

## **Chapter 6 Natural Conditions In And Around The Port**

### **6.1 Location**

The Port of Constantza is situated on the western coast of the Black Sea, at 179 nautical miles (nM) from the Bosphorus, and at 85 nM from the mouth of Sulina Branch, through which the Danube flows into the Sea.

Its geographical coordinates are: Lat.: 44°06' N, Long.: 28°39' E.

The Romanian coastline is generally north-south oriented, having a length of 244 km. There is a cliff height of 25 to 30 m within the range of the Port of Constantza.

### **6.2 Topography and Bathymetry**

#### **6.2.1 Topography**

In general the Port is constructed by land reclamation filling in the sea to the east of a cliff running from north to south. Therefore, the ground surface is very flat with the elevation varying from 2m to 15m above Mean Sea Level. The wharves are designed to 2.5 m and 3.0m above Mean Sea Level.

To the western side of the port are city of Constantza and other surrounding cities, which are sitting on hills with elevation varying from 20 to 40m. Access to the port from the city is rather limited due to: 1) the difference in elevation between the city and the port and 2) railways laid alongside the hill. At present, there are 9 accesses in the north of the Danube – Black Sea Canal, out of which 6 are in North Port, connecting in-between the hill and the port.

The port has 133 berths with a total quay length of 25km and total land area of 1094 ha. A general layout plan is presented in **Figure 6.1**.

#### **6.2.3 Bathymetry**

The original seabed elevations were inclining toward east with a slope of between 1:200 to 400. Currently the basin is maintained at between – 6m and –13m in the north port, between –3m and –15m in the south port, and between –15 and –18 m at Access Channel. A bathymetric map with planned depths is shown in **Figure 6.2**.

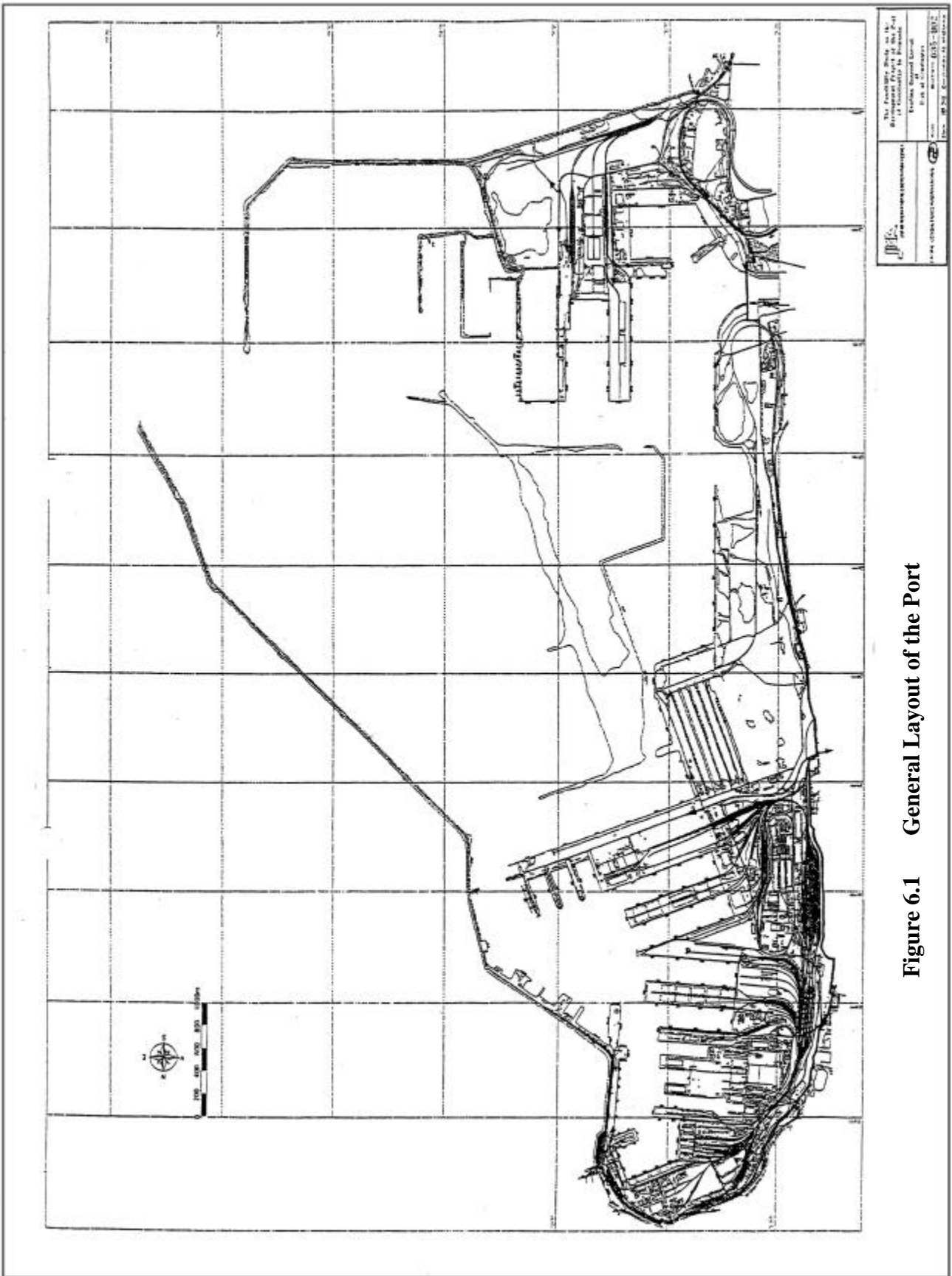
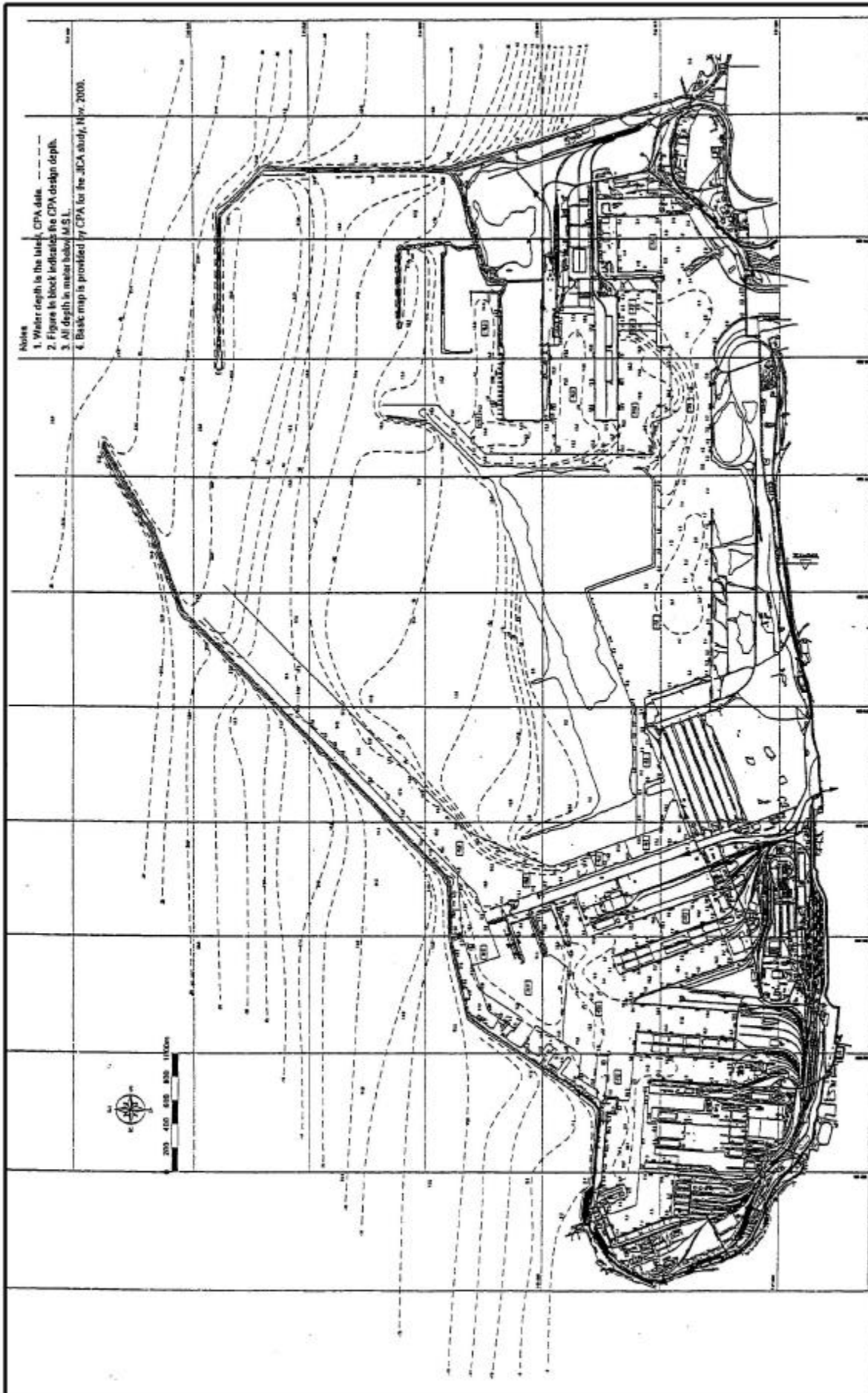


Figure 6.1 General Layout of the Port



The Government of Kerala  
 Public Works Department  
 Planning Water Works (I)  
 Part of Kerala  
 Scale: 1:50,000  
 No. 633-2004

Figure 6.2 Bathymetric Map

### 6.3 Climate and Meteorology

**Temperature:** Due to the influence of sea, the climate is rather milder than other parts of Romania. The annual average temperature is around 11°C. It is very cold in winter and hot in summer with monthly average temperature below 0°C and about 20°C respectively.

**Precipitation:** The annual average precipitation is about 380 mm, which is smaller than other parts of the country. Seasonal variations are small and monthly average is between 23 mm and 42 mm. Snow in winter is common. Normally the first snow falls in November and last one in March or April.

**Humidity:** Annual average of the humidity at Constantza is approximately 80 %. In December, the monthly average is 87 to 89 %, while in June it is lower, about 70 to 72 %. Very dry days are estimated to be about 2.3 days in a year, when the relative humidity becomes lower than 30 %. Wetter days are 129.8 days when the humidity exceeds 80 %.

**Winds:** Strong winds occur at the end of autumn and in winter (January) with storms, sometimes up to Beaufort 9 to 10 (20 to 30 m/s). Calm weather is typical for the end of the summer season and the beginning of autumn. The maximum-recorded wind velocity for 10 minutes average is approximately 40m/sec (January 31, 1962) and the maximum instantaneous wind velocity is 55 m/sec according to **CMRC**<sup>1</sup>.

**Ice:** The waters in and around the Port of Constantza do not freeze, although the specific density of the salt water is relatively low (1.012 ton/m<sup>3</sup>). Buoys are sometimes frozen due to water spray. In that condition, the visibility of buoys is significantly reduced.

**Visibility:** The average number of days with fog at the Port of Constantza is 50 days per year. The maximum number recorded is 68 days. Fog is most frequent during the winter season with an average of 8 days per month and a recorded maximum of 16 days per month. Fog can be rather persistent in this area, particularly during the winter season.

### 6.4 Oceanography

#### (1) Water Levels

For its deeper waters, the wind set-up is compensated by return flow, and the fluctuation of the water surface is not expected to be larger than 1 m between high and low water levels. Also, due to the absence of tidal motion, the mean sea level (designated as MSL) is used for the reference elevation of the water surface and the chart datum level (CDL) in the Black Sea. Note: Datum is 13cm above Mean Sea Level.

#### (2) Current

Current is measured 1.6 km offshore of Mamaia every 15 minutes in summer season. Along the coast in Constantza area, the prevailing current is from north to south and the (maximum)

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<sup>1</sup> Centrul Meteorologic Regional Constantza; Meteorological County Centre of Constantza.

velocity is about 1 knot. Measured velocities at the port entrance were 5 cm/sec to 15 cm/sec and moderate.

### **(3) Waves**

There have also been many studies on wave assessment in the Port of Constantza, e.g., study reports prepared by Frederic R. Harris B.V. (FRH, 1997)<sup>2</sup>. FRH collected data from the British Meteorological Office. From the above data, the 1 in 50 year wave heights have been calculated. FRH also estimated the wave heights at the shallower water with different wave period for the use of breakwater design. The result indicates offshore waves,  $H_o = 6.9\text{m}$  from taking the European Waters Model and  $H_o' = 6.4\text{m}$  with  $T = 10\text{sec}$  at  $-18\text{m}$  depth calculated from the Ship Observation data.

## **6.5 Geotechnical Conditions**

### **6.5.1 General**

The profile of limestone layer at the port is the bearing stratum; however, it is very complicated. Generally the limestone surface inclines toward the East from  $-10$  to  $-20\text{m}$ ; however, along Danube-Black Sea Canal, there is an old valley and in other places there are a lot of spots where limestone is not found. In the north port it is found around  $-7$  to  $8\text{m}$ .

The port is constructed by dumping filling materials on existing seabed within quay wall enclosures. The filling materials are of clay, silty clay or oiled and calcareous fragment with sizes from gravel to big blocks. The filling of south port was carried out mainly between 1986 and 1989. Main materials used were excavated during the Danube – Black Sea Canal Construction, which had been piled in a disposal site at about 10 km from the present project site. The other source of the reclamation is a borrow quarry nearby Constantza.

### **6.5.2 Soil Investigations**

#### **(1) General Descriptions**

In Port of Constantza, more than 100 berths have been designed and constructed. As a consequence, more than 150 borings were carried out and the data are possessed by IPTANA which is a leading port consultant worked for the study team in this investigation. In addition to studying the old data, new soil investigations with 16 borings are carried out under the supervision of Study Team.

The locations of borings are shown in **Figure 6.3**. These boring works were carried at the end of 2000 by a Turkish boring company (Kasktas) and soil samples were tested at the laboratory of Technical University of Civil Engineering Bucharest, managed by IPTANA.

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<sup>2</sup> Constantza Port Rehabilitation Project, Phase I, Review Original Breakwater Design, Frederic R. Harris B.V., August 1997

15 cross-sectional profiles created from mixing the old data and new data together are provided. As can be also observed in the profiles, the entire area the top layers are filling materials with various characteristics. The boring logs created in the new investigation are also prepared.

Laboratory Tests were conducted also including Consolidation Test, Unconfined Compression Test and others.

### **6.5.3 Seismic Condition**

The large earthquakes generated in Vrancea are characterized by the following:

- There are two zones of the maximum intensity, symmetrically located around the epicenter, somewhere in Moldavia and Muntenia, while the epicentral zone is less affected.
- Depth of the seismic focus varies from 20 to 185 km, mostly at about 100 km.

### **6.6 Coastal Stability**

In the Romanian coast of the Black Sea, sedimentation is remarkable. Great amounts of sand carried in Danube River are deposited where the river meets the sea, and a delta is formed. The deposited sand is further transported South by a southward current.

However, recently, the west coast of Black Sea is experiencing serious problems of coastal erosion. The main causes for the erosion are assumed as follows: 1) Hydrotechnical works on Danube and its tributary streams 2) Jetties on Sulina Branch and 3) Expansion of seaports (Midia, Constantza and Mangalia)

### **6.7 Recorded Natural Disasters**

#### **(1) Earthquakes**

No damages were recorded in modern times (last two centuries) to the Port of Constantza.

#### **(2) Storms**

Heavy storms of the Black Sea usually cause closing of the port, but do not alter the breakwater. No damage to the breakwaters caused only by storms has been recorded during the development of the port in all its stages.

### **(3) Oil Spill**

No oil spill disaster has been recorded near the Romanian coast of Black Sea, to cause closing of the Port.

### **(4) Other Causes**

In January 1995, a winter storm alert caused the Harbor Master to notify all ships in the strait and recommended them to leave anchorage at once. All ships departed except two: You Xiou and Paris.

The violent storm carried the two ships astray and struck them against the North Breakwater. Repeated wreck strikes during the storm crushed the Breakwater armor in hit areas and finally induced failure of the structure. Two breaks occurred at km 2+200 and 3 + 500. The wreck sunk at the breakwater toe.

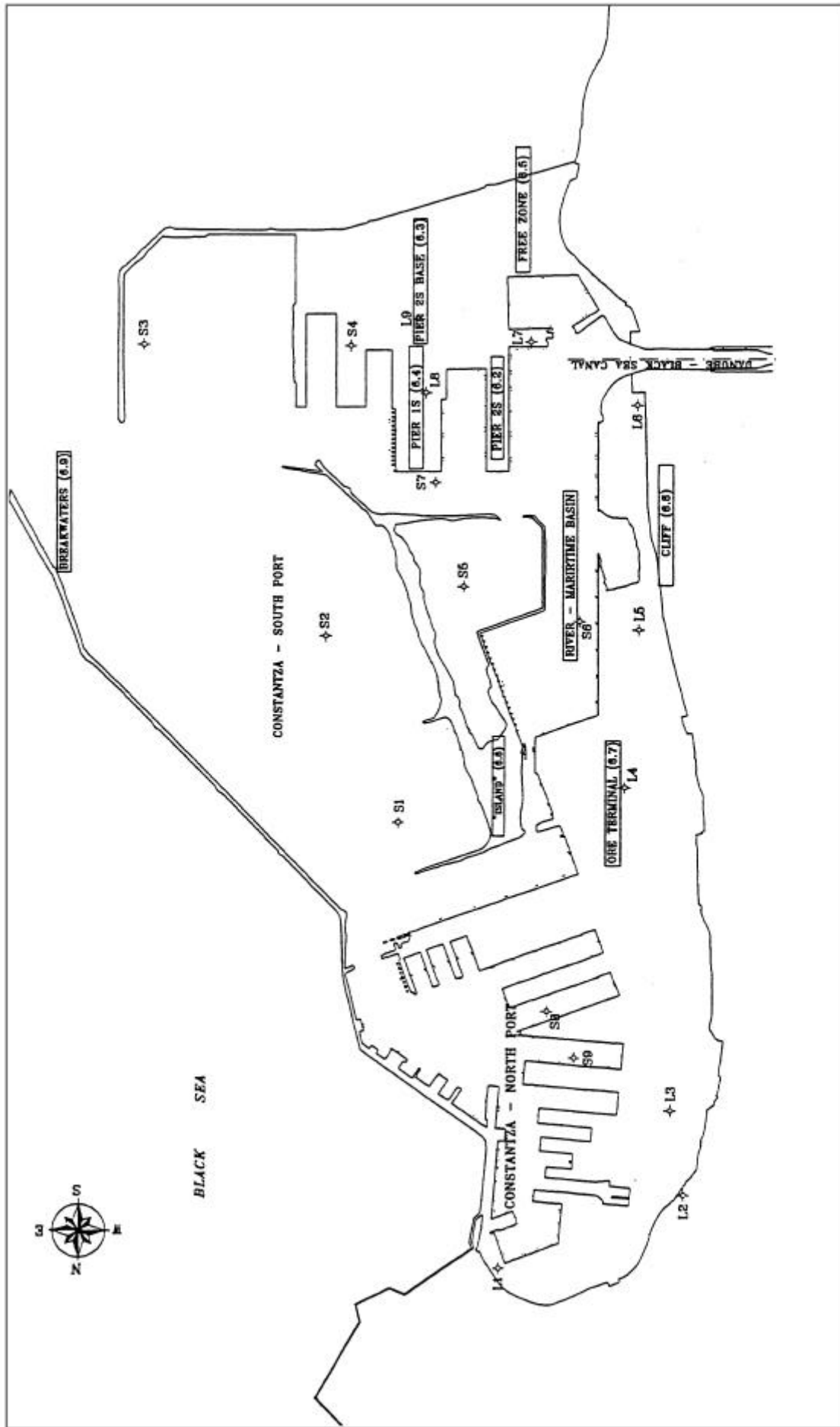


Figure 6.3 Location of Borings



## **Chapter 7 Environmental Condition of the Port Area**

### **7.1. Introduction**

The port of Constantza, the largest among all Black Sea ports, is essentially sandwiched between the most famous summertime beach resorts in the country: toward the north (Mamaia resort area) and the south (Eforie Nord resort area and others at further south).

The Black Sea is very unique due to its closed nature caused by the single constrained outlet at Bosphorus Strait. Accordingly, it could be categorised as a vast saline lake rather than a sea, which makes it vulnerable to pollutant accumulation induced water quality deterioration due to anthropogenic activity including that of shipping.

### **7.2. Environmental Issues of Constantza Port**

Current environmental issues of the port are both due direct port operational activity as well as non-port (not related to direct port operation) activity.

#### **7.2.1 Direct Port Operational Issues**

- (1) Inadequate waste management facility in the port to handle shipping activity related waste reception and management.
- (2) Fugitive (dust) emission in dry-bulk cargo handling terminals of the port.

#### **7.2.2 Non-port Issue**

The port water serves as the final disposal location of wastewater generated fromto miscellaneous Constantza city based activities of domestic, commercial and others. Currently, due to the inadequate capacity of city sewage treatment plants, untreated and /or inadequately treated wastewater is discharged into the port basin by RAJA (Water and Sewerage Authority), Constantza.

### **7.3 Environmental Improvement Measures**

- (1) Port waste management

CPA (Constantza Port Authority) with financial assistance from Dutch government and also with self-financed study has already formulated the necessary projects to improve the port waste management system. The improvement projects include both that of solid waste management and ballast and bilge waste management. Prompt implementation of these projects is very important to achieve the required improvement in overall port waste management.

## (2) Fugitive emission due to dry-bulk cargo handling

Modernisation of existing dry-bulk handling system of the port to mitigate fugitive emission, is the most important environmental improvement requirement of port operational improvement. Accordingly, closed belt conveyor system is recommended as the norm to be applied by all relevant dry-bulk cargo handling operators. In this respect CPA is recommended to adopt a step-wise improvement program.

## (3) City sewerage system

Improvement plans for the Constantza city sewerage system, principally targeting treatment capacity, processing and efficiency enhancement of the two city sewage treatment plants, has already been formulated by RAJA. The upgrading construction works for the south treatment plant is ongoing. It is also important to undertake the required improvement works for the north treatment plant.

### **7.4. Field Surveys on Environmental Condition**

The field survey on port environmental condition was conducted once each during the master plan (November 2000) and feasibility study (June 2001) stages. Principally based on the results of later field survey of June 2001, progressing seawater environmental deterioration of the port became clear.

Moreover, conventional pollution indicator parameters such as COD and DO alone are inadequate to account for this progressing port seawater environmental degradation. This could be attributed to the peculiarity of Black Sea, which could also be classified as a vast saline lake. Port seawater environmental degradation was essentially indicated by heavy metal accumulation in the seabed and also by the results of biological sampling represented by high density and biomass of phytoplankton in seawater and low density and biomass of macrobenthos in the seabed.

### **7.5 Environmental Laws and Regulations**

The present legislation on environmental protection of Romania can be structured into six categories:; namely, inter-sectorial legislation for environmental protection, waters, maritime zones, toxic substances, wastes and human environment. In particular, under the inter-sectorial legislation for environmental protection, Law No.137/1995 on Environmental Protection comprehensively defines and stipulates the requirement of environmental impact assessment (EIA) and the environmental authorisation process of Romania. Accordingly, the project schemes subjected to mandatory EIA include all transport infrastructure projects like roads, rails, ports and airports.

## **Chapter 8 Issues Facing the Port of Constantza**

### **8.1 Issues on Port Facilities and Layout**

The Port of Constantza handled cargo of 23 million ton in 1999, while the existing cargo handling capability of the Port is said in about 80 million ton per year. At present the Port has a sufficient handling capacity of cargo in calculated figures.

However, there are two issues about handling capacity of the port and layout of port facilities, and the future Master Plan of the Port based on these issues should be examined.

#### **(1) Handling capacity of the port**

In the Port of Constantza, the main cargo was conventional bulk cargo such as oil, coals and ores before. With change of the industry and trade structure of Rumania, it will be expected that general cargo, especially container, will increase.

It is necessary to forecast change of such demand structure and to develop the facility corresponding to the volume and type of cargo change in the future.

Today, it is required that the port has international competitiveness against surrounding ports, which means that efficient cargo handling and smooth intermodal operation are expected. It is necessary to renew the facilities at suitable time so that the port may not lose international competitiveness due to superannuated facilities or inefficient operation.

#### **(2) Layout of the port facilities**

At present, general cargoes are handled by various operators on the dispersed terminals in the port. Moreover, this port is divided into Old North Port, North Port and newly developed South Port. With foreseeing future cargo demand, it is necessary to examine facility layout in order to perform the efficient operation as a whole port.

Furthermore, while the Central Island and the South Port, where deep sea berth and Free Zone are located, has large future development room, the development scale and time should be determined, after examining development strategy of the Port.

## **8.2 Issues on Port Management and Operation**

### **(1) Ambiguousness on legal framework of Port Administration**

Rights of public port assets: The concession contract regarding public port assets between MPWTH and CMPA recently provided for the interdiction to grant sub-concessions and also the interdiction to transfer any right obtained over these assets. Practically, there is no legal possibility up to now to give the port operators a sound right to stay and use the port land.

Port Planning: One of the most important functions for a port management body is to make port planning. There are not extensive legal provisions or procedures regulating this subject. Some regulations are provided for MPWTH responsibility on port planning. On the other hand, same regulation is provided for the port administration responsibility. It is ambiguous situation regarding responsibility for port planning.

### **(2) Insufficiency of CMPA revenues**

It is necessary for CMPA to properly carry out investment in port infrastructure, such as maintenance and improvement of breakwaters, quays and roads, dredging of channels, etc. However, at present such investment has not been adequately carried out because of insufficient CMPA revenues. The only solution would be to increase their revenue and minimize their expenses, and CMPA should take any countermeasures immediately.

### **(3) Inefficiency of port procedures**

The Romanian legislation provides that the customs duties be levied upon foreign goods that enter Romanian ports and the customs control can be carried out on the board. According to such provisions, the customs control is practically carried out on board. This procedure leads to delay in ship's operation as well as immobilization of a large amount of money for guaranteeing the customs duties upon import goods as well as transshipment goods.

### **(4) Lack of Competition**

Concerning the cost structure of the terminal operators in the Port of Constantza, the lease fee level is almost nominal and, generally speaking, the depreciation cost is low because of the relatively old cargo handling equipment. The labor cost is also low because of the low wage level. These factors help the operators to survive in spite of their small annual handling volume and are caused lack of competition.

### **8.3 Issues of Inland Transportation in the Port**

#### **(1) Issues of Road**

The north port area has several issues for related to road conditions. The most serious issue is the condition of Gate 5.

Traffic at Gate 5 is very heavy in the mornings, with loaded trucks for the export cargo, passenger cars and other vehicles crowding at the port entrance because the almost of all loaded trucks for export cargo should enter to the port through Gate 5. In addition, the trucks, after passing through Gate 5, must reduce speed to negotiate the acute-angled curve on their way to Moles 3, 4 or 5. This results in long queue and unsafe traffic conditions for the anxiety about to over the centerline at the load.

The capacities of main roads in the port areas for North and South including the new elevated road in the south pot area (under the planning by CMPA) have to be checked because the cargo handling volume in the target year is forecast to increase.

#### **(2) Issues of Railway**

The share of the traffic volume of railway between Constantantza Port and the hinterland is very large. Therefore, the increasing of cargo handling volume at the port influences the traffic volume of railway. The capacity of Railway should be checked about the railway traffic volume between the port and the hinterland in the target year.