity, which scatters and attenuates light levels and potentially affects the growth of plants indirectly by reducing the availability of light and consequently the photosynthetic process in plants. High levels of localised turbidity can be expected during dredging of the mud in the basin area. Due to the weak water currents in this part of the basin, the turbidity is not expected to move very far. From our study, there is no sensitive biota in the vicinity of area to be adversely affected by light attenuation. It should also to be noted that the turbidity regularly occurring in the harbour after prolonged rainfall, would potentially have a much more deleterious effect than that caused by the proposed short-duration dredging works.

Dredger Spillage and Leakage:

i. Deliberate spillages: It is a practice in some dredging operations to maximise the amount of solid material in the hopper hold by allowing the slurry water mixed with the dredged material to overflow from the vessel. In the case where fine sediments are being dredged, this results in high turbidity of the water surrounding the vessel, which could then be transported by surface water currents over sensitive habitats. A second means of deliberate spillage occurs when the bottom gates of the hopper hold are opened slightly so as to release sediments while the vessel is on route to the reclamation site. However, in Thangassery as the dredging and reclamation site are very close to each other, this potential impact is not expected to occur.

ii. Accidental spillages: The amount of material leaking from the bottom gates of a dredger would normally be insignificant. However, if a hard object or rock becomes lodged between the gates, then material will steadily spill out of the holder into the water column. In some cases measures can be taken to avoid or reduce the severity of the impact, and the appropriate mitigation measures are identified. In other cases the impacts cannot be avoided or successfully mitigated if the project is implemented and these represent irreversible impacts. Table 4.2 summarises the potential impacts related to dredging operations at Thangassery Port.

Summary of Potential Impact: The potential impacts related to dredging operations at Thangassery Port is summarised below. In some cases measures can be taken to avoid or reduce the severity of the impact, and the appropriate mitigation measures are identified. In other cases the impacts cannot be avoided or successfully mitigated if the project is implemented and these represent irreversible impacts. The major potential impacts relevant to the proposed project are:

Positive Impact

1. Improved capacity of entrance channel and helps harbour to receive vessels
2. Improved navigational safety in entrance channel
3. Increased employment opportunities, earnings and economic activity related to increased vessel movement.

Negative Impact

1. Sedimentation and turbidity affecting benthic communities along approach channel and at Port basin due to suspension and dispersal of fine sediments.
2. Medium term loss of biota at reclamation site.
3. Hindered boat/ship traffic and fishing during the dredging operations.

Table 4.2 Dredging – Summary of Potential Adverse Environmental Impacts

Activity	Potential negative impacts	Direction		Impact Significance	Mitigation Possible	Duration		Location		Magnitude		Extent	
		Positive	Negative			Long	Short	Direct	Indirect	Large	Small	Wide	Local
Dredging	Loss of benthic biota		✓ *	Mod^	No	✓		✓		✓			✓
	Modification of current & wave pattern		✓	Low	No	✓		✓			✓		✓
Sediment disturbance and overfilling of dredger	Settlement of suspended solids		✓	Mod	Yes		✓		✓		✓		✓
	Attenuation of light in water column		✓	Low	Yes				✓		✓		✓
	Dispersion of contaminated sediments		✓	Low	Yes		✓		✓		✓		✓
	Degradation of pelagic habit		✓	Low	Yes		✓		✓		✓		✓
	Damage to fishing gear		✓	Low	Yes		✓		✓		✓		✓
Presence / location of dredges	Increased ambient noise level		✓	Low	Yes		✓	✓			✓		✓
	Impaired visual aesthetics / seascape		✓	Low	Yes		✓	✓			✓		✓
	Hindrance to other boat traffic		✓	Mod	Yes		✓	✓			✓	✓	
Leakage of sediments during transportation	Increased turbidity over sensitive inshore habitats		✓	Mod	Yes		✓		✓		✓		✓
Reclamation	Sedimentation of deep-water benthic habitat		✓	Mod	No		✓		✓		✓	✓	
	Degradation of pelagic habitat		✓	Mod	No		✓	✓			✓	✓	

* The ✓ mark indicates the existence of impact, ^ Mod - Moderate

Noise Pollution: Given the proximity of the dredging operation to residential areas, the noise generated by the dredging vessels may cause a level of auditory discomfort, especially at night, which is difficult to evaluate in the absence of any noise measurements for dredging operations. However, given the very short-term nature of the dredging works, it is not expected to be intolerable. However, the dredging vessels being employed to carry out the dredging works should be modern vessels fitted out with noise abatement equipments.

Visual / Seascape Impacts: To some individuals, the presence of the dredging vessels possibly could appear as a visual intrusion on the normal seascape. However, given the normal nature of shipping activity in this area, and the short-term nature of the proposed dredging operation, this potential impact is not considered to be intolerable or significant.

Impairment to Fishing Activities: The generation of turbidity and dispersed sediments by dredging prevents fishermen from being able to see and find their fish pots, clog gill nets, and cause suffocation of fish caught in traps. However, as the local fishermen of Thangassery offers full support for the port construction, there is no need to consider the impairment to fishing activities.

Modification of Wave and Current Pattern inside Port: The minor modifications of the bathymetry of the area will not significantly change the existing pattern of currents and waves in the open sea.

Spoil Disposal: The potential impact would be dependent on the economic value assessed on the ecosystem. From the environmental point of view, it is very difficult to assess the economic value of the area especially the service and ecological functions that they offer. However, from our study, it is revealed that there is no endangered or endemic species of flora or fauna in this region. All species noted here are very common and hence, the proposed reclamation could have only limited short-term impact on inshore biological resources and ecosystems.

Economic / Employment Impacts: Economic impacts include employment opportunities created during dredging activities. As direct figures are not available for this development, based on similar engineering projects, it would provide new jobs for the duration of the activities. Out of this, about 75% would be casual labour and 25% skilled and semiskilled jobs. The projected impact of the proposed project on economic/ employment opportunities is positive, direct and very significant, over the short term.

Construction of Buildings: The Port construction includes provision for construction of transit sheds, godowns, concrete yards, water supply, electricity and sanitary arrangements. The raw materials for construction are not available locally and have to be brought from quarries that are away from the construction site. As the construction materials are to be transported from places away from the site, the impact due to mining and other extraction is eliminated at the Port site.

Post – Construction Phase

a. Water Pollution

Ships calling at the port might generate oily wastewater such as bilge water. Other solid and liquid wastes will also be generated by the port community including ships' crews. A waste reception facility will be established to deal with such liquid and solid wastes. Oily liquid wastes are expected to be handled by third parties. Solid wastes generated at the port area will be collected and disposed of by the Port Authority. Sewage generated at the port area will be treated in septic tanks.

A large quantity of waste water will be generated from various sources like sewage from toilets, waste water from canteen, oil and grease pollutants from repair quay and the like during the operational stage. Oil pollution will be a major nuisance and proper mitigation measures should be taken. The direct disposal of the various effluents into the water body should be prevented at all cost and separate treatment facilities for sewage, wastewater and pollutants should be provided. The treated effluents, only on verification that the parameters are under permissible limits, should be allowed for disposal into the water body. The water quality of the receiving water bodies should be thoroughly monitored and kept under permissible limits.

b. Air and Noise

During the operational phase, transportation activities will increase and also the ambient noise and air quality will get affected due to the various operational activities like berthing, unloading, auctioning and transportation. Loading, unloading and transportation of Cement will affect the air and noise quality. Even though all the operational activities will affect the air and noise quality, the impacts are considerably negligible and will not cause much direct or indirect harmful effect on any living form around the area. At loading and unloading points, arrangement for Water sprinkling is being made so that dust generation during transportation of materials be minimized further. It would be ensured that all the vehicles plying in the working zone are properly tuned and maintained to keep emissions within the permissible limits. Competent authorities should strictly monitor all operational phase activities and rules and regulations should be strictly adhered to. All environmental parameters must be checked regularly by an Environmental Safety Officer and should be maintained within permissible limits.

Potential sources of air pollution are ships and vehicles for the transportation of cargo and other port operations. However, such impacts will be limited to the hours of port operation, and the intensity will be relatively low; hence no significant impacts are anticipated. Also, no dusty or hazardous cargo will be handled in the port. Since there are few local residents near the project area, noise generated at the port area will not have significant impacts on local people.

c. Social Impacts

About 400 persons are expected to be involved in port operations. The port activities will create other business opportunities, particularly in the service sector, contributing to the development of the local economy. Such positive impacts are considered to be significant.

Informal discussions with the stakeholder communities were arranged at Thangassery, to incorporate the views and ideas of the local population regarding the harbour, its impacts – be it positive or negative. Major stakeholders like fish catchers, fish sellers, boat owners and the like were given the opportunity to openly express their views regarding need for a harbour and its positive and negative impacts. The views and suggestions expressed by the community were considered and critically analysed by the study team.

A critical analysis of the opinion from the community points to the fact that the majority of the community is in favour of constructing the Port. A few groups had the apprehension that sharing of the existing breakwaters of the fishing harbour may influence the fishing vessel movement.

The post-construction phase impacts due to the operation of the proposed Thangassery Port are shown in Table 4.3.

Table 4.3 Project Activities and its impact – Post Construction Phase

Impact on	Anchoring of vessels	Loading & Unloading	Transportation	Urbanization	Immigration	Settlements
Landscape	N	N	N	N	N	N
Ground water	0	0	0	0	0	0
Surface water	N	N	N	N	0	0
Air quality	N	N	N	N	N	N
Noise Level	N	N	N	N	N	N
Flora	0	0	0	N	N	N
Fauna	N	0	0	N	N	N
Settlements	N	N	N	N	N	0
Transportation	P	P	0	0	0	0
Economy	P	P	P	P	P	P
Tourism	N	N	0	N	N	N
Culture	N	N	0	0	N	0
Employment	P	P	P	P	N	0
Aesthetic	N	N	0	N	0	0
Hazard	N	N	N	0	N	N

N = Negative, P = Positive, 0 = Nil

Summary of Impacts

Port construction and its associated activities and their probable impacts on the various ecosystems and environmental processes have been outlined in detail in the previous sections. These are summarised in Table 4.4. The various impacts can be reduced considerably through proper mitigation measures and implementing Environmental Management Plan, including good house-keeping practices.

Table 4.4 Project Activities and its Impacts

Sl. No.	Environmental Attributes	Project Activity	Nature of Impact
1.	Landscape	<ul style="list-style-type: none"> • Land Reclamation • Construction work • Transportation 	Minor degradation Minor degradation Minor degradation
2.	Ground water resource	<ul style="list-style-type: none"> • Civil works 	No major effect
3.	Water Quality	<ul style="list-style-type: none"> • Waste Disposal • Oil Leakage 	Major impact Major impact, but infrequent
4.	Air Quality	<ul style="list-style-type: none"> • Transportation • Civil Works • Unpleasant Smell of fish 	Temporary effect Temporary effect Permanent effect
5.	Noise Quality	<ul style="list-style-type: none"> • Dredging & Reclamation • Civil Works • Transportation • Working Phase 	Temporary impact Temporary impact Temporary impact Permanent impact
6.	Natural Vegetation	<ul style="list-style-type: none"> • Site Clearing 	Permanent impact, but not significant
7.	Natural Fauna	<ul style="list-style-type: none"> • Construction works • Site clearing 	Permanent impact, minor Permanent impact, minor
8.	Transportation	<ul style="list-style-type: none"> • Increased access for transportation of Port 	Degradation due to emission of exhaust from transportation vehicles and vessels
10.	Economy	<ul style="list-style-type: none"> • Increased economic activities 	Financial status of the local people as well as government will improve
11.	Tourism	<ul style="list-style-type: none"> • During the construction & operational phase 	Negative, but minor
12.	Employment	<ul style="list-style-type: none"> • During the construction & operational phase 	Positive
13.	Aesthetic	<ul style="list-style-type: none"> • During the construction & operational phase 	Will alter the scenic beauty
14.	Hazard	<ul style="list-style-type: none"> • During the construction & operational phase 	Chances of fire and occupational hazards

Chapter 4

Environment Management Plan

Formulation of Environmental Management Plan is one of the key criteria for the success of any type of project. This requires detailed study about the various factors of the project and its impact on the environment and it is based on this environmental impact study that future management plan has to be generated. Two aspects viz., the impact of the project on the environment and the action plan for limiting the environmental impacts, need to be considered in formulation of Environmental Management Plan of any development project including the construction of ports.

EIA is considered as a basic tool for the sound assessment of developmental proposals. Environmental scientists involved in the EIA of coastal development should be able to suggest appropriate mitigation measures for the probable impacts. It is necessary to provide detailed description for the proposed measures, indicate how they would actually be put in place and proposes how they might be modified if unforeseen post-project ecological impacts manifest themselves. The aim of mitigation is to minimize, and wherever possible eliminate, the damaging effects of development.

1. Green Buffer Zones, wherever possible, should be encouraged in and around the port area.
2. An environmental cell should be made operational within the port area with adequate facilities/ equipment/ mobile van/boat for collection and analysis of air, water solid waste samples. Immediate corrective measures should be taken if level of any constituent is higher than the prescribed limits.
3. Dredging and reclamation operations should be, undertaken only where it can be conclusively proved that these are required for operation purposes related to the activities permissible under Coastal Regulation Zone Notification. These operations, wherever necessary, should be undertaken in consultation with reputed institutes such as Central Water & Power Research Institute, Pune, National Institute of Oceanography, Goa which in turn should ensure that environmentally safe technologies/practices are adopted to minimise adverse environmental impacts.
4. Best practicable technology and operating methods should be used for dredging/ reclamation to minimise adverse environmental impact.
5. Disposal of dredged material should be on the basis of proper scientific/ modeling studies at designated sites and during time interval so that there are no damages to surface, ground

water quality and marine productivity. Dumping of dredged material on coast should not be permitted in case it is likely to cause adverse impact on marine ecology.

6. Disposal sites should be so chosen that dumping should not cause interference with the natural drainage.
7. During dredging, construction and maintenance stages, water quality parameters should be inspected at different levels and periodic records maintained. Tests should be carried out to measure water quality parameters such as turbidity, dissolved oxygen, ammonia, nitrogen and other nutrients so as to ensure that these are maintained within the prescribed limits.
8. Screening of the pollutants in the harbour waters should be undertaken and periodical reports and water quality parameters should be forwarded to the concerned State Pollution Control Board/Committee at least once in six months.
9. Temporary bunds should be constructed to contain surface run-off from the land sites. Collected run-off should be passed through retention ponds to collect suspended solids before discharge.
10. It should be ensured that proper treatment facilities are available and the quality of treated effluents, emissions and solid wastes conform to the standards laid down by the Centre/ State Pollution Control Board.
11. To prevent discharge of sewage, oily wastes and other liquid wastes into marine environment, adequate system for collection, treatment and disposal of liquid wastes including shoreline interceptor for receiving liquid wastes from the shoreline installations and special connections to receive wastes from ships must be provided.
12. It should be ensured that effluents/wastes from ships/barges are not discharged into sea, in accordance with national/international laws.
13. Some special arrangements wherever necessary for dusty cargo can be made to avoid pollution.
14. Burning of wastes should not be permitted.
15. Adequate noise control measures must be taken to maintain levels within prescribed limits in the work places as well as port areas to avoid adverse effects on the workers as well as marine life.
16. To reduce the dust generation, noise pollution and emission of gaseous pollutants like SO₂ and NO_x during the loading, unloading and transportation of materials like cement, the following measures should be carried out.
 - Installation of Dust Suppression System & Regular Water Sprinkling on haul roads
 - Proper maintenance of Transportation vehicles
 - Checking up for overloading of Transportation vehicle.
 - Regular Air Quality Monitoring to check increment of pollutants.

CONCLUSION

It is predicted that socio-economic impact due to this project will positively increase the chance of more employment opportunities for local inhabitants. The project infrastructures especially the roads can be utilized by the community of the area. The revenue of the State Govt. shall be definitely increasing due to the enhanced port activities. . The entire project area is devoid of any endangered flora and fauna. Thus the proposed project is not likely to affect the species and the adjacent ecosystem adversely.

Annexure 1. **Rapid Environmental Impact Assessment (REIA) Checklist**

Screening Questions	Yes	No	Remarks
A. Project Siting: Is the Project Area adjacent to or within any of the following Environmentally Sensitive Areas?			
▪ Cultural Heritage Site		√	
▪ Protected Area		√	
▪ Wetland		√	
▪ Mangrove		√	
▪ Estuarine		√	
▪ Buffer Zone of Protected Area		√	
▪ Special Area for Protecting Biodiversity		√	
B. Potential Environmental Impacts: Will The Project Cause...			
▪ Encroachment on precious ecology resulting in loss or damage to Fisheries and fragile Coastal habitats such as Coral reefs, Mangroves, and Sea grass beds?		√	Work is on the existing fishing harbour
▪ Short-term increase in turbidity and sunlight penetration as well as changes in sediment pattern and flows at dredging site?		√	
▪ Removal and disturbance of Aquatic flora and fauna at dredging site?		√	
▪ Deterioration of Water quality due to silt runoff and sanitary wastes from Worker-based camps and chemicals used in construction?		√	
▪ Alteration of bottom surface & modifications to bathymetry, causing changes in tidal bore, river circulation, species diversity, and salinity?		√	
▪ Changes in sediment pattern and littoral drift that may cause beach erosion of neighboring areas?		√	
▪ Modification of terrestrial habitat by upland disposal of dredged material or covering of potential archaeological sites with dredge spoils?		√	
▪ Short-term Air quality degradation due to dredging-related operations?	√		Negligible
▪ Noise and vibration due to blasting and other civil works?	√		Negligible
▪ Dislocation or Involuntary resettlement of people?		√	
▪ Other social concerns relating to inconveniences in living conditions in the Project areas?		√	
▪ Social conflicts if construction depletes local fishery resources on which communities depend for subsistence?		√	
▪ Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?		√	
▪ Social concerns relating to local inconveniences associated with Port operation (e.g. Increased volume of Port traffic, Greater risk of accidents, Communicable disease transmission)?		√	
▪ Deterioration of water quality due to Ship (e.g. Ballast water, Oil waste, Lubricant and fuel spills, Sewage) and Waterfront industry discharges?	√		Negligible
▪ Increased noise and air pollution resulting from airborne emissions (e.g. Gas, Smoke, Fumes) from maneuvering and berthing ships and the Waterfront industry?	√		Work Is on the Existing Structure