PART I

PRESENT CONDITIONS

Chapter 1 Socio-economic Conditions of the Greater Alexandria Port and Egypt

1.1 Population

1.1.1 Population of Arab Republic of Egypt

Egypt is the most populous country in the Arab world and has the second largest population in Africa after Nigeria. Population was 30.08 million in 1966, 36.63 million in 1976 and 48.25 million in 1986. The preliminary result of the 1996 Census indicated that, the total population inside Egypt reached 59.27 million. Migration has traditionally been negligible in Egypt. Egyptians living abroad totaled 2.18 million, according to the preliminary results of the 1996 Population Census. The average annual growth rate decreased from 2.8% for the period 1976-1986 to 2.1% for the period 1986-1996 (see Table 1.1.1).

According to the Mid-year Census, Population was 54.44 million in 1991 and 61.40 million in 1997. The average annual growth rate is 2.0% for the period 1991-1997 (see Table 1.1.2). Population of Egypt estimated by the World Bank is shown in Table 1.1.3.
There are four urban governorates, nine lower Egypt governorates, nine upper Egypt governorate and five frontier governorates in Egypt. Among urban governorates, Cairo has a population of 6.8 million accounting for 11.5% of the total population, followed by Alexandria (3.3 million), Port Said (0.47million) and Suez (0.42 million) in 1996 (see Table 1.1.4). Nearly 39.8% of the total urban population lived in two of the world's oldest cities, namely Cairo and Alexandria.

The problems associated with the rapid rate of population growth are complicated, namely the extreme scarcity of cultivated land relative to people. Over 97% of the Egyptian population (59.3million) is crowded in about 4% (386,000km2) of the total area of more than one million square kilometers.

Table 1.1.1 Population of Egypt by Census Years

(Unit: thousand)

Item / Year	1960	1966	1976	1986	1996 (2)
Total population (1)	26,085	30,076	36,626	48,254	59,272
Average annual growth rate (%)	2.5	2.4	2.0	2.8	2.1

Source) "Statistical Year Book 1991-1996, June 1997" The Central Agency for Public Mobilization and Statistics

Remarks) (1) Excluding Egyptian abroad, (2) The preliminary result of the 1996 Census

Table 1.1.2 Population of Egypt by Mid-year Census

(Unit : thousand)

Item / Year	1991	1992	1993	1994	1995	1996	1997
Total population	54,437	55,893	56,434	57,556	58,978	60,236	61,404
Annual growth rate (%)	2.9	2.7	1.0	2.0	2.5	2.1	1.9
Average annual growth rate for the 1991-1997 (%)				2.0			

Source) The Central Agency for Public Mobilization and Statistics

Table 1.1.3 Population of Egypt by the World Bank

(Unit : thousand person)

Item / Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total population	50,070	51,257	52,442	53,617	54,780	55,930	57,064	58,180	59,272
Annual growth rate (%)	2.4	2.4	2.3	2.2	2.2	2.1	2.0	2.0	1.9

Source) "World Development Indicator 1998" the World Bank

Table 1.1.4 Number and Percentage of Population, by Governorate and Urban/Rural Residence (The Preliminary Results of the 1996 Census)

(Unit: thousand persons)

Governrate	Total		Urban		Rural UAL	
	Number	Percent	Number	Percent	Number	Percent
Grand Total	61,452					
Total Egyptians Abroad	2,180					
Total Population	59,272	100.0	25,471	100.0	33,801	100.0
Urban Gov.	**11,005**	**18.6**	**11,005**	**43.2**		
Cairo	6,789	11.5	6,789	26.7		
Alexandria	3,328	5.6	3,328	13.1		
Port - Said	470	0.8	470	1.8		
Suez	418	0.7	418	1.6		
			0			
Lower Egypt Gov.	**25,811**	**43.5**	**7,108**	**27.9**	**18,703**	**55.3**
Damietta	915	1.5	251	1.0	664	2.0
Dakahlia	4,224	7.1	1,175	4.6	3,048	9.0
Sharkia	4,288	7.2	968	3.8	3,319	9.8
Kalyoubia	3,303	5.6	1,346	5.3	1,957	5.8
Kalf - El - Shcikh	2,223	3.8	510	2.0	1,713	5.1
Gharbia	3,405	5.7	1,057	4.2	2,348	6.9
Menoufia	2,758	4.7	549	2.2	2,210	6.5
Behera	3,981	6.7	911	3.6	3,070	9.1
Ismailia	715	1.2	341	1.3	374	1.1
	0		0		0	
Upper Egypt Gov.	**21,640**	**36.5**	**6,860**	**26.9**	**14,779**	**43.7**
Giza	4,780	8.1	2,590	10.2	2,190	6.5
Beni - Suef	1,860	3.1	438	1.7	1,422	4.2
Fayoum	1,990	3.4	447	1.8	1,543	4.6
Menia	3,309	5.6	643	2.5	2,666	7.9
Asyout	2,802	4.7	763	3.0	2,039	6.0
Suhag	3,123	5.3	684	2.7	2,439	7.2
Qena	2,441	4.1	517	2.0	1,924	5.7
Aswan	974	1.6	417	1.6	557	1.6
Luxur	361	0.6	361	1.4	0	0.0
	0		0		0	
Frontier Gov.	**817**	**1.4**	**498**	**2.0**	**319**	**0.9**
Red Sea	156	0.3	139	0.5	17	0.1
El - Wadi El - Gidid	142	0.2	68	0.3	73	0.2
Matrouh	212	0.4	112	0.4	99	0.3
North Sinai	253	0.4	149	0.6	104	0.3
South Sinai	54	0.1	29	0.1	25	0.1

Source) "Statistical Year Book 1991-1996, June 1997"
Central Agency for Public Mobilization and Statistics

1.2 Gross Domestic Products (GDP)

1.2.1 GDP

The Egyptian GDP amounted to 161.5 billion Egyptian Pound (LE) in the fiscal year of 1996/97 at constant price of the year 1991/92.GDP growth rates (at factor cost) rose to 5.3% in 1996/97 up from5.0% in 1995/96, and from 5.1% to 5.9% (at market prices). Nevertheless, there was a decline of 5% in the output of the oil sector and of 4.2% in Suez Canal's compared with the previous year (see Table1.2.1, 1.2.2 and Figure 1.2.1).

Table 1.2.1 GDP at Factor Cost and Annual Growth Rates (1991/92 price)

(Unit: LE billion)

	1992/93	1993/94	1994/95	1995/96	1996/97
GDP at factor cost	134.3	139.6	146.1	153.4	161.5
Annual growth rate (%)	2.5	3.9	4.7	5.0	5.3
GDP at market price	143.11	148.76	155.54	163.54	173.16
Annual growth rate	2.9	3.9	4.6	5.1	5.9

Source: "Annual Report 1996/97" Central Bank of Egypt

Table 1.2.2 GDP at Factor Cost and Annual Growth Rate of Egypt (1988 price)

(Unit: LE billion)

Item / Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
GDP at Factor Cost	51,807	54,161	56,692	58,689	59,826	61,333	63,689	66,623	69,891
Annual growth rate (%)	5.0	4.5	4.7	3.5	1.9	2.5	3.8	4.6	4.9

Source: "World Development Indicator 1998" the World Bank

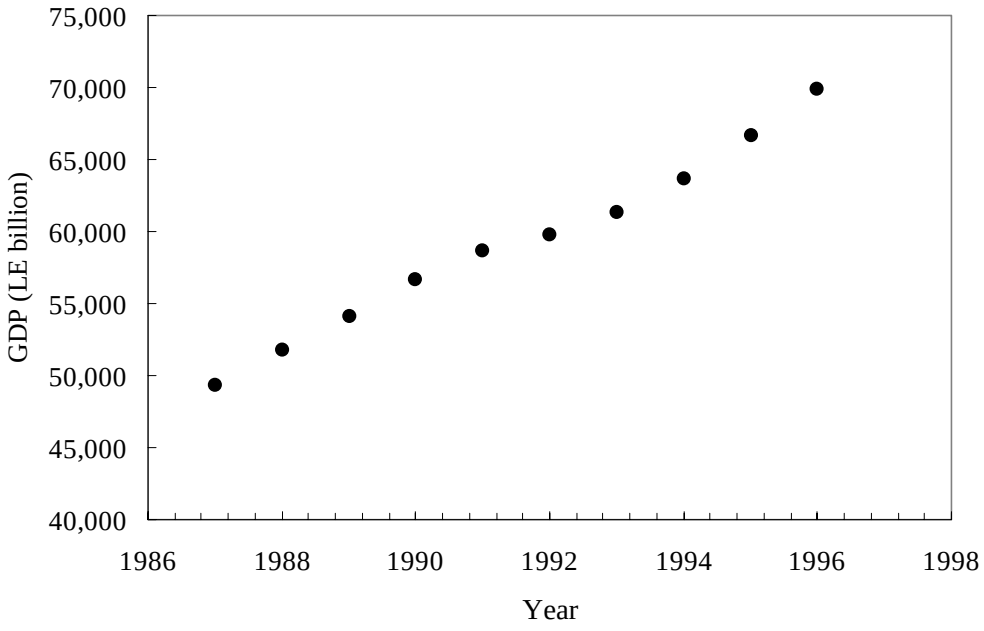


Figure 1.2.1 Historical Trend of Egyptian GDP

1.2.2 GDP by Sector

The structure of the national economy underwent some change as the since of the industrial sector climbed from 16.6% in 1992/93 to 18.1% in 1996/97. Thus, the industrial sector ranked first contributing the bulk of GDP. Conversely, the agriculture sector accounted for a lower share of 15.7% in 1996/97 down from 16.5% in 1992/93 (see Table 1.2.3).

As for commodity sectors, the marked increase in growth rates of non-oil sector nearly offset the lower output of the oil sector. Hence, the total growth rate of commodity sector reach 4.2% against 4.3% a year earlier. The construction sector contributed the highest growth rate, following financing reform many of its unit. The industrial sector came second as it benefited from the newly developed infrastructure and modernization. The electricity and agricultural sector followed suit, realizing increased growth due to the expansion of the existing station, the operation of new electricity units, along with the enhancement of productivity due to the attention paid to agriculture guidance.

On the other hand, production service sectors recorded a growth rate of 6.4% up from 5.9%, headed by the tourism sector which was followed by the sectors of finance, transportation and communication.

Table 1.2.3 Composition of GDP by Economic Sector at Factor Cost (at 1991/92 prices)

(Unit: LE million)

Economic Sector	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Commodity Sector	65,373	66,886	70,173	73,203	76,361	79,589
Agriculture	21,680	22,220	23,072	23,741	24,470	25,310
Industry and Mining	21,730	22,360	23,295	25,087	26,970	29,228
Petroleum and Oil Products	13,008	13,210	14,345	14,365	14,365	13,650
Electricity	2,220	2,296	2,382	2,525	2,658	2,830
Construction and Building	6,735	6,800	7,079	7,485	7,898	8,571
Productive Services Sector	43,606	44,494	45,592	47,878	50,674	53,923
Transportation and Communications	8,710	14,860	9,334	9,906	10,495	11,380
Suez Canal	6,125		5,778	5,516	5,621	5,387
Trade	21,730	27,109	23,260	24,619	25,936	27,631
Finance	4,545		5,080	5,435	5,909	6,454
Insurance	76		85	92	104	114
Restaurants and Hotels	2,420	2,525	2,055	2,310	2,609	2,957
Social Services Sector	22,078	22,955	23,857	25,068	26,334	27,976
Real Estate Ownership	2,350	2,878	2,568	2,712	2,819	3,008
Public Utilities	401		459	495	532	575
Personal Services	9,895	10,245	10,613	11,194	11,833	12,622
Government Services	9,345	9,832	10,120	10,565	11,039	11,653
Social Insurance	87		97	102	111	118
Total GDP	**131,057**	**134,335**	**139,622**	**146,149**	**153,369**	**161,488**

Source: Central Bank of Egypt

1.3 Foreign Trade

1.3.1 Trade of Import/Export Value

The foreign trade value of export and import in 1996 reached 12.3 billion Egyptian Pound (LE) and 44.2 billion LE respectively. Import value has exceeded the export value in the last six years, consequently, balance of payment became deficit. Annual growth rate of export was 2.7% in 1996 compared with the previous year while that of Import was 10.8% (see Table 1.3.1)

1.3.2 Trade of Import/Export Value by Commodity

Import and export by items are shown in Table 1.3.2. Principal commodities of import and export are shown in Table 1.3.3. Among those commodities, Wheat account for 3.7 billion LE, followed Organic and inorganic chemical (1.5 billion LE) and Maize (1.5 billion LE).As to value of export, Crude Oil accounts for 2.8 billion LE, followed by cotton goods (1.3 billion LE), refined petroleum products (0.8 billion LE) and clothing manufactured (0.8 billion LE).

1.3.3 Trading Partner of Egypt

Trading partners of Egypt are shown in Table 1.3.4. As to import trading partners, Western Europe accounted for 17.1 billion LE, followed by North America (9.2 billion LE) and Asian Countries (6.0 billion LE) in 1996. On the other hand, in export, Western Europe accounted for 5.2 billion LE, followed Asian Countries (2.0 billion LE) and Arab Countries (1.8 billion LE) in 1996. Import and Export Value of major trading partners are shown in Table 1.3.5 and Table 1.3.6.

Table 1.3.1 Balance of Trade

(Unit: LE million)

	1991	1992	1993	1994	1995	1996
Exports	11.765	10,374	10,596	11,925	11,954	12,277
Growth Rate		-11.8%	2.1%	12.5%	0.2%	2.7%
Imports	25,216	27,656	27,550	32,461	39,891	44,218
Growth Rate		9.7%	-0.4%	17.8%	22.9%	10.8%
Deficit	-13,452	-17,283	-16,955	-20,536	-27,937	-31,941
Growth Rate		-28.5%	1.9%	-21.1%	-36.0%	-14.3%

Source: “Statistical Year Book 1991-1996, June 1997”
Central Agency for Public Mobilization and Statistics

Table 1.3.2 Import and Export, by Items and Year

(Unit: LE million)

Item / Year	1991	1992	1993	1994	1995	1996
Import						
Machinery and mechanical appliances and electrical	4,759	5,743	6,837	6,837	7,649	8,900
Vegetable products	3,337	4,435	3,281	4,737	5,740	7,152
Base metals and related products	2,819	2,433	2,522	3,250	4,025	4,827
Chemical products	2,628	2,669	2,632	2,828	3,637	3,684
Artificial resins and plastic materials cellulose and rubber	1,631	1,586	1,634	1,861	2,503	2,749
Prepared foodstuffs, beverages and tabacco	1,635	1,689	1,380	1,807	1,961	2,484
Vehicles, aircraft, and related parts	1,137	1,397	1,587	2,472	2,251	2,193
Wood and wood products, wood charcoal, cork, busketware and wisherwork	1,396	1,341	1,498	1,673	2,160	2,032
Live animals and related products	1,020	1,176	1,410	1,813	1,990	1,766
Fats, oils and related products	435	892	594	659	1,740	1,763
Minerals products	921	830	867	915	1,150	1,758
Paper, paperboard, paper-making materials and related	1,215	1,233	1,101	1,129	2,040	1,634
Textiles and textile articles	1,233	1,068	1,018	1,138	1,477	1,532
Optical,cinematograohic, surgical instrument and watches	548	681	704	737	828	930
Produces of stone, cement, asbestos and glass	348	290	290	315	393	476
Miscellaneous manufactured products	128	147	153	219	264	264
Footwear, headgear, umbrellas, and artificial flowers	4	8	12	19	19	24
Pearls, precious and semiprecious stones, costume jewelry and coins	10	16	10	19	24	23
Raw hides and skins, furs and fur products	7	13	9	22	19	19
Arms, ammunitions and related parts	5	8	10	7	21	9
Works of art, collector's pieces and antiques	2	0	0	1	0	0
Import Total	25,216	27,656	27,550	32,461	39,891	44,218
Export						
Minerals products	6,366	4,512	5,275	4,666	4,432	5,796
Textiles and textile articles	2,347	2,102	2,160	3,812	3,505	2,772
Vegetable products	729	878	753	830	1,058	1,201
Base metals and related products	837	1,296	1,099	1,276	1,406	1,032
Chemical products	497	513	352	521	651	561
Prepared foodstuffs, beverages and tabacco	218	187	204	158	202	185
Produces of stone, cement, asbestos and glass	91	78	98	120	132	139
Artificial resins and plastic materials cellulose and rubber	79	73	57	79	118	138
Living animals and related products	107	221	203	87	60	74
Miscellaneous manufactured products	143	87	75	72	72	71
Paper, paperboard, paper-making materials and related	44	46	50	55	68	68
Machinery and mechanical appliances and electrical	121	152	63	61	78	59
Footwear, headgear, umbrellas, and artificial flowers	71	79	56	46	42	50
Raw hides and skins, furs and fur products	44	64	57	54	34	40
Wood and wood products, wood charcoal, cork, busketware and wisherwork	16	16	23	38	58	27
Optical,cinematograohic, surgical instrument and watches	15	15	37	6	5	25
Fats and related products	20	21	18	27	16	23
Vehicles, aircraft, and related parts	17	26	11	11	13	11
Pearls, precious and semiprecious stones, costume jewelry and coins	1	2	2	3	2	5
Arms, ammunitions and related parts	0	5	3	0	0	0
Works of art, collector's pieces and antiques	3	1	1	1	1	0
Export total	11,765	10,374	10,596	11,925	11,954	12,277
Total	36,981	38,030	38,146	44,386	51,845	56,495

Source: "Statistical Year Book, 1991-1996, June 1997"
Central Agency for Public Mobilization and Statistics

Table 1.3.3 Principal Commodity of Import and Export

(Unit: LE million)

Commodity	1991	1992	1993	1994	1995	1996
Import						
Wheat	1,615	2,350	1,131	2,501	2,976	3,738
Organic and inorganic chemicals	1,102	971	947	1,107	1,525	1,491
Maize	428	593	807	893	1,185	1,479
Automobiles	336	388	550	746	741	692
Parts for motor vehicles and tractors	364	472	518	762	760	674
Dairy product	406	525	503	509	574	614
Meat chilled or frozen	437	400	563	535	600	498
Excavating lending lording and excreting machinery	178	208	224	323	345	415
Bars and rods building iron	220	109	260	91	98	353
Cement	14	3	4	52	165	309
Motor vehicles for transport of goods	24	63	63	260	96	209
Sugar refined	528	385	204	52	230	121
Wheat flour	317	175	470	235	202	43
Export						
Crude oil	4,655	3,100	3,622	2,685	2,382	2,773
Petroleum shale oils other than crud	754	761	808	798	757	1,833
Clothing manufactured	554	543	665	780	858	812
Cotton yarn	987	820	721	1,280	1,039	657
Rice	123	191	135	268	193	400
Cotton, raw	193	175	147	791	517	312
Cotton fabrics	309	236	272	409	371	301
Potatoes	152	142	108	98	347	271
Oranges	142	108	56	28	44	59
Aluminum products	432	563	406	405	23	23
Sugar cane, refined	12	0	5	0	8	4

Source: "Statistical Year Book 1991-1996, June 1997"
Central Agency for Public Mobilization and Statistics

Table 1.3.4 Trading Partners of Egypt

(Unit: LE million)

Region	1995			1996		
	Import (1)	Export (2)	Balance (2)-(1)	Import (1)	Export (2)	Balance(2)-(1)
Arab countries	1,525	1,688	163	1,730	1,791	61
Eastern Europe	3,953	1,242	-2,711	4,556	1,362	-3,194
Western Europe	16,584	5,035	-11,549	17,095	5,221	-11,874
Asian Countries	5,751	1,765	-3,986	5,974	1,990	-3,984
African Countries	548	98	-450	525	165	-360
North America	7,801	1,869	-5,932	9,232	1,651	-7,581
South America	141	4	-137	61	5	-56
Central America	1,092	41	-1,051	1,783	33	-1,750
Oceania	518	5	-513	1,468	6	-1,462
Other Region	1,977	207	-1,770	1,794	52	-1,742
Total Region	39,890	11,954	-27,936	44,218	12,276	-31,942

Source: "Statistical Year Book 1991-1996, June 1997"
Central Agency for Public Mobilization and Statistics

Table 1.3.5 Import Value by Major Trading Partners (CIF Value)

(Unit: LE million)

Trading Partner	1990	1991	1992	1993	1994	1995
United States of America	3,503	4,057	4,852	4,137	5,471	7,514
Germany	2,621	2,631	2,872	2,992	3,093	3,550
Italy	1,620	1,709	1,814	2,287	2,078	2,484
France	2,329	1,745	1,383	1,829	2,005	2,328
Japan	924	1,026	1,192	1,236	1,357	1,067
Grate Britain	991	1,141	1,206	1,132	1,184	1,291
Netherlands	761	864	989	956	967	1,296
Total Import Value	24,823	25,216	27,656	27,550	32,461	39,891

Source: "Statistics Yearbook 1990-1995" Central Agency for Public Mobilization and Statistics

Table 1.3.6 Export Value by Major trading Partners (FOB Value)

(Unit: LE million)

Trading Partner	1990	1991	1992	1993	1994	1995
United States of America	597	895	955	1,450	1,234	1,773
Italy	894	1,744	1,444	1,347	1,444	1,559
Saudi Arabia	206	366	675	662	525	385
Netherlands	440	450	584	580	701	566
France	278	695	431	524	468	490
Germany	386	440	423	443	709	704
Grate Britain	208	255	341	286	487	484
Libya	117	384	194	210	149	180
Japan	189	165	247	184	169	148
Total Export Value	6,954	11,765	10,374	10,596	11,925	11,954

Source: "Statistics Yearbook 1990-1995" Central Agency for Public Mobilization and Statistics

1.4 Agriculture

1.4.1 Agriculture Production

The agricultural sector plays a major role in the national economy. It is the main source for achieving food sufficiency and the supply of productive sectors with raw materials. It provides important foreign currency, and absorbs a great portion of the workforce.

Agricultural production by type of major crop and year is shown in Table 1.4.1 and Figure 1.4.1. Agricultural production achieved a continuous increase during the last six years. The production of Wheat increased to 5.7 million tons in 1996 with an average annual growth rate of 5.0% during 1991-1996, in the same way, Maize (5.8 million tons, 5.5%), Rice (4.9 million tons, 7.3%), Sugar-cane (14.1 million tons, 4.9%) and Vegetable (11.9 million tons, 7.2%).

Table 1.4.1 Agricultural Production by Type of Major Crop and Year (1991-1996)

(Unit: thousand tons)

Type of Crop	1991	1992	1993	1994	1995	1996	Growth Rate(1)
Wheat	4,482	4,618	4,833	4,437	5,723	5,735	5.10%
Maize	5,122	5,070	5,039	5,550	5,178	5,825	2.60%
Rice	3,448	3,909	4,161	4,583	4,764	4,900	7.30%
Potato	1,786	1,619	995	1,325	1,765	1,939	1.70%
Onion	579	606	742	481	692	811	7.00%
Tomato	3,806	4,697	4,768	4,707	5,087	6,021	9.60%
Sugar-cane	11,095	11,624	11,708	12,412	13,822	14,105	4.90%
Beet	1,106	744	795	825	920	842	-5.30%
Orange	1,694	1,771	1,324	1,513	1,555	NA	-2.1%(2)
Vegetables	8,378	8,960	9,640	9,955	10,567	11,858	7.20%

Source: "Statistics Year Book, 1991-1996, June 1997"Central Agency for Mobilization and Statistics

Remarks: (1) average annual growth rate during 1991-1996
(2) average annual growth rate during 1991-1995
NA, Not available

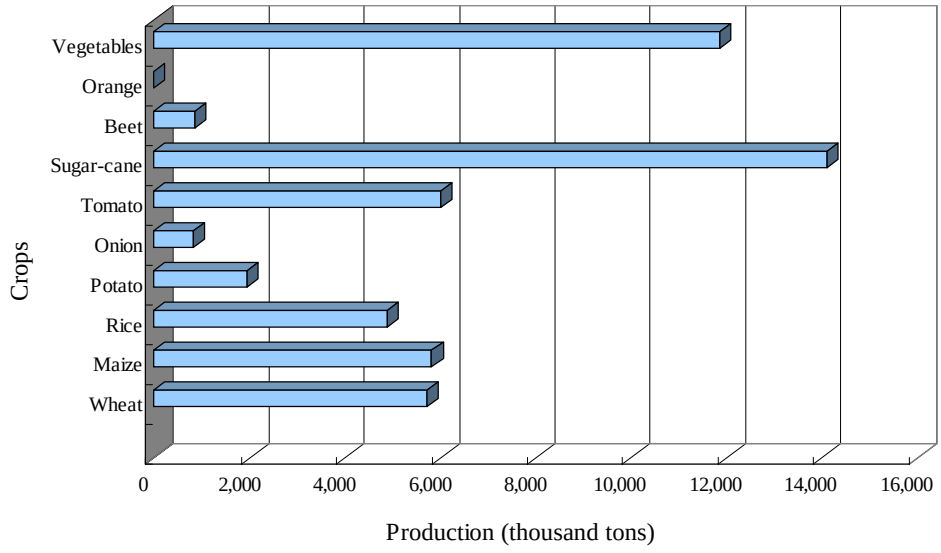


Figure 1.4.1 Production of Agricultural Crops

1.4.2 Chemical Fertilizer Production

Chemical fertilizers used in the Agricultural sector are shown in Table 1.4.2 and Figure 1.4.2. Consumption volume of Azot and Ammonia fertilizer reached 4.5 million tons in 1995/96 and that of Phosphate fertilizer and Potassium fertilizer reached 18 thousand tons and one thousand tons respectively.

Table 1.4.2 Chemical Fertilizer Used in Agricultural Sector by Type and Year

(Unit: thousand tons)

Type	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Azot and Ammonia Fertilizers	5,007	4,678	2,649	731	676	552	4,539
Phosphate Fertilizers	1,101	1,230	649	200	59	46	18
Potassium Fertilizers	44	58	44	53	57	26	1

Source: "Statistics Year Book, 1991-1996, June 1997"The Principal Bank for Agriculture Credit and Development

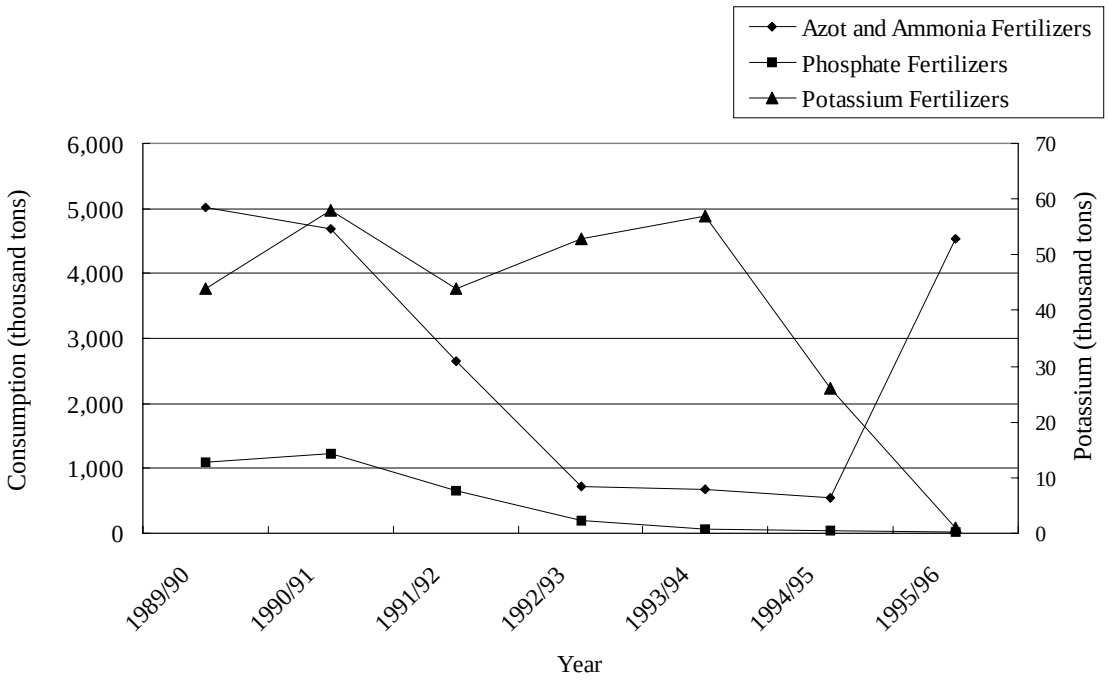


Figure 1.4.2 Chemical Fertilizer Used in Agriculture Sector

1.5 Industry

1.5.1 Industrial Products

(1) General

Egypt has made great progress in the field of traditional industries namely, spinning, weaving and food industries. Significant progress also has been made in the modern industries such as engineering, metallurgical and chemical industries. The State contributed to a most efficient drive towards increasing production in many industries, such as iron and steel, ceramics and porcelain, cement, paper, fertilizer, pottery and refractories, and petroleum industry. Coordination between heavy and consuming industries has been considered in such a way to secure self-sufficiency and reduce the need for imports.

(2) Spinning and Weaving Production

Spinning and Weaving Production are shown in Table 1.5.1. Production of Cotton Yarn reached 250 thousand tons in 1995/96 and that of Wool Yarn reached 16 thousand tons. Value of Cotton Textiles and Wool Textiles accounted for 1.56 billion LE and 12 million LE respectively.

(3) Production of Food Industries

Production of Food industries is shown in Table 1.5.2. Production of White Sugar Crystal and Refined Sugar reached 282 thousand tons and 745 thousand tons in 1995/96 respectively. Production of Molasses reached 259 thousand tons in 1995/96.

(4) Metal Industry Products

Production of Metal Industries are shown in Table 1.5.3. Production of Steel Billet and Steel Section reached 473 thousand tons in 1995/96 and that of Steel Sheet reached 280 thousand tons in 1995/96.

(5) Construction Material Industry Production

Production of Construction Material Industry is shown in Table 1.5.4. Production of Cement reached 15.6 million tons in 1995/96 with an annual growth rate of 9.4%.

Table 1.5.1 Spinning and Weaving Production

Product	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Cotton Yarn (thousand tons)	306	316	293	299	294	250
Cotton Textiles (LE million)	1375	1504	1704	1737	1670	1561
Wool Yarn (thousand tons)	20	20	19	20	19	16
Wool Textiles (LE million)	23	23	17	14	14	12

Source: "Statistics Year Book, 1991-1996, June 1997" Central Agency for Mobilisation and Statistics

Table 1.5.2 Production of Food Industries by Products and Year

(Unit: thousand tons)

Products	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
White Sugar Crystal	525	510	454	629	710	282
Refined Sugsr	366	419	455	481	661	745
Preserved Vegetables	11	10	11	12	11	17
Molasses	2127	219	200	214	282	259
Cotton Sheed Oil	357	312	330	318	306	267

Source: "Statistics Year Book, 1991-1996, June 1997" Central Agency for Mobilisation and Statistics

Table 1.5.3 Metal Indutry Products

(Unit: thousand tons)

Product	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Steel Billete and Steel Section	402	403	386	368	335	473
Steel Sheet	389	390	350	392	450	280
Reinforced Steel	158	270	339	362	329	266
Cars (thousand cars)	8,878	6,831	4,444	6,557	8,211	12,141

Source: "Statistics Year Book, 1991-1996, June 1997" Central Agency for Mobilisation and Statistics

Table 1.5.4 Construction Material's Industry Production

(Unit: thousand tons)

Product	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Cement	13,286	12,399	12,937	13,544	14,237	15,569
Ceramics	7	8	8	8	8	6
Safty Glass	1	1	3	3	3	2

Source: "Statistics Year Book, 1991-1996, June 1997" Central Agency for Mobilisation and Statistics

1.6 Energy and Mining

1.6.1 Electricity

The production of generated power in 1995/96 reached around 54.5 billion KWH with a growth rate estimated at 6.2% of which the exploited power reached 45.6 billion KWH.

1.6.2 Petroleum and Mining

Newly discovered oil and gas deposits in Lower Egypt and the Western Desert, especially at Alamain, El-Fayoum, and the Red-Sea area are considered as a turning point in the petroleum industry in Egypt. The State is now raised to become one of the oil exporting countries.

Petroleum and Mining production are shown in Table 1.6.1 and 1.6.2.Production of Crude Petroleum reached 44.0 million tons in 1995/96, and that of Iron ore reached 2.1 million tons in 1995/96. Production of Fuel oil, Butane Gas and Natural Gas are reached 12.6 million tons, 0.5 million tons, 10.2 million tons in1995/96 respectively.

Table 1.6.1 Petroleum Production by Products

(Unit: thousand tons)

Product	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Benzine (Gasoline)	2,253	1,932	1,900	1,890	1,910	1,987
Kerosene	2,304	2,226	1,877	1,744	1,199	1,269
Jet Fuel	406	340	497	585	886	847
Gas oil and Diesel Oil	4,030	4,118	4,415	5,111	5,488	5,810
Fuel Oil	11,707	11,536	11,502	11,744	12,212	12,557
Butane Gas	338	318	370	392	437	451
Natural Gas	6,620	7,160	8,226	9,114	9,710	10,168

Source: "Statistics Year Book, 1991-1996, June 1997" Central Agency for Mobilization and Statistics

Table 1.6.2 Mining Production by Type

(Unit: thousand tons)

Product	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Crude Petroleum	45,000	44,000	45,000	45,000	44,000	44,000
Phosphate	1,865	2,089	1,585	864	1,044	1,238
Iron ore	2,144	2,392	2,190	2,703	2,433	2,098
Salt (common)	891	936	972	1,116	1,193	1,632
Others	272	295	294	280	310	393

Source: "Statistics Year Book, 1991-1996, June 1997" Central Agency for Mobilization and Statistics

1.7 Fourth Five Year Plan

(1) General Framework

The fourth five-year plan envisages a rise in the overall resource of the economy by 35.7% at an annual growth rate of 6.9%. GDP of Industry is expected to rise from 8.7% in 1996/97 to 10.8% in 2001/02. Agriculture sector's GDP will reach 15.5% of the total GDP with the growth rate of 4.2% by the end of plan.

The agricultural crops whose exports are expected to grow in the next five years include fresh and frozen vegetable, 14.4%; fruits, 20.5%;potatos, 12.8%, and medicinal and perfume herbs, 14.5%. Cotton will also continue to be exported in adequate quantities in order to preserve its presence on world markets.

As to industrial exports, they are expected to grow at 25.1% for engineering industries, 19% for food industries, 18.9% for textile industries, 17% for chemical industries, 23.2% for construction materials and refractory industries and a high growth rate is forecast for leather and furniture industries.

Targeted total GDP for the Year 2001/02 according to Economic Sectors is shown in Table 1.7.1

Table 1.7.1 Targeted Total GDP for year 2001/02 according to Economic Sectors

(Unit: LE million at the 1996/97 prices)

Sector	Expected for 1997/98	Planned for 2001/02	Annual growth rate (%)
Agriculture	42,325	52,021	4.2
Industry	43,383	72,447	10.8
Petroleum	15,854	16,713	1.1
Electricity	4,220	6,158	7.9
Construction	12,750	21,507	11.0
Total of commodity production	**118,532**	**168,846**	**7.3**
Total of Production service	**77,552**	**111,142**	**7.5**
Total of social services	**43,416**	**55,012**	**4.8**
Total	**239,500**	**335,000**	**6.9**

Source: "The Fourth Five Year Plan for Economic and Social Development(1997/98-2001/02), and the Plan of Its First Year (1997/98)" The Ministry of Planning

(2) Population

Population features at the end of plan are shown in Table 1.7.2.

Table 1.7.2 Population Features of 2001/02

Item	1996/97	2001/02
Population growth rate	1.94%	1.66%
Birth Rate	2.60%	2.27%
Mortality Rate	0.66%	0.61%
Average babies per woman	3.4	2.9
Use of birth-control by wives	50%	60%

Source: "The Fourth Five Year Plan for Economic and Social Development(1997/98-2001/02), and the Plan of Its First year (1997/98)" The Ministry of Planning

(3) The Agricultural Sector

The 1997/98-2001/02 five year plan aims at adding more arable land to the cultivated area, so as to increase the agricultural production. The most significant aspects of the crop structure targeted are as follows:

- Cultivating 2,850 thousand feddans with wheat, with a 14% increase over the wheat-cultivated area in 1997/98, so as to increase the level of self-sufficiency and curb imports
- Cultivating 430,000 feddand with barley, with a 91.1% increase over 1997/98, to exploit the large volume of rain in coastal areas
- Cultivating 2,320 thousand feddans with maize, with an 11.6% increase over 1997/98, to meet human needs and supply corn for the mixed-flour bread program.

(4) The Industrial Sector

Some of the most important proposed project of the industrial sector during the five year plan (1997/2001) are as follows:

- Chemical industries projects, producing phosphoric acid and ammonium phosphat dioxide fertilizer with a capacity of 500,000 tons yearly, as well as urea fertilizer 46.5%, azote ammonium nitrate fertilizers 33.5% with a capacity of 750,000 tons annually, completing the extensive production of newsprint and packaging paper, producing 9.6 million tons of cement.
- According to the fourth five-year plan (1997/2002), the industrial production is expected to grow by a rate of 9.5% annually in the average over the five years.

Production volumes selected industrial products are shown in Table 1.7.3.

Table 1.7.3 Production Volume of Selected Industrial Products in 2001/02

Commodity	Unit	Volume in 1996/97	Volume in 2001/02	Annual Growth Rate (%)
Aluminium	'000tons	180	257	7.4
Reinforcing iron	'000tons	2,100	3,100	8.1
Phosphate fertilizer	'000tons	1,210	1,900	9.4
Cement	'000tons	19,800	30,000	8.7
Refined sugar	'000tons	1,231	1,503	4.1
Flour and shelled	'000tons	13,487	14,484	1.4
Oils	'000tons	366	543	8.2
Cotton yarn/fibroin	'000tons	325	390	3.7
Garments	Million pieces	193	300	9.2

Source) "The Fourth Five-Year Plan for Economic and Social Development(1997/98-2001/01) , And the Plan of Its First Year" The Ministry of Planning

1.8 Egypt in the 21st Century

(1) Population

According to the most reserved estimates, population is projected to reach 80 million in 2017, excluding Egyptian expatriates abroad. This requires successful family planning and increased awareness of the need to maintain the downtrend of population growth rate and bring it gradually to around 1.2% in 2017.

(2) Agriculture Development

Agriculture development strategy is primarily based on preserving and improving the productivity of cultivated land, and protecting it from urban expansion. It is also planned to further enhance the productivity of the newly-reclaimed land since 1982, amounting to 1.6 million feddens, adjacent to the boundaries of the Old Valley, and to the east and west of the Delta. It is also targeted to increase agricultural production at a real growth rate of around 4% per annum, in order to meet food requirements of the population and cope with the needs of development.

Crop structure should be adjusted in line with an indicative policy, taking into consideration water rationing and relationship between water unit and value added for each crop, especially rice and sugar cane. Areas for growing grain crops should be expanded and rainy coastal areas exploited.

(3) Industrial Development

Industrial development is the mainstay for establishing production bases and maximizing the export capabilities of the national economy. A growth rate of not less than 9% in the forth five-year plan is targeted which would progressively rise to an average of 11% until 2017.

(4) Petroleum

The petroleum sector plays a leading role as a foreign currency-generating activity. It has become the main source of operating electric power, and the basic raw material for some industries such as Azote fertilizers. The development strategy of this sector is based on integrated policies based on the following:

- Maximizing the pivotal role of the petroleum sector as a key source of national income, foreign exchange , and job opportunity.
- Preserve and protect the environmental against pollution.
- Boost development efforts north of the Valley by increasing available refinery capacity at Wadi Firan refinery. and so on

Chapter 2 Natural Conditions in and around the Greater Alexandria Port

2.1 General

During the Field Surveys in Egypt, data and project-related information on the natural conditions at the Greater Alexandria Port were collected from both governmental and non-governmental sources of agencies. The data and information collected on the natural conditions will determine the basis for port planning and the criteria for preliminary design of port facilities in order to formulate the conceptual zoning, master planing together with facilities arrangement and designing port facilities.

In addition, a series of site surveys such as topographic survey in port area, bathymetric survey along the port access channel and/ at inner port basin and subsoil investigation was executed during the field survey (I) and (III) in Egypt. The results of these field surveys for natural conditions are presented in this chapter in details.

2.2 Outline of Natural Conditions

The city of Alexandria is situated upon the western end of the Nile Delta at the distance of around sixty kilometers to the west from the river Nile. Along this coastal line of the Nile Delta, there exists a succession of peaks or rocky points separated the coastal zones by bays. The city of Alexandria developed along the coastal area is geographically sandwiched between the Mediterranean Sea to the northwest and the lake of Maryut to the southeast and extends as a narrow coastal strip along northeast-south west direction. The Alexandria port composes of the eastern fishing harbor and the western harbor for international trade. The areas for the Alexandria western port together with Dikheila port which was recently developed at about 10 km southwest distance from the Alexandria port, as called by the Greater Alexandria Port, form integral parts of concern of this study.

The Greater Alexandria Port faces to the sea area limited by the two peaks of Ras El Tin and El Agami of which distance is about 10 km between them. Along the alignment of these two peaks, there exists a succession of shoals or rocks such as Ras El Tin, El Aramil, El Ikhwan, El Hut, El Kalb, El Qitt, El Far, North Shoal, Hydrographer Shoal, Hommey Shoal, forming underwater shelf with a water depth less than 10 meters. At present, the manmade breakwaters protect the port extending between the two peaks to the west from Ras El Tin and to the east from El Agami covering more than half distance between the two peaks.

The weather regime of Alexandria belongs to the Mediterranean climate and generally mild and highly seasonal with a few rainfalls experienced only in winter and therefore oceanographic environment is relatively calm and moderate in nature as well.

2.3 Meteorological Conditions

The meteorological information (wind, rainfall, temperature, etc.) in the Alexandria port area has been recorded by the Egyptian Meteorological Authority and collected by the Study Team.

The area in the city of Alexandria belongs to the weather regime of Mediterranean Climate. The Mediterranean climate is strongly related to the development of large-scale pressure systems going beyond the boundaries of the Mediterranean area and further extending towards the North Atlantic, Eurasia and North Africa. The transitional months of the system are May and October, which give rise to the year into winter season and summer season. In the winter season, the Azores anticyclone becomes predominant over the Libyan desert areas and North Atlantic depressions enter the Eastern Mediterranean area which bring the masses of cold air, causing frequent weather instability in this region.

Unlike dry desert climate in Cairo with little raining, the weather in Alexandria is highly seasonal in nature. The temperature is mild and humidity is relatively high having a little rainfall in winter season. The cool winter season in Alexandria is the period from November to April while the hot summer season covers from July to September. The months of May-June and October are considered as a transitional period of the weather climate. The nearest stations of climatic observation to the study area are the Alexandria Port and Alexandria Airport. The data from the port station will be used in this study.

2.3.1 Temperature

The temperature in Alexandria is mild and moderate. Table 2.3.1 and Figure 2.3.1 show the monthly change of the maximum and minimum temperatures for 16 years period from 1979 to 1997. The maximum temperature records 29.1 °C (in August) and the minimum temperature is 11.6 °C (in February). The difference of temperatures between the maximum in the summer season and the minimum in the winter season is 17.5 °C.

Table 2.3.1 Monthly Change of Temperature in Alexandria (1979～1997)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Maximum	17.6	17.7	20.0	22.7	24.9	27.3	28.5	29.1	28.2	26.5	22.8	19.4
Minimum	12.1	11.6	13.4	15.9	19.5	22.0	24.1	24.6	23.7	21.3	18.3	13.3

Source : Meteorological Authority of Egypt

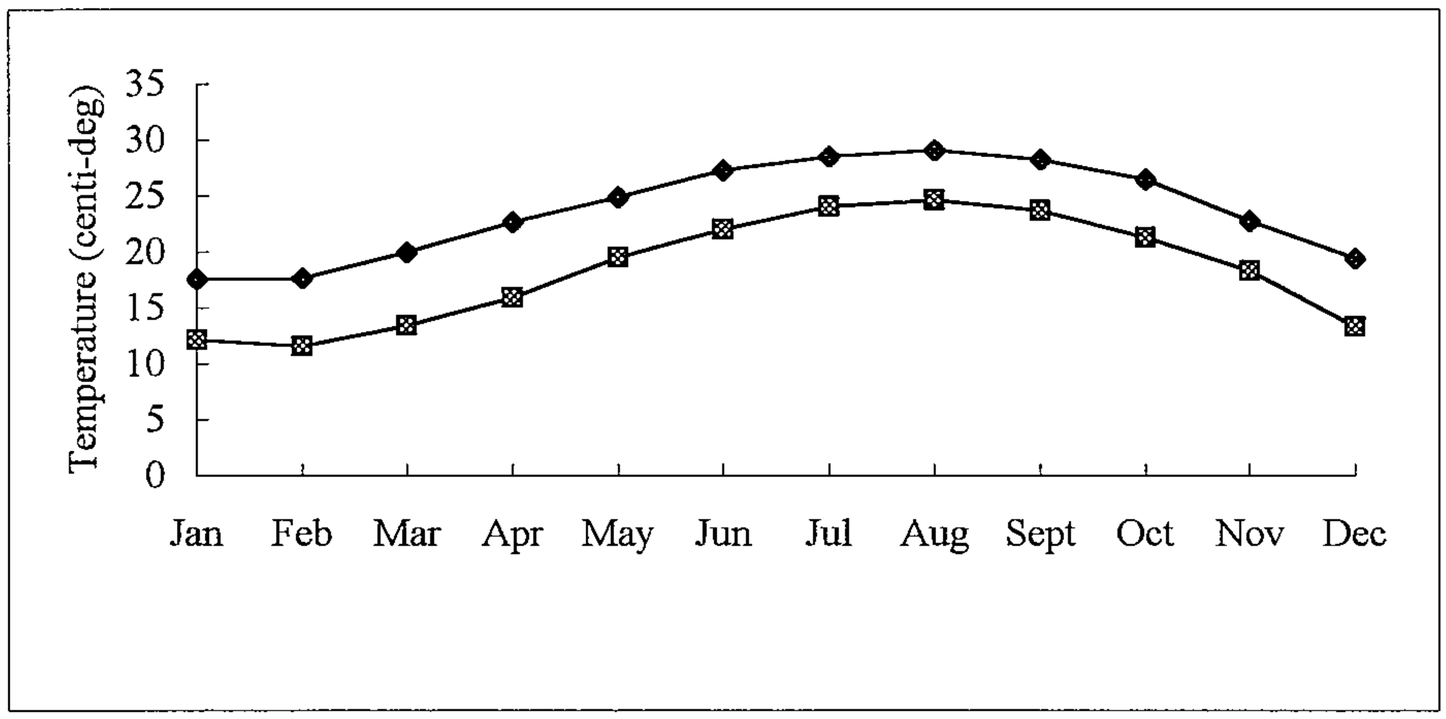


Figure 2.3.1 Monthly Change of Temperature in Alexandria (1979～1997)

2.3.2 Humidity

Table 2.3.2 and Figure 2.3.2 show the monthly change in humidity. The minimum humidity is 57% in January while the maximum 75% in July and varies little throughout the year. Unlike those changes recorded in Cairo, the monthly humidity is very high and the mean humidity throughout the year is about 68% as shown.

Table 2.3.2 Monthly Change of Mean Humidity in Alexandria (1979～1997)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average
Humidity (%)	57	65	67	67	71	74	75	74	69	69	66	65	68

Source : Meteorological Authority of Egypt

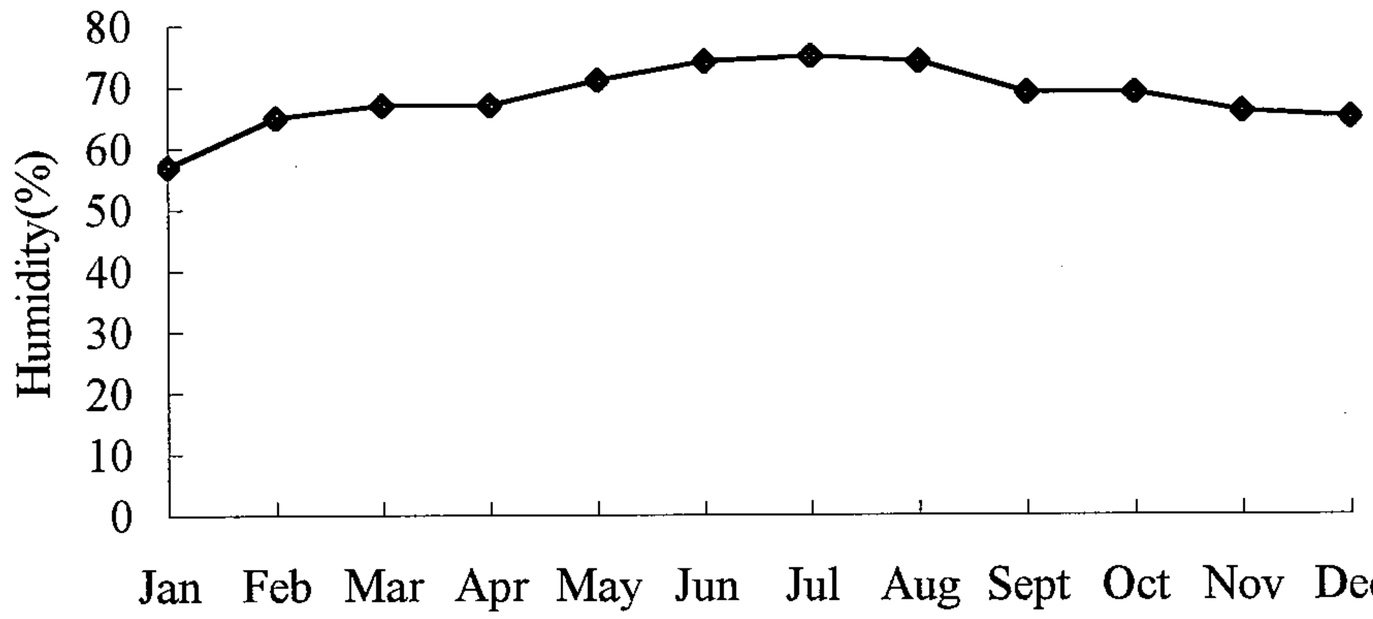


Figure 2.3.2 Monthly Change of Mean Humidity in Alexandria (1979～1997)

2.3.3 Rainfall

Table 2.3.3 and Figure 2.3.3 show the change in monthly records of rainfall. Although the weather in Alexandria has a little rainfall, the rainfall concentrates in the cool season from November to February and records the maximum rainfall of 41.4 mm/month in December. The warm season from June to September has no rainfall. The annual mean rainfall is 146.7 mm.

Table 2.3.3 Monthly Change of Rainfall in Alexandria (1979～1997)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Mean
Rainfall (mm/month)	37.5	30.6	8.2	2.1	0.6	0.2	0	0	0	5.2	20.9	41.4	146.7

Source : Meteorological Authority of Egypt

Source : Meteorological Authority of Egypt

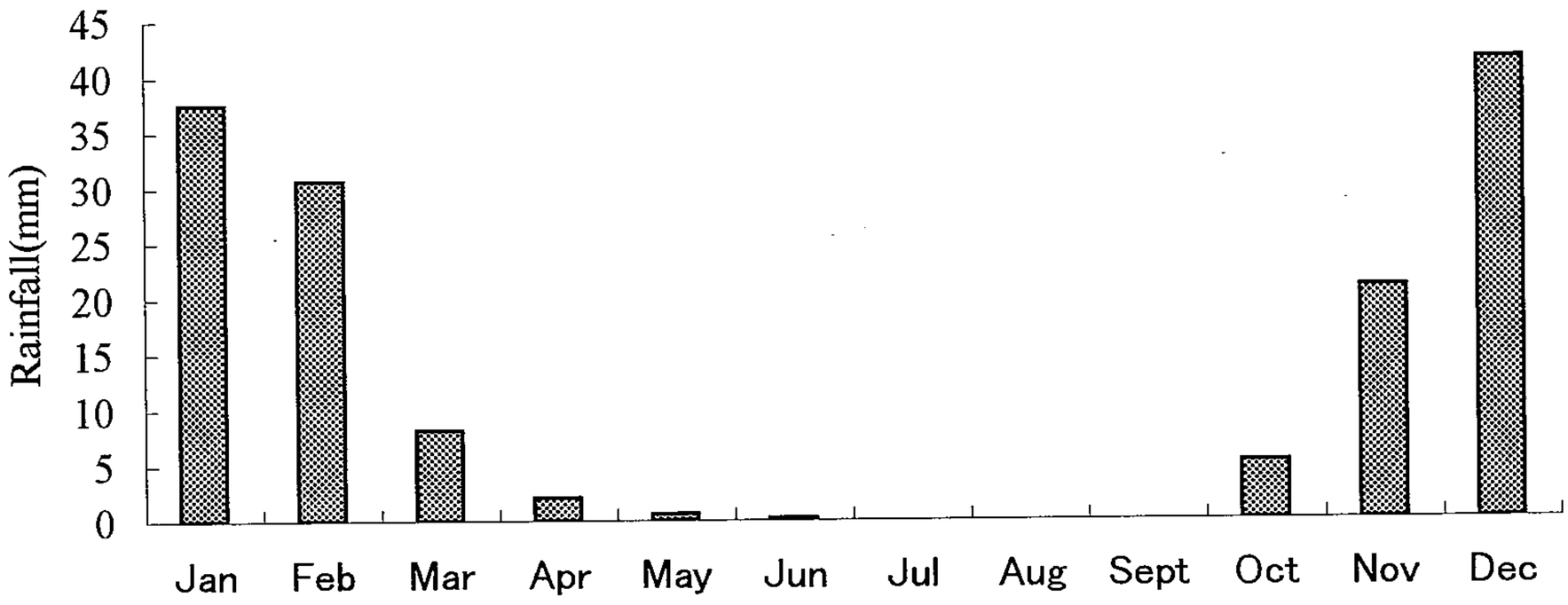


Figure 2.3.3 Monthly Change of Rainfall in Alexandria (1979～1997)

2.3.4 Winds

The climate in Alexandria and the adjacent area facing the Mediterranean is relatively calm throughout the year. But, in winter season, due to the extension of the Azores anticyclone over the Libyan Desert, the masses of cold air associated with the North Atlantic depressions entering the Eastern Mediterranean area causes vertical instability along the meteorological fronts with the warm and moist air of the Mediterranean. The westerly strong wind occasionally occurs due to the depression moving to east in the south region of Europe but the speed of the winds are usually not more than 20 m/s.

Table 2.3.4 shows the annual frequency of occurrence of wind by speed and direction compiled from the wind data observed in the Alexandria Port observation station for 16 years from 1979 to 1997. These data show that the predominant wind directions in Alexandria range from north to west and the 88% of the whole wind is less than 10 knots (5.14 m/s) in speed. The wind having more than 34 knots (17.5 m/s) in speed has not been observed.

Table 2.3.4 Frequency of Occurrence of Wind in Alexandria Port (1980～1996)

	Variable	345-014	014-044	045-074	075-104	105-134	135-164	165-194	195-224	225-254	255-284	285-314	315-344	All
		N			E			S			W			directions
Calm														0.8
1-3	0.9	5.6	2.0	2.1	2.5	3.1	1.8	1.1	0.7	0.8	1.7	3.7	5.5	31.5
4-6	0.0	8.2	3.0	1.7	1.6	2.0	0.7	0.7	0.7	0.9	1.9	4.6	8.2	34.2
7-10	0.0	5.1	2.1	0.8	0.5	0.6	0.2	0.3	0.7	0.8	1.8	3.4	5.7	22.0
11-16	0.0	1.6	0.5	0.2	0.1	0.1	0.1	0.1	0.5	0.9	1.4	1.8	2.4	9.7
17-21	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.2	1.3
22-27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.5
28-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.9	20.6	7.6	4.8	4.7	5.8	2.8	2.2	2.7	3.9	7.2	13.9	22.1	100.0
Total(0-10 knots)	0.9	18.9	7.1	4.6	4.6	5.7	2.7	2.1	2.1	2.5	5.4	11.7	19.4	88.5
Total(11-21 knots)	0.0	1.7	0.5	0.2	0.1	0.1	0.1	0.1	0.6	1.2	1.7	2.1	2.6	11.0
Total(more than 21knots)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.5

Source : Meteorological Authority of Egypt

Table 2.3.5 shows the frequency of occurrence of wind by speed and direction which is compiled from the strong wind data more than 10 m/s in speed at the Alexandria Port station for 10 years period from 1985 to 1994. The data show that the strong wind having more than 10 m/s in speed predominates in the directions from southwest to northwest and the 96% of whole strong wind are 10 to 15 m/s in speed. The wind having more than 25 m/s in speed has been observed only one time.

Table 2.3.5 Frequency of Occurrence of Strong Wind in Alexandria Port (1985～1994)

Direction / Speed	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NE	NNW	N	Total (%)
10.0-14.9	1.8	0.6	0.6	0.3	0.0	0.1	0.1	2.6	9.6	18	16.3	14	12.3	9.1	8.2	2.8	96.5
15.0-19.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.2	1.6	0.9	0.0	0.2	0.2	0.0	0.0	3.4
20.0-24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.0-29.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
30.0 m/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (%)	1.8	0.6	0.6	0.4	0.0	0.1	0.1	2.8	9.8	20	17.2	14	12.5	9.3	8.2	2.8	100.0

Source : Meteorological Authority of Egypt

2.4 Oceanographic Conditions

2.4.1 Tides

The tide observation is gauged inside port area by the survey department of the Alexandria Port Authority. From the data obtained for the past 5 years period from January 1994 to May,1998, the tide levels inside the Greater Alexandria Port are simply summarized as shown in Tables 2.4.1 and 2.4.2. As shown in the tables, all the tides are given by the levels referred to the Chart Datum Level (=the Port Datum Level DL -±0.00.) and it is observed that the tide characteristics in the port of Alexandria shows a notable pattern of semi-diurnal tide variations with about 0.3 meters range in difference between mean high and mean low water levels as being generally the most case in the Mediterranean Sea.

Table 2.4.1 Tide Levels recorded in the past 5 years at Alexandria Port

Highest Water Level for past 5 years period	+0.96 m
Mean Monthly Highest Water Level	+0.77 m
Mean High Water Level	+0.61 m
Mean Sea Water Level	+0.48 m
Mean Low Water Level	+0.34 m
Mean Monthly Lowest Water Level	+0.21 m
Lowest Water Level for past 5 years period	+0.04 m
Chart Datum Level (=Port Datum Level)	±0.00 m

Source : APA

Table 2.4.2. Annual Tide Levels for the past Five Years

Water Levels	`94	`95	`96	`97	~May,`98	Average
Highest	+0.96	+0.90	+0.96	+0.85	+0.84	---
Mean Monthly Highest	+0.77	+0.73	+0.80	+0.78	+0.78	+0.77
Mean High	+0.62	+0.61	+0.67	+0.62	+0.56	+0.61
Mean	+0.49	+0.48	+0.53	+0.48	+0.42	+0.48
Mean Low	+0.35	+0.36	+0.39	+0.35	+0.29	+0.34
Mean Monthly Lowest	+0.19	+0.22	+0.23	+0.23	+0.19	+0.21
Lowest	+0.20	+0.10	+0.31	+0.18	+0.26	---

Unit: meter

Source: APA

2.4.2 Current

Owing to the weakness of the tide variations in the Mediterranean Sea, currents along the coastal area of the Greater Alexandria port are basically very small. General movement of current is to the east and weak although the movement is generally accelerated by the winds blowing from the northwest.

According to the final report on Alexandria/El Dikheila Port Modernization Study (March 1988), the past observation and measurement on the currents in the area of Alexandria shows that the most frequent values are in the order of 10 cm/sec. In addition, the maximum value for the currents over a high number of record is about 50 cm/ sec, which is mainly generated by the winds.

2.4.3 Waves

The following are the summary of existing available data on the wave climate applicable to the area of the Greater Alexandria Port.

-An analysis of the sea and swell charts information within the area from Alexandria to Cyprus/Crete and East Crete to Eastern Mediterranean by Bceom/Intecsa/Pam, provides some comments on winds. According to the analytical study, it is commented that the wave height of about 0.8 meter corresponds to a 50% frequency with predominant wave directions of NW and the highest waves occur in winter season.

-The National Plan for Coastal Fishing port Development in Egypt, 1994 has established the specific wave dimensions off the coastal area covering Maadia located near the port of Alexandria based on the Coastal Protection Studies by UNDP in 1978 as per Table 2.4.3.

Table 2.4.3 Specific Offshore Wave Dimensions

	Wave Direction	Significant Wave (m)		Season in Occurrence
		Height(Ho1/3)	Period(To1/3)	
Maximum Wave (30-50 years)	WNW	6	10	Winter
	NNE	3	8	Winter
Maximum Wave (1 years)	WNW	4	10	Winter
	NNE	2	8	Winter
Predominant Wave (1 year)	NNW	1.1	8	Summer
	WNW	2	8	Winter
	NNE	1.5	8	Winter

Source: described as above

-The JICA study on Maadia Fishing Port provides ordinary and extraordinary offshore waves by frequency of occurrence and directions, which were hind-cast by means of the SMB method. The study indicates that the predominant waves range from north to west directions as for ordinary waves and, for extreme waves, offshore waves derived through wind data over the 30 years period are summarized in Table 2.4.4. According to this study, extreme offshore waves are 6.9 meter in height, 9.9 seconds in wave period from west direction.

Table 2.4.4 Dimensions of Extreme Offshore Waves

Direction		W	NW	NNW	NE
Wave Height	Ho (m)	6.9	6.2	5.7	3.7
Wave Period	To (sec)	9.9	9.5	9.1	7.7
Wave Length	Lo (m)	153	141	129	92

Source: described as above

-Directional wave measurements program was carried out at west of Alexandria during the period from 1992 to 1995 using an S4DW wave/current meters. [Fanos et al (1995)] Wave height distributions were calculated on monthly, seasonally and yearly basis. The study results show that the predominant wave direction is from N-W sector. Waves from NNE and NE are limited in magnitude and occur primarily during summer season. The maximum wave heights are 2.62m, 1.53m and 1.96m in winter-, spring- and summer-seasons respectively. The following Table 2.4.5 summaries the design waves characteristics (Fanos et al 1995).

Table 2.4.5 Design Wave Characteristics

Return Period (year)	1	10	20	50
Ho (m)	3.4	5	6	6.8
T (sec)	6	8.5	10	15

Source : described as above

2.5 Previous Observation on Subsoil Conditions and Bathymetry of the Port

2.5.1 Subsoil Conditions inside the Port

The subsoil around Alexandria areas is composed of quaternary deposits, which are mainly recent accumulation. The subsoil profile of the Greater Alexandria Port is characterized by the existence of parallel sand bar deposits. These bars were formed during various periods when the sea water levels were subject to changes. The bars are composed of cemented sands with some finely divided or broken shells. Sandwiched by these bars, lagoon deposits are found in the form of fine sands or silts and in most cases weak clays. Large amount of silty or clayey deposits exists in the subsoil under the sea bed which would be formed when Nile alluvium were transported by an old tributary of the river. The lagoon deposits also include layers of fibrous peaty materials mixed with sands and clay or clayey soil, which are extensively ranged into the bay.

The Study Team collected the existing available boring logs. These collected data indicate general profile of subsoil at offshore area of center zone of Alexandria port where the very soft soil (described as mud) deposits exist from the sea bed surface down to the rock bearing stratum. The elevation of the bearing stratum is around 25 meter below the port datum. The depth of the bearing stratum varies by places but becomes deeper by distance to the offshore of the port.

2.5.2 Bathymetry of the Port

The Greater Alexandria Port is situated facing the sea area limited by the two peaks of Ras El Tin and El Agami of which distance is about 10 km between them. Along the alignment of these two peaks, there exist a number of shoals or rocks, forming underwater shelf with a water depth less than 10 meters. This bathymetric profile of the area provides preferable advantages against sedimentation and siltation. Actually, the presence of the two peaks and the alignment of shelf between them results in a considerable reduce of littoral drifts so that the littoral transit of sediments across the shelf becomes very weak pattern and therefore is composed of a small amount of volume of finer materials.

All the inner port basins were surveyed periodically. It is also informed that the periodical sounding works along the existing quay walls are performed on annual basis regularly by the Survey Engineering Department of APA.

In 1979, an Italian contractor S. I. Deir performed dredging work alongside quay walls at the port of Alexandria. In addition, based on the periodical sounding results, dredging work along the existing quay walls is carried out by APA to maintain the required the water depth of quay wall for about 10 to 15 quay walls per annual. But, it is reported that the siltation along navigational channel together with approach channel is minor concern for the Greater Alexandria Port and substantial siltation problem is deemed to be minimal.

2.6.2 Field Survey (I) for Natural Conditions

During the 1st Field Study period in Egypt from March to June 1998, the following field surveys were carried out.

(1) Topographic survey within the inner area of the Greater Alexandria Port to supplement the lack of indication provided on the existing available map of 1:10,000 scale.
(2) Sounding survey to measure the water depth at the navigational/approach channels and water area inside the Greater Alexandria Port

2.6.1 Topographic Survey

Topographic survey within the inner ports area of the Greater Alexandria Port (the ports of Alexandria and Dikheila) was carried out to supplement the lack of indication provided on the existing available map of 1: 10,000 scale. Prior to conduct of survey, a free tour all over the port was conducted for searching notable ground spots, existing structures, waterway and other sudden change of ground features visible as well as a local system grid, zero point locating beside the service building.

The survey control was executed within the framework of vertical and horizontal control system for survey references at strategic 10 points within the inner port area considering notable major ground spots and abrupt or sudden change of ground conditions. Three vertical closed loops were conducted for obtaining the necessary accuracy. A topographic survey map to cover the survey area was prepared at scale of 1:10,000 based on and referred to the existing available map as shown in Figure 2.6.1.

2.6.2 Sounding Survey

Sounding by means of hydrographic recording echo sounder was conducted on each specified sounding survey line in the greater Alexandria port. The sounding was carried out for total length of 25.2 km along the following lines at the specified interval of 100 meters

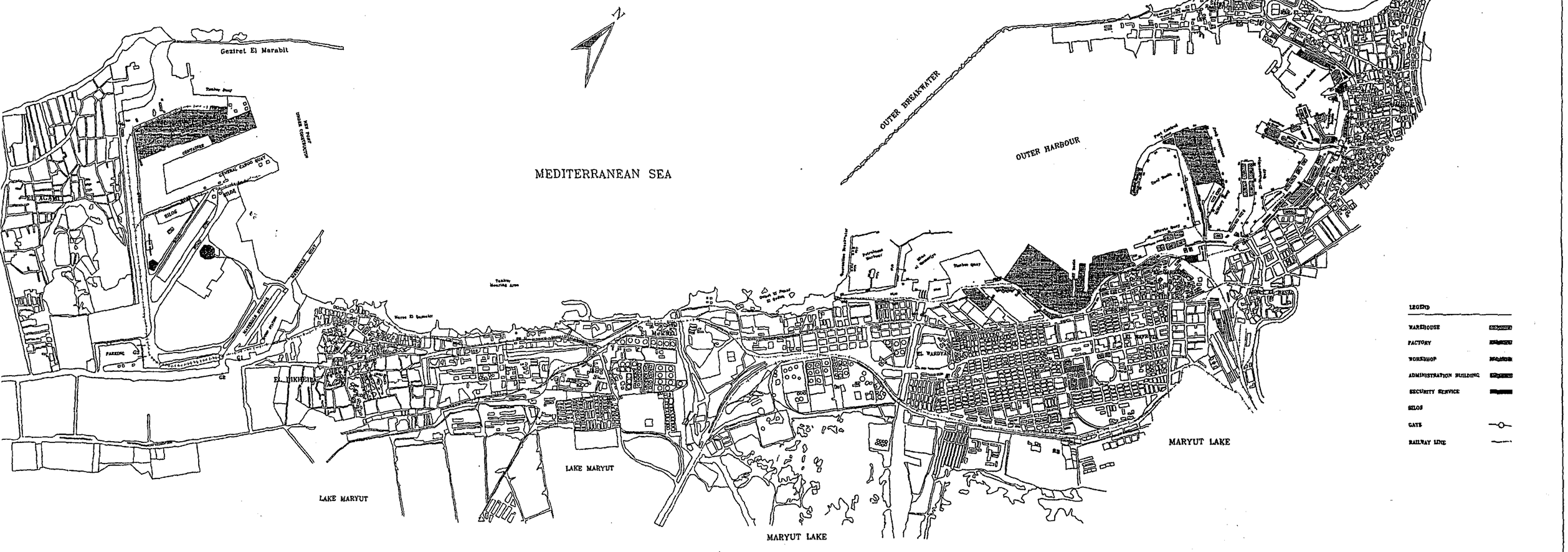
- Section 1 (El Bughaz El Kebir Pass) : 4.4 km
- Section 2 (El Dikheila Pass) : 3.8 km
- Section 3 (El Bughas Pass) : 4.4 km
- Section 4 (Alexandria Inner Harbor Fairway) : 4.4 km
- Section 5 (Dikheila Inner Harbor Area to Container Terminal) : 2.3 km
- Section 6 (Dikheila Inner Harbor Area to Mineral Jetty) : 1.1 km
- Section 7 (Alexandria Inner Harbor Area to Timber Wharves) : 1.3 km
- Section 8 (Alexandria Inner Harbor Area to Coal Basin) : 2.0 km
- Section 9 (Alexandria Inner Harbor Area to Passenger Terminal) : 1.5 km

The sounding was carried out by means of hydrographic recording echo sounder with continuous recording papers for each section to be surveyed. To collect the data relative to the lowest low water level (=Port Datum Level), the sea level variation was recorded at the site during the sounding measurement. All recorded water depths were correlated with the observed sea levels obtained from tidal observations made during the sounding survey work and then reduced to the Port Datum Level. Final hydrographic sounding map indicates the reduced water depths subtracted from the each echogram value.

The reduced water depth for each section are indicated on maps at scale of 1:10,000 as shown in the Figures 2.6.2 and 2.6.3. The results of water depth measured show that there are several points along navigational channel having less water depths than required as follows:

Section	Location	Least depth (m)	Required depth (m)*
1	El Bughaz El Kebir Pass	13.8	13.7
2	El Dikheila Pass	17.5	20.0
3	El Bughas Pass	8.2	9.14
4	Alexandria Fairway	12.8	14.0
5	Dikheila Inner Harbor	13.0	
6	Dikheila Inner Harbor	16.0	
7	Alexandria Inner Harbor	14.0~14.8	
8	Alexandria Inner Harbor	10.2~14.5	
9	Alexandria Inner Harbor	11.8~14.2	

* According to data by Ports of the World, Lloyd's of London Press 1996



ALEXANDRIA PORT AUTHORITY	JICA JAPAN INTERNATIONAL COOPERATION AGENCY	MASTER PLANE AND REHABILITATION SCHEME FOR THE GREATER ALEXANDRIA PORT	TOPOGRAPHIC SURVEY (ALEXANDRIA PORT AREA)	PACIFIC CONSULTANTS INTERNATIONAL TALAAT-IMAM CONSULTING ENGINEERS

Figure 2.6.1 Topographic Survey Map

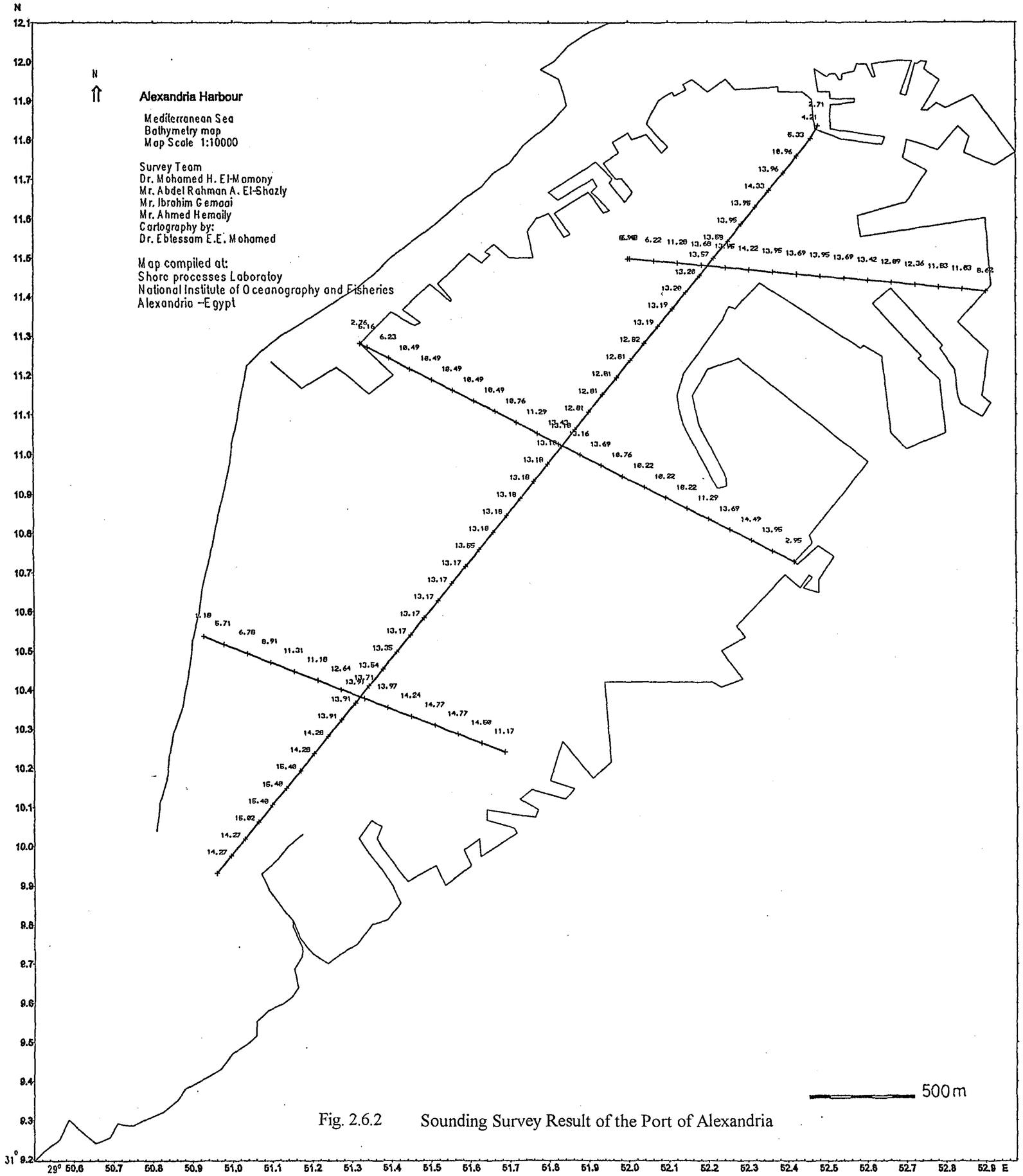


Fig. 2.6.2 Sounding Survey Result of the Port of Alexandria

El-Dekhila Harbour

Mediterranean Sea
Bathymetry map
Map Scale 1:10000

Survey Team
Dr. Mohamed H. El-Mamony
Mr. Abdel Rahman A. El-Shazly
Mr. Ibrahim Gemaal
Mr. Ahmed Hemally
Cartography by:
Dr. Ebtessam E.E. Mohamed

Map compiled at:
Shore processes Laboratoy
National Institute of Oceanography and Fisheries
Alexandria - Egypt

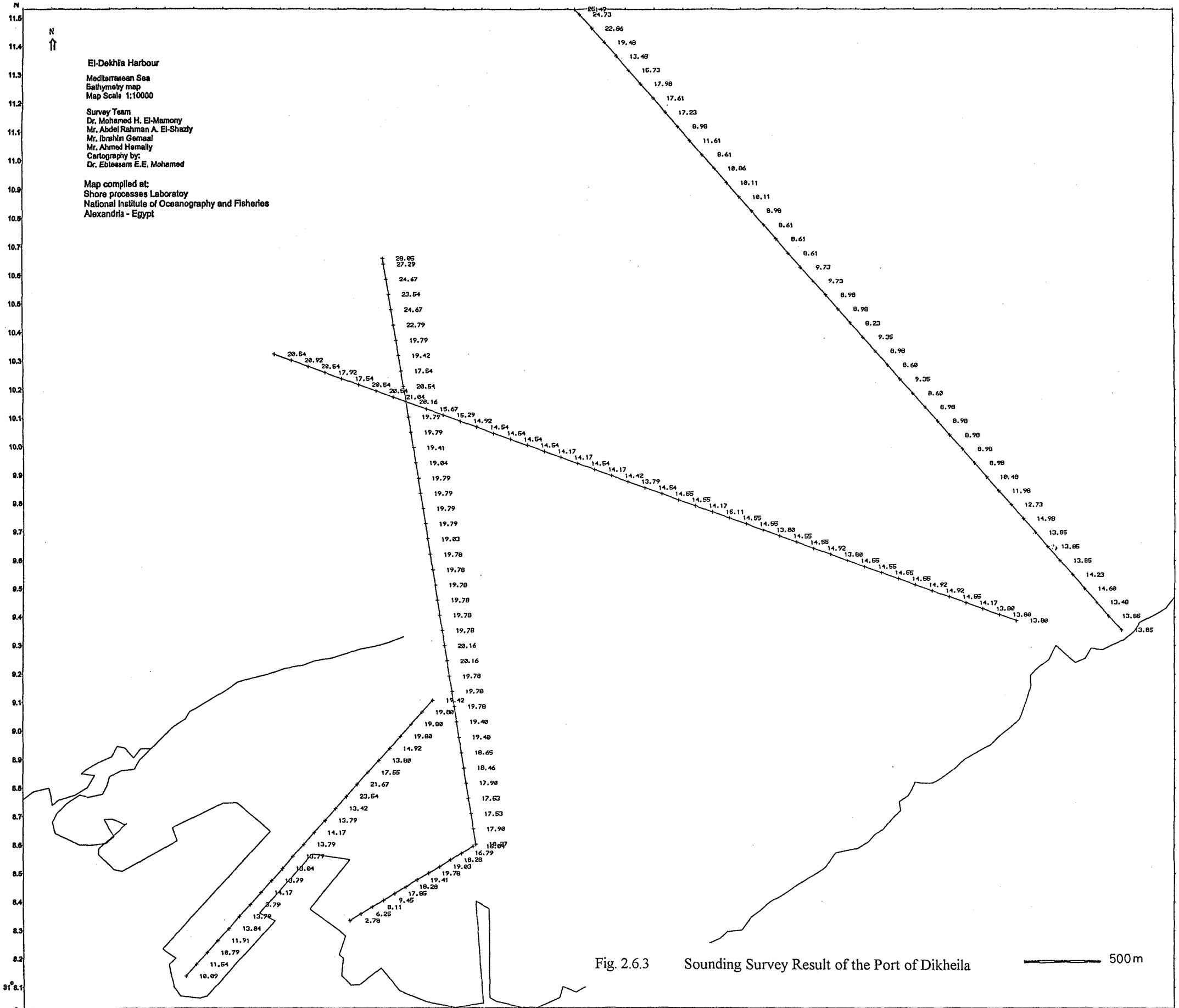


Fig. 2.6.3 Sounding Survey Result of the Port of Dikheila

2.7 Field Survey (II) for Natural Conditions

During the fields survey (II) in Egypt from April to May 1999, subsoil investigation and water depth sounding were carried out at the area where the short-term development plan were envisaged.

2.7.1 Subsoil Investigation

Although the Study Team collected available data on subsoil conditions within the port of Alexandria, these data show only general profile of subsoil with neither information on N-value of Standard Penetration Test (SPT) nor physical or mechanical properties of subsoil. In order to supplement such subsoil information, seven (7) borings which composed of one (1) onshore boring and other six (6) offshore borings were conducted by the Study Team in April to May, 1999 at the location shown in Figure 2.7.1 .

The objectives of the subsoil investigation are to characterize the site subsoil, define their geotechnical conditions and to evaluate soil strength and compressibility parameters relevant to foundation design and construction. The subsoil investigation includes the execution of boring, in-situ testing, laboratory testing, analysis of field and laboratory test results, evaluation of design subsoil parameters and preparation of final report.

(1) Boring Logs
Characteristics of the subsoil at each location are obtained through the subsoil investigation as described below.

- BH-1
  Ground elevation at BH-1 located near the existing port bridge is 4.26m above Port Datum (D.L.±0.00m). The subsurface layers mostly consist of sandy soils of around 2 to 14 N-value of SPT. There exists very stiff or hard limestone layer deposits below the depth of 9 m (D.L.-5 m), which is deemed the bearing stratum around this area.
- BH-2
  The sub surface layer consists of loose or very loose sandy soils having N-value of 0-12. From the depth of 7 m, this sandy deposit becomes medium dense to dense. Very dense sand layer was encountered from the depth of 12 m (D.L.-22 m) and this layer is deemed the bearing stratum. No clayey deposit exists at this boring hole. The loose to dense sandy soil deposits upon the bearing stratum at this area are sandy soils which were dumped for the replacement of underground soft subsoil below the existing berth structures.
- BH-3
  The seabed surface layer composes of very loose sandy soils. Below the depth of 5 m, very soft clayey layer become dominant till the lower sandy deposit exists at the depth of 13 m (D.L. –23 m). Although N-value of SPT varies from 17 to over 50 by depth, this sandy deposit is considered the bearing stratum around this area.

- BH-4 to 6
  Except for very loose sandy subsurface layer of around 2 to 7 m thick, subsoil around this area is mostly composed of very soft clayey deposit having N- value of 0 or 1. The sandy layer having N- value of more than 30 deposits below the clayey layer at the depth of D.L – 23 to 26m, which forms the bearing stratum at this area.
- BH-7
  The seabed elevation of BH-7 is D.L.-16m due to the dredging of turning basin. A thin layer of very loose sand is sandwiched at the upper layer of very soft clayey soil deposits. The bearing stratum of more than 50 N-value in SPT exists below the depth of D.L –24 m.

(2) Subsoil Profile

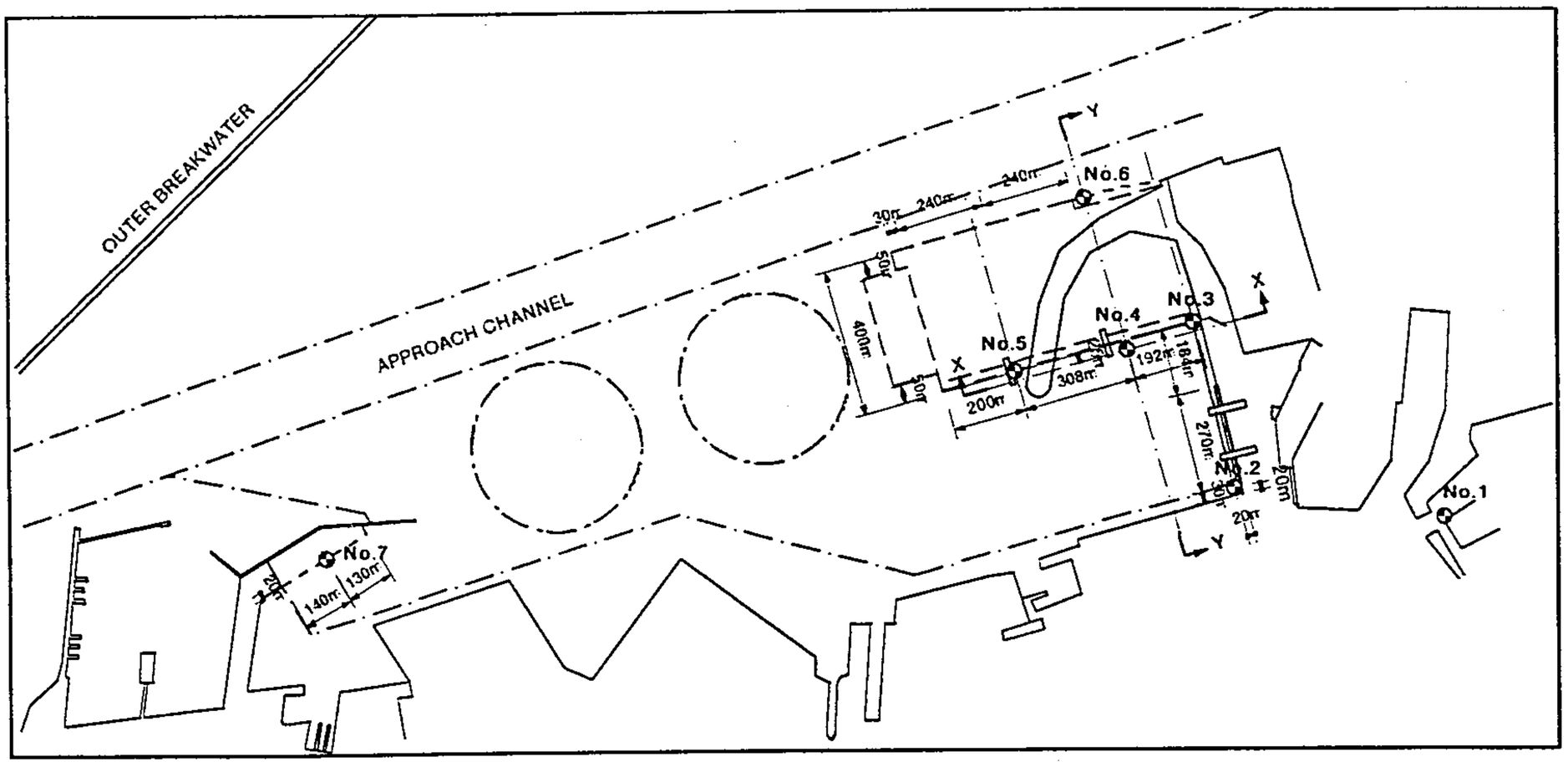
The sectional subsoil profiles with boring logs at the area from new multipurpose terminal to deep water coal berth are shown in the Figure 2.7.1.

(3) Physical Test Results

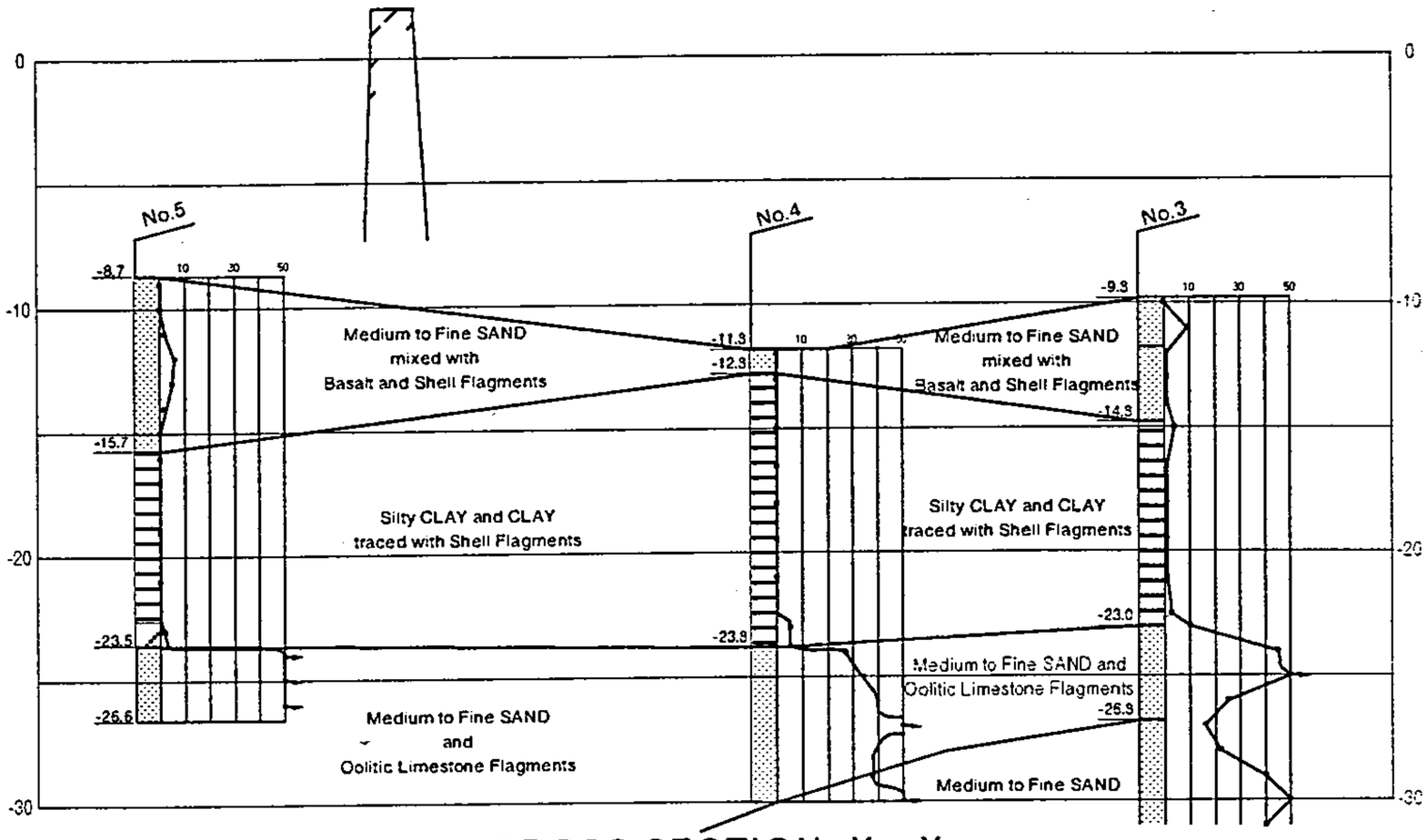
Physical tests at laboratory were conducted on disturbed or undisturbed samples of each different layer of subsoil extracted from the subsoil samplers. The laboratory test result of physical tests for each bore hole and sample is summarized in Table 2.7.1.

(3) Mechanical Test Results

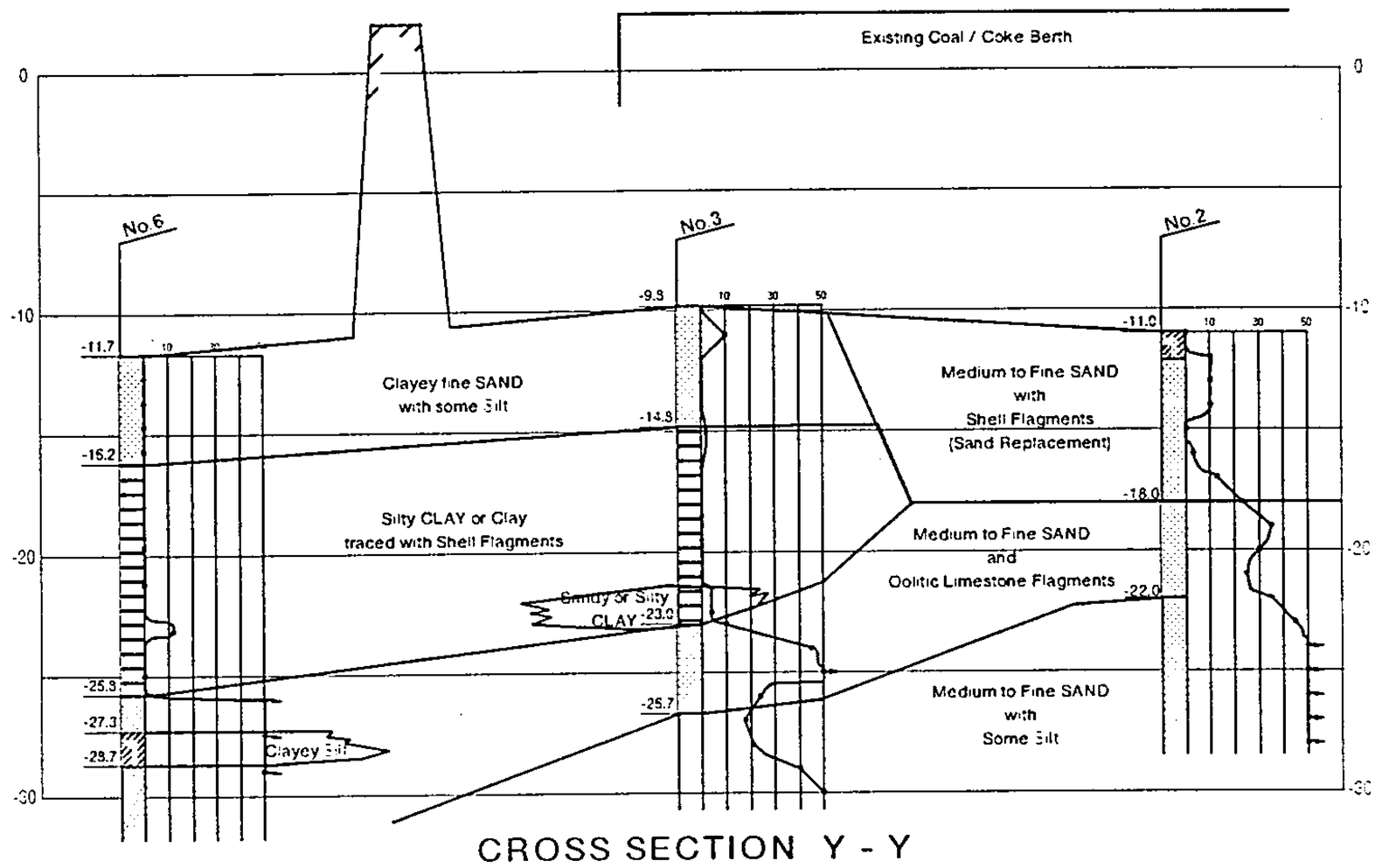
The laboratory test result of uni-axial/unconfined compression tests and consolidation tests for each bore hole and sample is also summarized in Table 2.7.1. As shown in Fig. 2.7.2, it is evaluated that cohesion of very soft clay deposit is more or less 0.3 kg/cm2 showing an increase with depth despite of its very low N-value and its compressibility is very high.



BORING LOCATIONS



CROSS SECTION X - X



CROSS SECTION Y - Y

Fig. 2.7.1 Subsoil Condition at the Port of Alexandria

Table 2.7.1 (1) Summary of Laboratory Test Results on Subsoil Samples

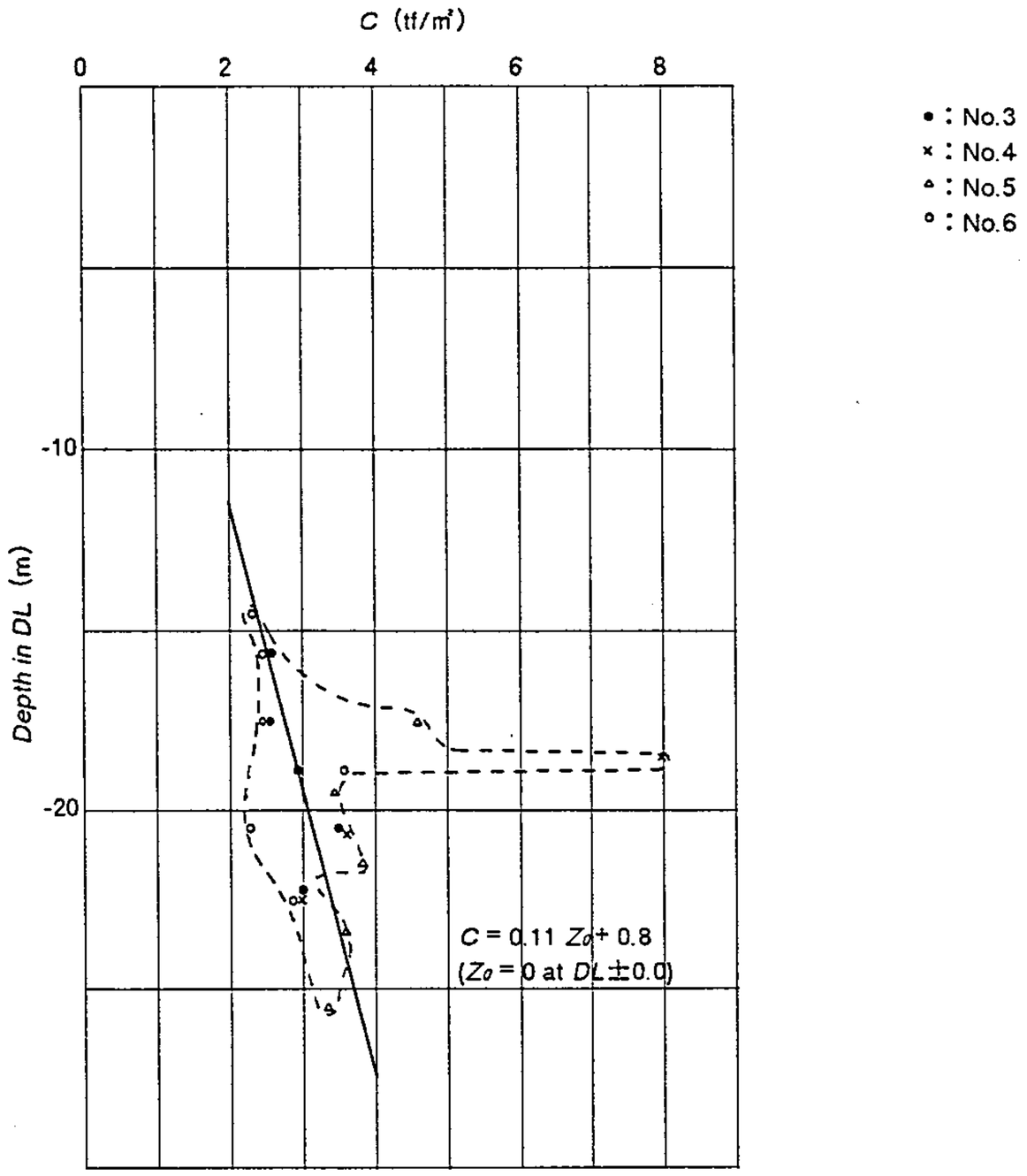
Location : Alexandria Port

Boring No.	Sample No.	Depth of Sample (m)	Unified Soil Classification System	Sieve Anaysis				Effective Diameter	Uniformity Coefficient Uc	Unit Weight	Water Content	Atterberg Limits			Uniaxial Shear		Consolidation	
				Passing No.4 Sieve Wt (%)	Passing No.40 Sieve Wt (%)	Passing No.200 Sieve Wt (%)	Clay Fraction by Wt Wt (%)	D10 (mm)	(D60/D10)	W (g/cm2)	Wn (%)	Liquid Limit Wl (%)	Plastic Limit Wp (%)	Plasticity Pl (%)	Undisturbed qu (kg/cm2)	Remolded (kg/cm2)	Com. Index Cc	Coefficient of Vol. Com-pressibility mv (m2/min)
1	D1+D2	1.2-2.8	SM	64.7	46.3	18.9	6											
	D3+D4	3.0-4.5	SM	70.2	33.6	12.2												
	D5	5.0-5.5	SM	96.0	79.4	13.6												
	D6	6.0-6.5	SM	99.8	76.3	19.6	5											
	D7	7.0-7.5	SM	98.6	88.1	40.2	5					22.4	NA	NA				
	D8	8.0-8.5	GW-GM	37.8	20.1	6.1		0.173	7.627									
	D9	9.0-9.2	SW-SM	57.4	26.0	9.1		0.095	10.426									
	Core2	10.0-11.3																
	D10	12.3-12.4	SM	67.2	34.3	13.4												
	Core5	13.5-14.8																
	D11	18.0-18.4	SM	72.9	33.4	12.2												
2	D2 to D4	1.0-3.5	SP	100	55.4	1.0												
	D5 top	4.1-5.0	SM	91.6	49.6	18.6	8											
	D5 bot. to D7	4.1-5.0	SC	94.1	78.7	48.7	20					25.0	16.4	8.6				
	D8	7.0-7.5	GM	54.2	37.5	12.2												
	D9 to D11	8.0-10.5	SW-SM	55.5	36.4	9.6		0.085	6.693									
	D12	11.0-11.5	SM	100	42.1	12.6												
	D13 to D16 top	12.0-15.5	SM	86.7	43.0	12.7												
	D16 bot. to D18	15.5-17.5	SP-SM	92.6	83.9	9.2		0.084	3.393									
3	D1+D2	0.0-1.5	GP	42.5	12.6	1.7		0.343	5.606									
	D3+D4	1.9-3.5	SP-SM	91.8	57.3	10.0		0.075	5.893									
	D5	4.0-4.6	SP	100	62.3	3.5		0.214	1.935									
	D6	5.0-5.5	CH	100	97.0	94.0	50					68.2	26.9	41.3				
	USD1	5.5-6.3	CH	100	94.3	90.3	65			1.71	50.2	80.0	27.9	52.1	0.54	0.26	0.353	0.792
	USD2	7.0-7.8	CH	100	97.2	94.9	87			1.56	72.4	108.6	33.5	75.1	0.52	0.16	0.963	1.374
	USD3	8.5-9.3	CH	100	99.1	98.5	91			1.53	79.3	144.1	35.6	108.5	0.58	0.18	1.001	1.052
	D9	9.3-9.8																
	USD4	10.0-10.8	CH	100	99.8	98.0	91			1.47	93.6	149.1	36.0	113.1	0.70	0.22	0.921	1.318
	USD5 top	11.5-12.3	CH	100	93.1	89.1	74			1.69	53.4	81.7	27.8	53.9	0.60	0.32	0.631	0.902
	USD5 bot.	11.5-12.3	CH	84.8	65.8	58.0	24				38.4	41.2	22.0	19.3				
	D11 top	12.3-12.8	CH	85.2	73.0	53.4	19					26.6	15.9	10.7				
	D11 bot.	12.3-12.8	CH	100	96.2	89.4	37					41.2	21.0	20.2				
	D12 top	13.0-13.5	CH	85.0	80.0	72.6	38					41.3	21.1	20.2				
	D12bot. to D15	13.0-16.5	GW-GM	46.5	27.9	10.0		0.075	10.69									
	D16	17.0-17.5	SM	87.0	60.1	19.9	11					24.2	15.8	8.5				
	D17 top	17.9-18.4	SM	79.5	57.3	14.9	7											
	D17 bot. to D20	18.4-21.5	SM	99.3	96.0	13.5												

Table 2.7.1 (2) Summary of Laboratory Test Results on Subsoil Samples

Location : **Alexandria Port**

Boring No.	Sample No.	Depth of Sample (m)	Unified Soil Classification System	Sieve Anaysis				Effective Diameter	Uniformity Coefficient	Unit Weight	Water Content	Atterberg Limits			Uniaxial Shear		Consolidation	
				Passing No.4 Sieve Wt (%)	Passing No.40 Sieve Wt (%)	Passing No.200 Sieve Wt (%)	Clay Fraction by Wt Wt (%)	D10 (mm)	Uc (D60/D10)	W (g/cm2)	Wn (%)	Liquid Wl (%)	Plastic Wp (%)	Plasticity Pl (%)	Undisturbed qu (kg/cm2)	Remolded (kg/cm2)	Com. Index Cc	Coefficient of Vol. Com-pressibility mv(m2/min)
4	D2	1.0-1.6	CH	97.4	80.0	58.0	31					53.2	24.6	28.6				
	P.S.1	2.0-2.8		100	85.8	69.8	52			1.64	59.7	67.2	26.8	40.4	0.46	0.18	0.366	0.918
	D3	2.8-3.3	CH	96.9	88.9	76.0	40					59.8	25.5	34.3				
	P.S.2	3.5-4.2		100	89.0	82.3	63			1.59	67.6	78.1	27.6	50.6	0.50	0.17	0.418	1.335
	USD1	5.0-5.8	CH	100	95.6	92.0	74			1.58	70.7	85.2	28.7	56.5	0.50	0.16	0.613	1.881
	D5	5.8-6.3																
	USD2	6.5-7.3	CH	100	99.0	95.8	88			1.51	85.2	109.6	30.3	79.3	0.72	0.24	1.007	2.024
	USD3	8.0-8.8	CH	100	100	98.0	90			1.48	92.7	123.0	19.1	103.9	0.46	0.12	1.043	1.755
	D7	9.0-9.5																
	USD4	10.0-10.8	CH	100	99.0	99.0	91	83.0		1.54	78.8	107.9	31.5	76.5	0.56	0.18	0.844	1.789
	D8 top	11.0-11.5	CL	98.6	94.5	84.3	28					37.6	19.1	18.5				
	D8 bottom	11.0-11.5	CL	100	93.1	80.0	29					34.3	18.8	15.5				
	D9 to D12	12.0-15.3	GW-GM	36.2	20.5	7.3		0.158	6.848									
5	D1+D2	0.0-1.6	SM	99.0	61.8	19.0	7											
	D3 to D6	2.0-5.5	SM	99.1	78.3	13.9												
	D7	6.0-6.5	SC	99.7	87.3	48.8	26					37.6	19.6	18.0				
	D8+D9	7.0-8.5	CH	97.5	89.5	80.2	40					58.8	25.6	33.2				
	P.S.1	9.0-9.8	CH	100	100	97.2	63			1.61	65.0	81.0	27.1	53.9			0.830	0.877
	D11	11.9-12.4																
	USD1	11.1-11.9	CH	100	100	98.8	92			1.51	89.3	151.0	35.9	115.1			1.288	0.866
	USD2	13.0-13.8	CH	100	94	77.6	30			1.93	29.8	35.2	20.1	15.1			0.200	0.345
	D12	13.8-14.3	CL	99.2	93.9	75.8	19					32.9	17.8	15.1				
	D13 to D15	15.0-18.0	GM	55.4	31.0	12.4												
6	D1	0.0-0.6	SC	95.2	78.0	29.0	19					32.5	17.5	15.0				
	D2 to D4	1.0-3.5	SM	98.4	79.1	20.9	7											
	P.S.1	5.0-5.8	CH	100	92.1	79.5	73			1.61	65.6	91.0	28.9	62.2			0.467	1.159
	D6	6.0-6.5																
	P.S.2	7.0-7.8	CH	100	95.5	90.7	72			1.62	63.9	87.3	27.8	59.5			0.684	1.025
	USD1	9.0-9.8	CH	100	98.5	97.4	91			1.54	78.0	111.1	33.8	77.3			0.989	0.845
	D8	10.0-10.5																
	USD2	11.0-11.8	CH	100	98.5	97.4	91			1.47	94.2	132.9	35.3	97.7			0.784	1.881
	USD3	13.0-13.8	CH	100	74.9	58.8	50			1.62	64.1	80.6	27.7	52.9			0.813	2.130
	D10+D11 top	14.1-16.3	SC	100	64.2	36.6	16					30.5	16.8	13.7				
	D11 bottom	15.5-16.3	CL	100	96.2	84.4	20					36.7	18.9	17.8				
	D12 to D14	17.0-20.3	GW-GM	48.3	29.3	10.0		0.075	9.532									
7	D1	0.0-0.6	SC	97.2	66.4	38.0	29					47.3	23.2	24.0				
	D2	1.0-1.5																
	P.S.1	2.0-2.8	CH	100	93.6	89.8	68			1.51	88.5	113.6	32.9	80.7			0.480	0.918
	D3+D4	3.0-4.5	SC	92.9	66.8	42.0	25					45.6	21.0	24.6				
	D5	5.0-5.5																
	P.S.2	6.0-6.8	CH	100	93.6	89.8	68			1.62	63.5	80.5	27.6	53.0			0.404	1.335
	D6	7.0-7.5																
	D7 to D11	8.3-12.5	SM	60.1	31.9	13.3												



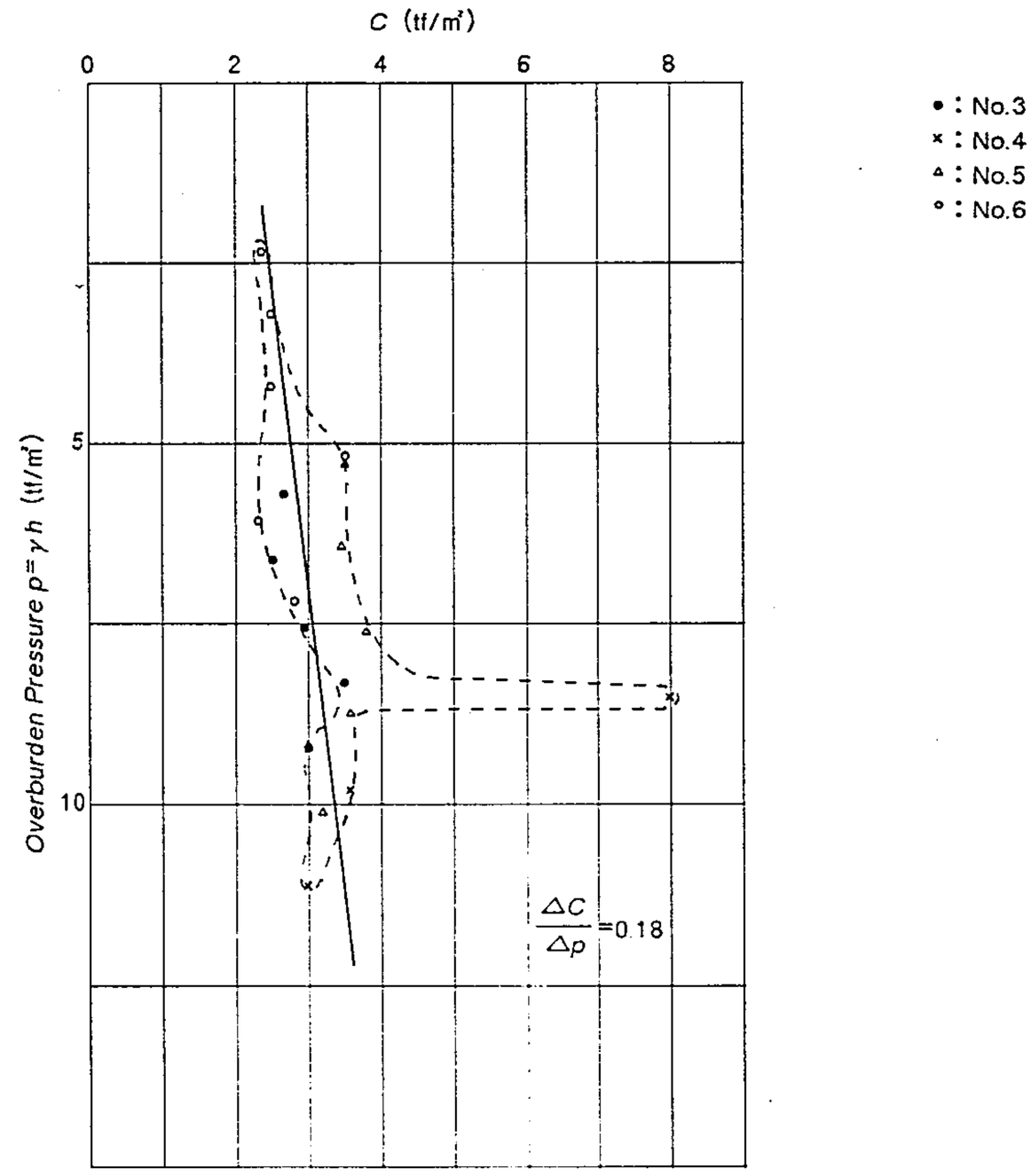


Fig. 2.7.2 Estimated Cohesion of Clayey Subsoil

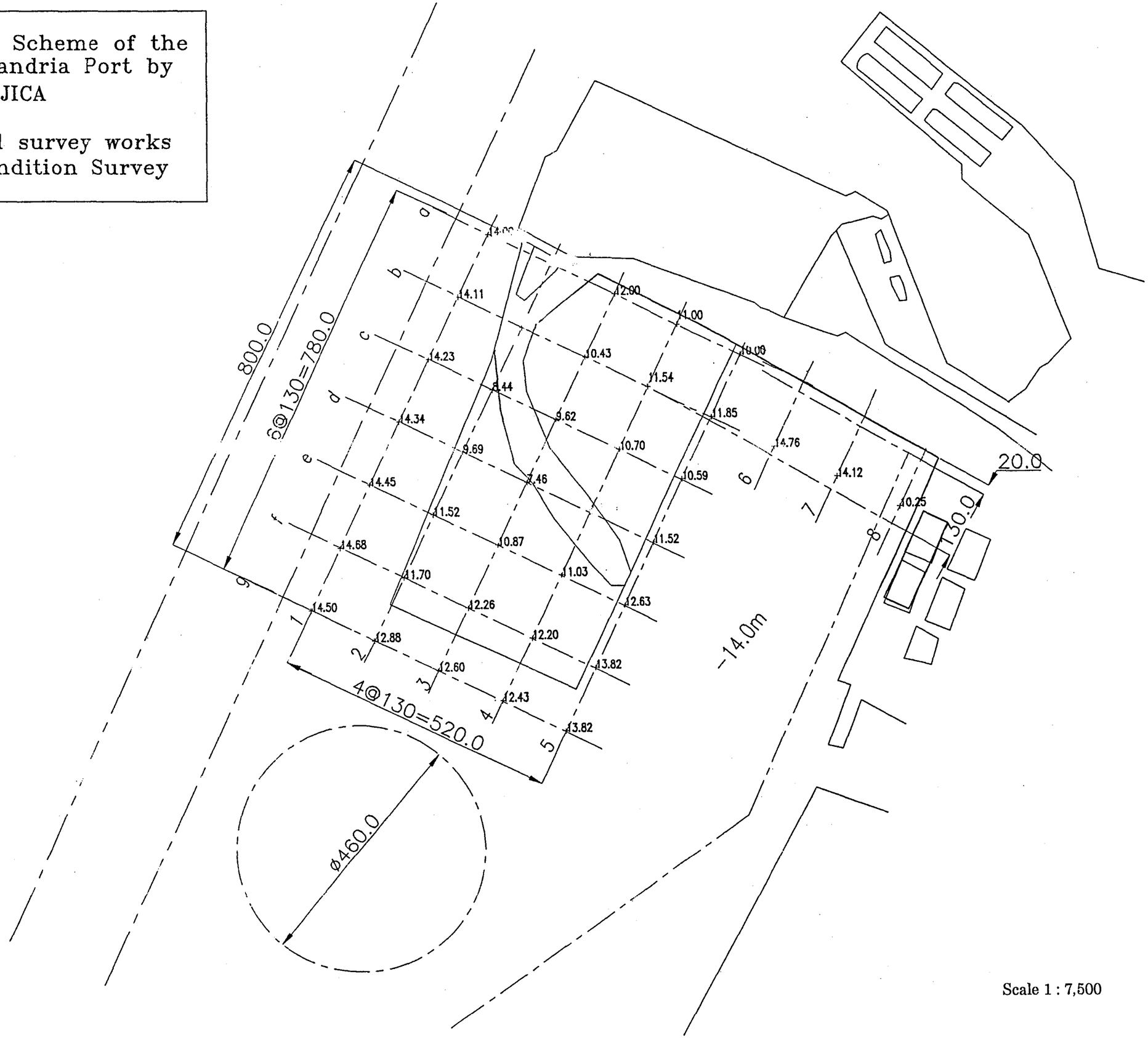
2.7.2 Water Depth Sounding

Water depth sounding was carried out at fifty (50) off shore points in order to obtain the present water depths within the area where the greater Alexandria port development are envisaged in the short term development. The water depth soundings were taken by casting a suspended weight from survey boat to the seabed to measure the present water depth within the specified area by using a calibrated precise total station based on points of coordinates. All recorded water depths were correlated with the observed sea levels obtained from tidal observations which was taken during the sounding survey work by fixing a graduated rod near the shore and were reduced to the D.L. (Port Datum).

Final hydrographic sounding map in a scale of 1:5,000 was prepared to indicate the correlated water depths to the Port Datum as indicated in Figure 2.7.3 at a reduced scale of 1:7,500.

Rehabilitation Scheme of the Greater Alexandria Port by JICA

Second field survey works
Natural Condition Survey



Scale 1 : 7,500

Fig. 2.7.3 (1) Sounding Survey Result of water Depth at the Port of Alexandria

Rehabilitation Scheme of the Greater Alexandria Port by JICA

Second field survey works
Natural Condition Survey

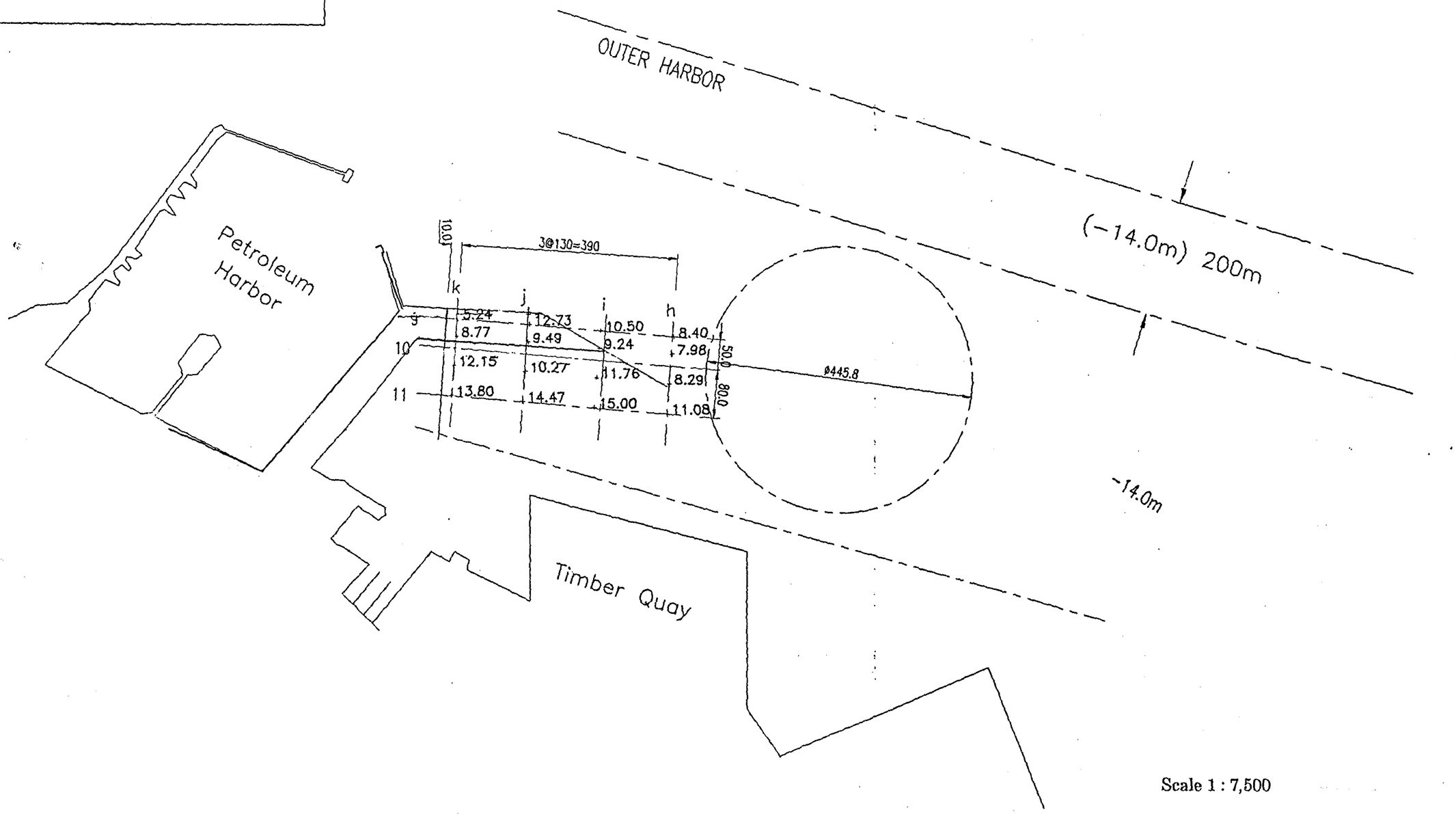


Fig. 2.7.3 (2) Sounding Survey Result of water Depth at the Port of Alexandria

Chapter 3 Environmental Condition in and around the Greater Alexandria Port

3.1 Overview of Environmental Condition

(1) General

The port city of Alexandria is well known for its more than 2000 years of rich history and culture. The city was one of the important ancient seat of learning of Greeks and Romans. Still it remains as a major cultural center of Middle East and also as a popular summer time beach recreation area due to its favorable Mediterranean climate and white sand beaches.

The city is basically boxed between the Mediterranean sea to the north and Lake Maryut to the south and extends as a narrow coastal strip along East-West direction. Its harbors, the Western Harbor and Dekheila Port of Alexandria Port Authority (APA), known as Greater Alexandria Port, for international trade, and the Eastern Fishing Harbor are integral parts of the landscape of the city.

(2) Population

The population of Alexandria is estimated at about 4 million permanent residents with a summer time floating population of more than 1 million, resulting in a total summer time population of more than 5 million (ref. Lake Maryut Capacity Building Report, December 1997). The population of Alexandria in the year 1996, as per the national census, was reported as about 3.3 million (ref. Statistical Year Book, June 1997).

(3) GDP

The total gross national domestic product (GDP) in the fiscal year 1996/1997 was estimated at 161.5 billion LE (Egyptian Pounds), at 1991-1992 price, with industrial and mining sector being the largest contributor (18%) (Central Bank of Egypt). Since no data on gross regional domestic product (GRDP) is available, the GDP contribution of the Alexandria Governorate is not known. Still Alexandria being the largest city next only to Cairo with port, tourism, industry and other activities, its GRDP would also rank second only to Cairo on a national basis.

(4) Historic and cultural assets

Despite its very old and rich history and culture of more than 2000 years, very few such assets remain intact at present in Alexandria. This is due to its turbulent history and also the new city being built over its past remains. No historical assets were reported to be found either in the Western harbour or Dekhela harbour waters, the present port area, though some historical remains were reclaimed from the Eastern (fishing) harbour waters. Known historical remains of the city like the Roman Theatre are located inland and being rehabilitated.

(5) Public health utility

Almost the whole population is served with piped water supply, which is managed by the Alexandria Water Supply Authority (AWSA). On the other hand, only about 2.5 million people or about 50 % of the population is connected to the city sewerage system, which is managed by the Alexandria General Organization for Sanitary Drainage (AGOSD). The city solid waste is independently managed by the 6 local administrative departments of the Governorate of Alexandria. The 6 local administrative departments are namely, from east to west, El Montazah Department, Eastern Department, Central Department, Western Department, El Gomorok Department and El Amreia Department.

The development and expansion of sewerage system for the city is still ongoing and funded with financial assistance from USAID (United States Agency for International Development) which is also assisting in the institutional improvement of AGOSD. The development of sewerage system has two (2) phases, of which the phase 1 has essentially been accomplished. Nevertheless, the sewer collection system expansion is still ongoing. The collected wastewater is conveyed to two independent treatment plants, one serving the eastern part of the city and called ETP (Eastern Treatment Plant) of capacity 410,000 m3/day, and the other the western part, WTP (Western Treatment Plant) of capacity 175,000 m3/day. Both these plants are located at south of the city in the vicinity of Lake Maryut and became operational since 1993 as the major components of the Phase 1 sewerage development, and provide primary treatment only, gravity sedimentation, with a treatment efficiency of about 35% (as BOD).

It is further noted that the WTP receives most of the industrial wastewater, since the western part of the city adjacent to the port area (in particular, the inland of western harbor) is the home of most industries in Alexandria.

The treated effluent of both of the treatment plants, still a major source of pollution due to its primary treatment level only, is disposed to Lake Maryut, that finally ends up in the port waters through internal canal and pump station (Max pump station near the entrance of Western Harbor).

3.2 Environmental Laws, Regulations and Standards

3.2.1 Environmental Laws and Regulations

(1) General laws and regulations

A comprehensive national environmental law including basic regulations known as Law for the Environment was enacted by Presidential Decree in 1994. This environmental law is also referred to as Law No. 4 for 1994 (Law No.4/1994) and its executive regulations. A detailed executive regulations for this Law No.4/1994 was promulgated by the Prime Ministers` Decree in 1995 (Prime Ministers` Decree No.338/1995). This Decree No.338/1995 incorporated some relevant environmental standards as dealt with in the subsequent section on Environmental Standards. It is further noted that the first basic environmental regulations and standards targeting the protection of River Nile and

other waterways, except that of coastal (sea) waters, from pollution was enacted in 1982 (Law No.48/1982). This law still remains effective since the Law No.4/1994 and the subsequent Decree No.338/1995 are intended at only supplementing this Law No.48/1982.

The Law No.4/1994 established clearly the basic frame for national environmental conservation and management for Egypt targeting all three (3) major environmental components of land, air and water. Moreover, this law (No.4/1994) established EEAA (Egyptian Environmental Affairs Agency) as the principal governmental authority for national environmental protection and management under the Prime Ministers` cabinet.
This law (No.4/1994) defines the basic responsibility of EEAA as follows;
The Agency (EEAA) shall formulate the general policy and prepare the necessary plans for the protection and promotion of environment. Also it shall follow-up the implementation of such plans in co-ordination with other administrative authorities.

Concerning the protection of water environment, since the port is principally a coastal water environment, its protection is delegated to a number of administrative agencies concerned including that of EEAA as per Item 38 of Article 1 under General Provisions of Chapter 1 of Law No.4/1994. The Port Authorities of Egypt, which would include APA as well, are also identified as competent agencies by the above Article 1. Accordingly this Article 1 grants the basic authority for the environmental protection of Alexandria Port to APA (Alexandria Port Authority).

Specific articles (Article 48 to 68) of the law (No.4/1994) concerned to the protection of marine environment including that of port waters are incorporated comprehensively under Chapter 1 on Pollution From Ships of Section 3 (Protection of the Water Environment form Pollution). In particular it is noted that Articles 49,66&67 prohibits indiscriminate disposal of any waste in the marine waters of Egypt by ships. Moreover the Articles 56&68 mandates all national ports to have the necessary ship related waste reception facilities for all types of wastes such as bilge waste, ballast waste and garbage.

(2) Environmental impact assessment (EIA) regulations

The Article 19 of Law No.4/1994 under Section 1 on the Protection of Land Environment stipulates the conduct of EIA by the competent authority or licensing authority concerned to the project development. Moreover the subsequent Article 20 mandates the submission of EIA reports to EEAA for evaluation. EEAA is given 60 days since the receipt of an EIA report to forward its evaluation results to the relevant authority.

The Executive Regulations of the Law No.4/1994, the Prime Ministers` Decree No.338/1995, further authorizes EEAA to decide the format and specification of EIA report (refer to Article 10 of Section 1). Moreover the Annex 2 of this Decree (No.338/1995) specifies the project activities subjected to EIA, which includes port development projects as well under the category of infrastructure projects.

3.2.2 Environmental Standards

The Executive Regulations of the Prime Ministers` Decree No.338/1995 stipulates various environmental standards in its annexes principally targeting air and noise pollution control, but still including standards limiting the quality of effluents disposed into coastal marine waters (Annex 1 on Limits and Specifications for Draining and Disposing of Certain Substances in the Marine Environment), the only available specific standards for marine waters. Standards of this Decree No.338/1995 is intended at supplementing those already stipulated by the Law No.48/1982 targeting River Nile and other waterways, but not coastal (sea) waters. It is noted that all the standards of Law No.48/1982 are also effluent water quality standards regulating the quality of effluents discharged to water bodies other than coastal waters.

Accordingly, the stream (environmental) water quality standards based on the intended use of a water body, including that of coastal waters for port use which is also much relevant to this port improvement master plan, is yet to be established. In this regard it is noted that the air quality standards as specified by the annexes of Decree No.338/1995 is very comprehensive since it covers a spectrum of air related environmental quality, ambient air (Annex 5), fugitive air emission (Annex 6) and as well indoor air (Annex 8).

3.3 Environmental Issues of the Port

3.3.1 Issues directly related to Port Operational Activities

The port waters is visibly polluted with floating oil and others including garbage. This clearly indicates a lack of commitment on the part of the Alexandria Port Authority (APA) in protecting the port water environment from pollution directly associated with port operation. The significant aspects concerned to port environmental management are summarized below.

(1) There is no responsible and authority yielding environmental section in the port organizational structure of the Alexandria Port Authority (APA). So pollution control due to ship berthing and other port related activities is not yet prioritized. At present port environmental affairs are simply assigned as an additional task of the Manager of Professional Health and Safety Unit, who is designated as the Manager of Professional Health and Safety and Environment Unit. Also Marine Services Unit is directly involved in the clean-up of harbor waters and has some related equipment and facilities.

(2) At present the port has no independent treatment facility either to treat the oil (bilge) waste or the ballast waste from the ships and oil tankers. However installation of a ballast waste treatment facility in the port is planned, but its installation is being delayed due to discrepancy in specification requirements.

(3) The Marine Services Unit has boats with oil skimmer which is used periodically to remove floating oil and other debris from the harbor waters, the capacity of which is inadequate to effectively remove the floating wastes. It is also noted that clean-up of harbor waters is not the major operational function of Marine Services Unit. Its major function is to provide various assistance to the ship calling in the port, such as to be a harbor master, provision of tug boats, floating crane and other services to ships for a fee as required.

(4) Concerning wastes from the general cargo ships, the ships by themselves, through their shipping agents, hire private contractors to haul their wastes. In such instances a private contractor uses barges and collects the wastes in drums and hauls it to land. Oil wastes from oil tankers are only accepted by the Alexandria Petroleum Company (APC) for regeneration (separation) of oil, since such oil wastes from oil tankers could be pumped directly via pipe lines only from the petroleum basin (oil berth) of the port to the APC. The other oil wastes collected by private contractors from general cargo ships are sold to furnace companies. Still the oil waste collected by the clean-up boats of the Marine Services Unit of APA is transported to the APC for the regeneration of the oil in line with a cooperative agreement between APA and APC. Garbage and other non-recyclable wastes are disposed at designated areas in desert. However, there are some private contractors who tend to dump the hauled wastes in the port waters, especially at night, which may be the case with some ships as well.

(5) As pointed out above the port waters is visibly polluted with floating oil and other debris indicating inadequate measures to protect port water environment from ship berthing activity by APA. Moreover, inefficient cargo handling and the resultant loss of product (cargo) during loading and unloading operation, in particular with respect to bulk and non-containerized cargo, is also considered as a significant source of pollution in port waters.

(6) It is emphasized that the **Law No. 4/1994** (refer to foregone section) for environment as per Article 49 of Section 3 (Protection of the water environment from pollution) forbids disposal of wastes by ships in marine waters of Egypt and also the subsequent Articles 56&68 mandates major ports of Egypt, which should include the Greater Alexandria Port as well being the largest national port, to have the required oil, ballast and other ship related waste reception facilities, including solid waste. In this regard, the APA is yet to comply with the Article 56 concerning bilge and ballast (oil) waste reception facility.

3.3.2 Issues concerned to Non-port related Activities

(1) Significant non-port pollution sources

The port water environment is very significantly affected by the discharge of polluted effluents of land based industrial, agricultural and domestic activity. The two polluted canals of Mahmoudeya and Nubariya discharge directly into the western harbor waters,

within the hub of port activity. The El Umum canal, which is integrated with the Lake Maryut since it is mostly submerged within the lake, serves as the conduit to pump the polluted wastewater of Lake Maryut near the entrance of the western harbor, into the Max Bay via the El Max Pump Station. There are also some untreated domestic sewage out-falls discharging directly or indirectly into the harbor waters.

The discharge of these three canals is determined respectively at 10,000 m3/day, 90,000 m3/day and 8,000,000 m3/day for Mahmoudeya, Nubariya and El Umum canals (ref. OCDI/MRCC seminar, 1997). Of these 3 canals, the Mahmoudeya canal is evaluated as the worst polluted simply from visual observation and the offensive odor. The average water quality of Nubariya canal and El Umum canal, which is also the quality of Lake Maryut since the drain is submerged within the lake, (at the Max pump station to sea near the entrance to the Alexandria port), based on one year monitoring data of 1994-1995 conducted by the Drainage Research Institute (ref. Final Report on Effluent Quality Reaching El Max Pumping Station, October 1995), was determined respectively at about 25 mg. BOD/l (70 mg. COD/l) and 50 mg. BOD/l (150 mg. COD/l), indicating that the El. Umum (also the Lake Maryut in El Max area) being more polluted than Nubariya canal.

As pointed out under the section 3.1 the sewage of Alexandria city is treated in two separate treatment plants of ETP (East Treatment Plant) and WTP (West Treatment Plant) to primary treatment level only. These primary treated effluents and other untreated domestic wastewater, untreated/inadequately treated industrial wastewater, agricultural run-off from the intensively farmed surrounding Nile delta area and others are identified as the prime sources of water quality deterioration of not only the above three canals but also the Lake Maryut.

In fact most wastewater of all origin including the primarily treated effluents of both the ETP (average capacity; 410,000 m3/day) and WTP (average capacity; 175,000 m3/day) essentially discharged initially into Lake Maryut and then enters into various canals including the El Umum and Nubariya, which are an integral part of the overall drainage system of Alexandria. A significant exception to this intricate Lake Maryut cum canal system is the Mahmoudeya canal which essentially carries independently domestic, industrial and other wastewater and hence not a beneficiary of the purification effect of Lake Maryut. This effect is represented by its low flow (10,000 m3/day) and high pollution indicated with the emanation of offensive odor at its final disposal location into the western harbor waters.

(2) Wastewater treatment system

As illustrated in the foregone sections, the wastewater generated in the Alexandria city is treated in the two treatment plants of ETP (East Treatment Plant) and WTP (West Treatment Plant), respectively for the eastern and western area of the city, since 1993. The treatment provided by both of these plants is primary sedimentation with conventional gravity settling only. These treatment plants and the associated common

sludge dewatering facility were provided as the major component of Phase-1 sewerage development plan by AGOSD with financial assistance from USAID.
Performance of both of these treatment plants were monitored for one year during 1994-1995 by the Drainage Research Institute (DRI) of the Water Research Center, Ministry of Public Works and Water Resources. This monitoring formed an integral part of a comprehensive monitoring program of waste sources entering the Lake Maryut, identified as the most polluted lake in Egypt, and hence the El Max pump station at the sea outlet of the Umum drain (ref. Final Report on Effluent Quality Reaching El Max Pumping Station, October, 1995).

Accordingly, the average and maximum treatment capacity of ETP is reported as 410,000 m3/day and 525,000 m3/day and that of WTP as 175,000 m3/day and 280,000 m3/day.

The average influent wastewater quality of ETP was about 170 mg. BOD/l (260 mg. COD/l) and that of primary treated effluent was about 100 mg. BOD/l (195 mg. COD/l), resulting in a BOD removal efficiency of about 40%. The corresponding average influent wastewater quality of WTP was about 175 mg. BOD/l (275 mg. COD/l) and that of primary treated effluent was about 100 mg. BOD/l (235 mg. COD/l), resulting in the same BOD removal efficiency of about 40% as ETP. The above BOD removal efficiency of both the plants are very satisfactory for a primary wastewater treatment plant.

Still the treated effluent quality of 100 mg. BOD/l is very unsatisfactory from the view point of water quality improvement of receiving water body, the Lake Maryut and finally the coastal waters of the Alexandria Port. It is also noted that the Phase 2 of the sewerage development plan is aimed at upgrading these two treatment plants so that the treated effluent could be reused for agriculture, which in combination with other pollution control measures including that of industrial pollution would be crucial for both the restoration of Lake Maryut and hence to limit the pollution load discharge into the coastal waters including the Alexandria port, thereby mitigating the port water pollution due to non-port related activities.

Moreover, form both the points of view of sanitation improvement and port water pollution mitigation, the people living along the port coastal areas need to be connected to the city sewerage system. It is understood that most people living along both the western harbor area and the Dekheila port area are not served by the present system and their wastewater is either directly or indirectly discharged into the port waters.

3.4. Field Survey for Environmental Condition

3.4.1 General

In order to define the baseline port environment as specifically as possible, the following 4 environmental field surveys were carried out in the Alexandria Port area. The field surveys were conducted two (2) times, during April-May, 1998 (first field survey) and October-November, 1998 (second field survey).

(1) Sea-water quality sampling survey within the port waters of western harbor and Dekheila port (the Greater Alexandria Port) at 5 locations but at two different depths at each location and at two times, once during the first field survey and the other during the second field survey.

(2) Seabed material sampling survey in the same Greater Alexandria Port at 10 locations with 5 locations being the same as above water quality sampling locations. The work was accomplished during the first field survey.

(3) Land utilization survey both within and around the vicinity of the entire Greater Alexandria Port area. The survey area was about 1500 ha outside the boundary of the port area and about 350 ha inside the port area. The work was conducted during the first field survey of April-May, 1998.

(4) Traffic condition survey within the port area including the major gates of the port (Alexandria and Dekheila ports) and the internal road network of the port. The survey was conducted during the first field survey at 30 selected stations for 2 days (48 hours) including the port gates.

3.4.2 Sea Water Quality Survey

Sampling of sea-water was conducted two times within the port waters of the Greater Alexandria Port at 5 locations but at two different depths of 1 and 5 meters at each location as shown in Figure 3.4.1. The first sampling was conducted in May 1998 during the first field survey and second sampling at the same locations in October 1998 during the second field survey.

The results of analysis for all the samples is summarized respectively in Table 3.4.1(1) and Table 3.4.1(2) for first sampling (May 1998) and second sampling (October 1998). The quality of the sea water samples was analyzed at the laboratory of National Research Center (NRC), Environmental Consultation and Water Quality Unit in Cairo. The reference for the laboratory analysis method was made to “the Standard Methods for the Examination of Water and Wastewater, 19th Edition 1995 APHA, AWWA, WEF”.

The analysis result of water quality clearly indicates highly polluted nature of the port waters. In particular high suspended solid level in the range of about 1000-4000 mg/l,

in fact mostly exceeding 2000 mg/l during first sampling was noted. Also high oil and grease level mostly exceeding 5mg/l, in fact mostly exceeding 10 mg/l during second sampling with the highest value even exceeding 80 mg/l was noted. These results clearly demonstrated the high pollution level of port waters in an overall sense. It is noted that high oil pollution level in the port waters could be attributed to indiscriminate and perhaps illegal disposal of oily waste (ballast and bilge waste) by ships and vessels into the port waters, and hence to improper operational and inadequate surveillance activity of the port authority (APA).

Moreover high metallic pollution level, in particular with respect to the heavy metal parameters of cadmium and chromium was also noted.

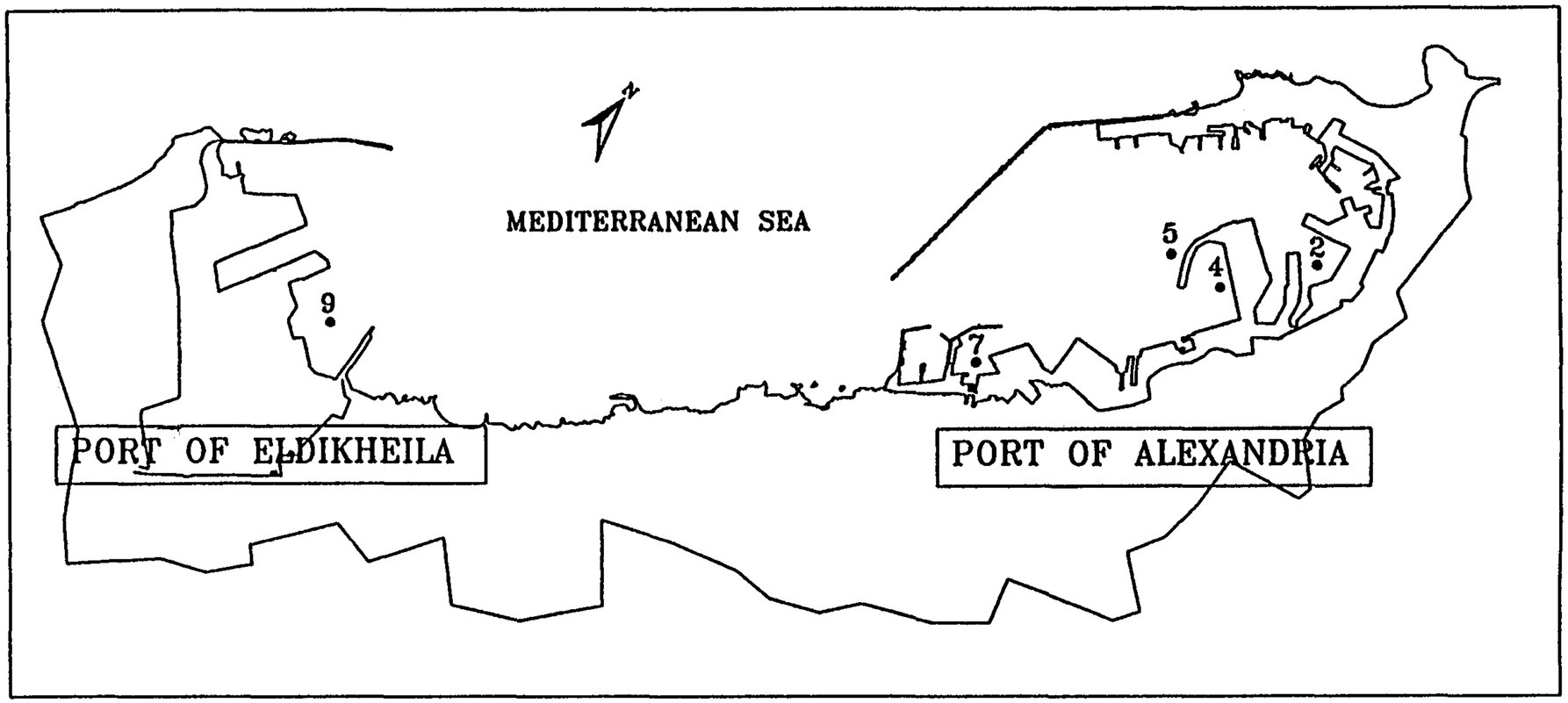


Figure 3.4.1 Locations of Sea Water Sampling

Table 3.4.1(1) Port Sea Water Sampling Results (First Sampling)

Parameter	Unit	No.2		No.4		No.5		No.7		No.9	
		1 m	5 m	1 m	5 m	1 m	5 m	1 m	5 m	1 m	5 m
Field Measurement											
Air Temperature	deg (C)	28	28	28	28	28	28	28	28	28	28
Water Temperature	deg (C)	23	26	23	26	23	26	23	26	22	25
Laboratory Analysis											
Color	Co-Pt	less than 5		less than 5		less than 5		less than 5		less than 5	
Odor	Unit	Faint Oily		Faint Oily		Faint Oily		Faint Oily		Faint Oily	
Transparency	cm	80	80	90	90	85	85	95	95	95	95
pH	-	7.8	7.6	7.9	7.5	7.8	7.4	7.7	7.5	8.1	8
Coliform Bacillus	MPN/100ml	1,600	1,200	140	120	26	26	220	200	8	8
Fecal Coliform Bacillus	MPN/100ml	350	300	50	40	26	26	17	17	8	8
Surfactant reacting Methylene Blue	mg/l	0.2	0.2	1.3	1	1.7	1.5	0.6	0.4	1.0	1.0
Oil and Grease	mg/l	15	5	17.8	8	6	6	5.8	5.8	10	7
Phenol	mg/l	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
DO	mgO2/l	10	9	10	9	11	9.5	9.5	8.5	9	8
Residual Tar	mg/l	1.8	1.8	0.4	0.4	1	1	0.8	0.8	0.6	0.6
Copper	mg/l	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Cadmium	mg/l	0.078	0.078	0.077	0.077	0.076	0.076	0.069	0.069	0.089	o.o89
Arsenic	mg/l	0.045	0.045	0.029	0.029	0.038	0.038	0.042	0.042	0.032	0.032
Chromium	mg/l	0.054	0.054	0.056	0.056	0.034	0.034	0.051	0.051	0.037	0.037
Lead	mg/l	0.708	0.708	0.719	0.719	0.642	0.642	0.614	0.614	0.730	0.730
Nickel	mg/l	0.499	0.499	0.503	0.503	0.486	0.486	0.414	0.414	0.571	0.571
Zinc	mg/l	0.01	0.01	0.007	0.007	0.008	0.008	0.150	0.15	0.013	0.013
Iron	mg/l	0.17	0.17	0.28	0.38	0.36	0.36	0.38	0.38	0.19	0.19
Mercury	mg/l	0.00066	0.00066	0.00091	0.00091	0.00085	0.00085	0.0011	0.0011	0.00099	0.00099
Manganese	mg/l	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Fluoride	mg/l	1.44	1.44	1.43	1.43	1.37	1.37	1.43	1.43	1.38	1.39
Others											
SS	mg/l	3,659	3,800	1,978	2,000	3,898	3,900	3,113	3,150	4,132	4,132

Table 3.4.1(2) Port Sea Water Sampling Results (Second Sampling)

Parameter	Unit	No.2		No.4		No.5		No.7		No.9	
		1 m	5 m	1 m	5 m	1 m	5 m	1 m	5 m	1 m	5 m
Field Measurement											
Air Temperature	deg (C)	28		28		28		28		28	
Water Temperature	deg (C)	24	26	24	26	24	25	24	25	24	26
Laboratory Analysis											
Color	Co-Pt	less than 5		less than 5		less than 5		less than 5		less than 5	
Odor	Unit	Faint Oily		Faint Oily		Faint Oily		Faint Oily		Faint Oily	
Transparency	m	1.5		3.25		2.8		2.0		0.5	
pH	-	7.79	7.6	7.97	7.87	8.05	7.95	7.99	7.80	8.00	7.80
Coliform Bacillus	MPN/100ml	23	20	0.00	0.00	0.00	0.00	23	23	23	22
Fecal Coliform Bacillus	MPN/100ml	13	11	0.00	0.00	0.00	0.00	2	2	2	2
Surfactant reacting Methylene Blue	mg/l	1.5	1.39	0.65	0.93	1.16	1.16	0.50	0.64	0.46	1.00
Oil and Grease	mg/l	33	13.2	44.2	20.2	9.4	12.8	13.0	19.4	84	12
Phenol	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DO	mgO_2/l	5.8	4.9	5.8	5.2	4.8	4.3	5.7	4.4	5.2	4.3
Residual Tar	mg/l	18.2	4.2	22.5	9.4	2.9	3.8	3.8	5.9	26.5	4.2
Copper	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.510	0.524
Cadmium	mg/l	0.185	0.190	0.183	0.188	0.182	0.186	0.179	0.182	0.104	0.109
Arsenic	mg/l	0.00081	0.00082	0.00071	0.00079	0.00095	0.00091	0.0009	0.00086	0.0012	0.0018
Chromium	mg/l	0.164	0.166	0.160	0.164	0.151	0.156	0.134	0.136	0.096	0.098
Lead	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel	mg/l	0.520	0.523	0.518	0.522	0.490	0.492	0.520	0.525	0.291	0.295
Zinc	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron	mg/l	0.03	0.05	0.03	0.04	0.08	0.06	0.09	0.10	0.09	0.04
Mercury	mg/l	0.0001	0.00013	0.00091	0.00018	0.0001	0.00012	0.000095	0.000098	0.0001	0.00011
Manganese	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluoride	mg/l	0.28	0.21	0.37	0.29	0.26	0.18	0.280	0.220	0.262	0.261
Others											
SS	mg/l	3,260	3,480	970	825	1,250	1,468	1,598	1,682	3,690	3,988

3.4.3 Seabed Material Quality Survey

Seabed material sampling survey was conducted simultaneously with sea water sampling in the same Greater Alexandria Port at 10 locations with 5 locations being the same as the above water quality sampling locations (for locations, refer to Figure 3.4.2). A composite sample, mixture of three (3) spot samples from one seabed surface layer, was collected for each location.

The results of the laboratory analysis for all 10 samples are summarized in Table 3.4.2. The sea bed material (sediment) quality was also analyzed at NRC laboratory in Cairo. The reference for the laboratory analysis method following the elution of constituents to be measured from the solid media to liquid (water) media was also made to "the Standard Methods for the Examination of Water and Wastewater, 19th Edition 1995 APHA, AWWA, WEF".

The analysis results indicate that the sea bed material in the entire port area is highly contaminated with heavy metals. In particular contamination level of copper (Cu) and cadmium (Cd) is very high as per the Dredged Materials Quality Standards of Netherlands (1987) as published in the World Bank Technical Paper Number 126 on Environmental Considerations for Port and Harbor Developments (1990). It is further noted that the eastern most inner port area of the Alexandria Port exhibited extremely high level of heavy metal contamination.

The measured ranges of copper (Cu) and cadmium (Cd) in all of the 10 sampling locations throughout the Greater Alexandria Port area were, respectively, 167-1313 mg/l and 12-54 mg/l. Both of these exceeded the permissible limit for unconstrained open water disposal of dredged material of 90 mg/l for Cu and 7.5 mg/l for Cd, designated as the Testing Values, as per the above Netherlands Standards. Accordingly at-least the top layer of the dredged material derived from the port consequent to the implementation of this master plan is contaminated with high heavy metal content and hence would require controlled disposal.

It is evident from the above that the determination of the vertical depth profile variation in the subsoil seabed material contamination level in an area designated for dredging is required for the formulation of cost effective dredged material management plan. This would lead to delineate the potentially contaminated top layer of seabed from that of uncontaminated bottom layer, there-by limiting the quantity of contaminated dredged material requiring controlled disposal (in other words dredged material not suited for open sea disposal).

Accordingly, vertical depth profile variation of contamination level in those areas designated for dredging in the port seabed as per the short term development plan of this master plan was conducted as supplemental environmental survey and illustrated in the subsequent section 3.5.

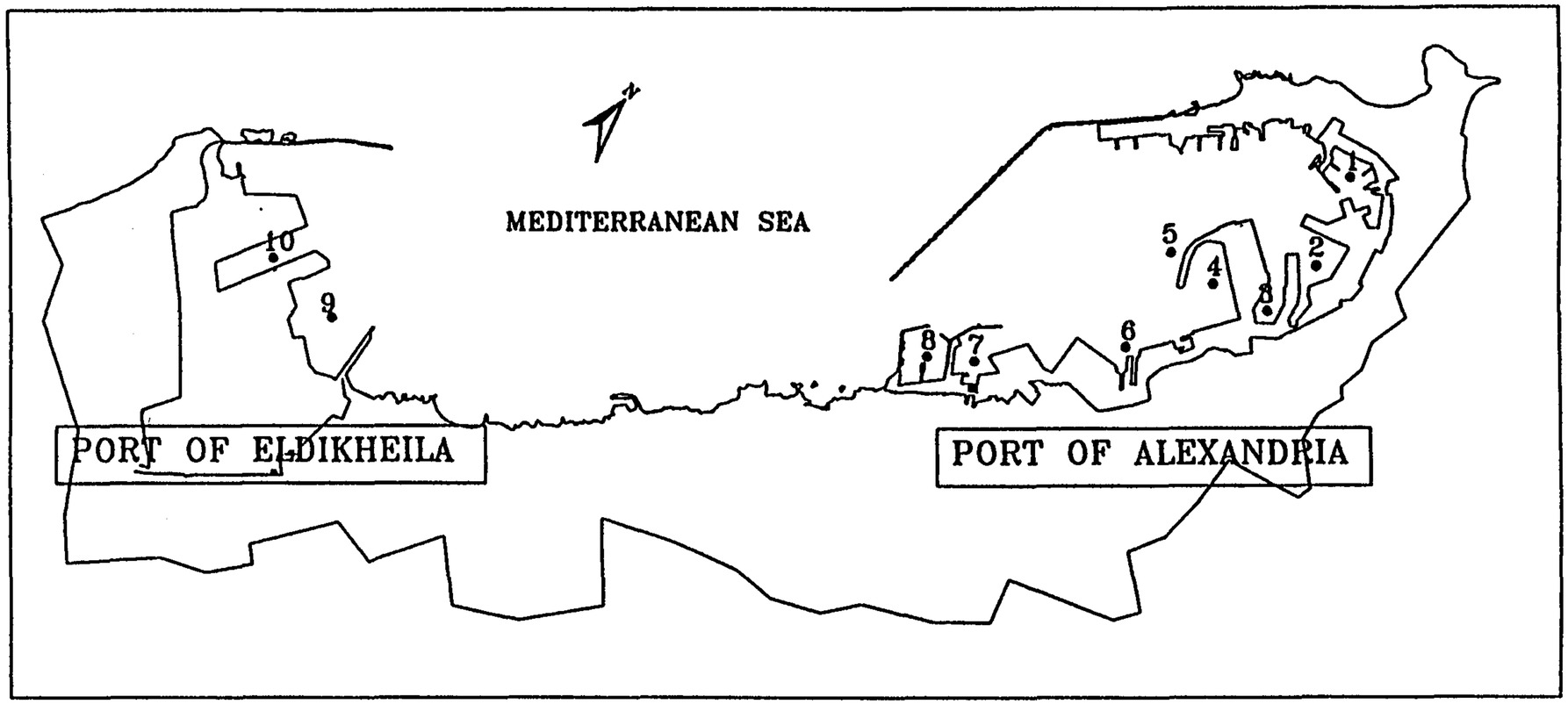


Figure 3.4.2 Locations of Seabed Material Sampling

Table 3.4.2 Port Seabed Material Sampling Results

Parameter	Unit	Sampling Location									
		No.1	**No.2**	**No.3**	**No.4**	**No.5**	**No.6**	**No.7**	**No.8**	**No.9**	**No.10**
Laboratory Tests											
Water Content	%	29.7	73.8	51.5	42.3	42.1	27.0	35.5	35.0	41.5	43.4
Ignition Loss	%	74	78.5	78.6	66.5	82	74	69.5	75.4	84.3	84.8
COD	gO2/kg	224	138	116	221.3	130	216.3	220	120	56	66
Ammonia	mg/kg	92.4	77.0	100.1	61.6	77	69.3	77	92.4	77	77
Cynaide	mg/kg	0.028	0.055	0.053	0.044	0.038	0.039	0.041	0.036	0.029	0.034
Sulfide	mg/kg	114	295.3	136.5	283.7	74.2	100	169	84.6	119.5	122.8
Nitrogen	mg/kg	4,300	1,100	2,100	3,200	2,600	3,100	3,700	2,900	2,600	2,300
Phosphorus	mg/kg	7.5	1.5	3.0	5.0	1.6	3.0	20.6	6.3	5.6	4.4
Copper	mg/kg	1,313	1,280	855	341	167	216	329	265	240	246
Cadmium	mg/kg	15.7	54	49	42	39	22	12	22	20	28
Arsenic	mg/kg	1.52	1.56	2.16	1.8	2.44	0.039	0.041	2.64	0.029	2.52
Chromium	mg/kg	283	283	390	256	312	296.6	257	349	246	254
Lead	mg/kg	688.6	512	450	360	320	154.2	432	232	43	52
Nickel	mg/kg	83.4	94	112	140	120	163.2	143	37	53	64
Zinc	mg/kg	1,115.7	750	663	500	462	275.8	336	154	169	283
Iron	g/kg	3.35	2.4	3.8	5.3	1.3	1.2	2.3	2.3	1.8	2.2
Mercury	μg/kg	1.3	1.1	0.9	1.1	1.3	1.2	0.8	1.3	1.3	1.3
Manganese	mg/kg	885	750	845	650	490	320	300	280	180	205

3.4.4 Land Utilization Survey

This survey has much related to the topographic survey conducted as natural condition survey. The survey includes rough field investigation to identify land utilization and road/railway alignment in the city area behind the Greater Alexandria Port together with detailed investigation of land use inside the port.

The field investigations inside the port and outside the port area were conducted in May 1998. The survey is divided into the following two parts:

- Empirical part depending on field survey, which was carried out by means of visual reconnaissance survey and supplemental distance survey
- Theoretical part aimed at clarifying the land use ratio

(1) Land Use Mode both inside and outside the Port

The Figure 3.4.3 shows a map indicating the result of the survey on the land utilization both inside the Greater Alexandria Port and the vicinity city area behind the port. The Figure indicates the land use mode of the survey area both at inside and outside the port area. The approximate ratios of classified land utilization are summarized as follows:

- Port and Harbor 9.1 %
- Storage 2.5 %
- Residential Area 40 %
- Industrial Area 32 %
- Commercial Area 5.1 %
- Recreations 4.1 %
- Health 1.2 %
- Educational Area 1.3 %
- Mosques, Churches, Cemeteries 0.5 %
- Services 1.5 %
- Army Camps 3.0%

(2) Land Use inside Port

The Greater Alexandria Port is roughly estimated to cover the following area, in which the utilization of land area is classified as shown below in Table 3.4.3. Industrial Area is defined as the zone(s) which occupied by companies work in such field of industry as arsenal company, cement company, Alex Container company, etc. The warehouse classification in Alexandria port indicates the land area used for cargo storage including such open air storage area surrounded by boundaries as container storage behind the timber quay and at the El Mahmoudiya quay.

Table 3.4.3 Land Use inside the Port Area

		Alexandria Port	Dekheila Port
Total Area	ha	960 approx.	325 approx.
Port Land Area	ha	110 approx.	275 approx.
Length of the Port	km	4.8 approx.	2.25 approx.
Width of the Port	km	2.0 approx.	0.75 approx.
Land Use Mode			
Industrial	ha (% of land area)	55.2 (50.0)	29.0 (10.5)
Workshop	ha (% of land area)	1.7 (1.6)	-----
Warehouse	ha (% of land area)	12.2 (11.0)	0.3 (0.1)
Administration	ha (% of land area)	5.1 (4.6)	0.5 (0.2)
Silo	ha (% of land area)	1.5 (1.3)	5.4 (2.0)
Security	ha (% of land area)	1.4 (1.3)	0.5 (0.2)
Others	ha (% of land area)	33.0 (30.0)	239.3 (87.0)

(3) Zones and Characteristics of Land behind the Port

The vicinity city area behind the ports is divided into eight (8) main regional zones and the land use modes thereof are classified as shown in Table 3.4.4. The role for industrial development is presented in the area behind the ports. Such major companies as Dekheila Iron and Steel Complex, Alexandria GAS Company, and other small size enterprises are established behind the ports. These port related companies have generated either directly or indirectly relationship with the port. At present, the Alexandria Government has to take into consideration of the environmental aspects for urban development as well as those inside the port area.

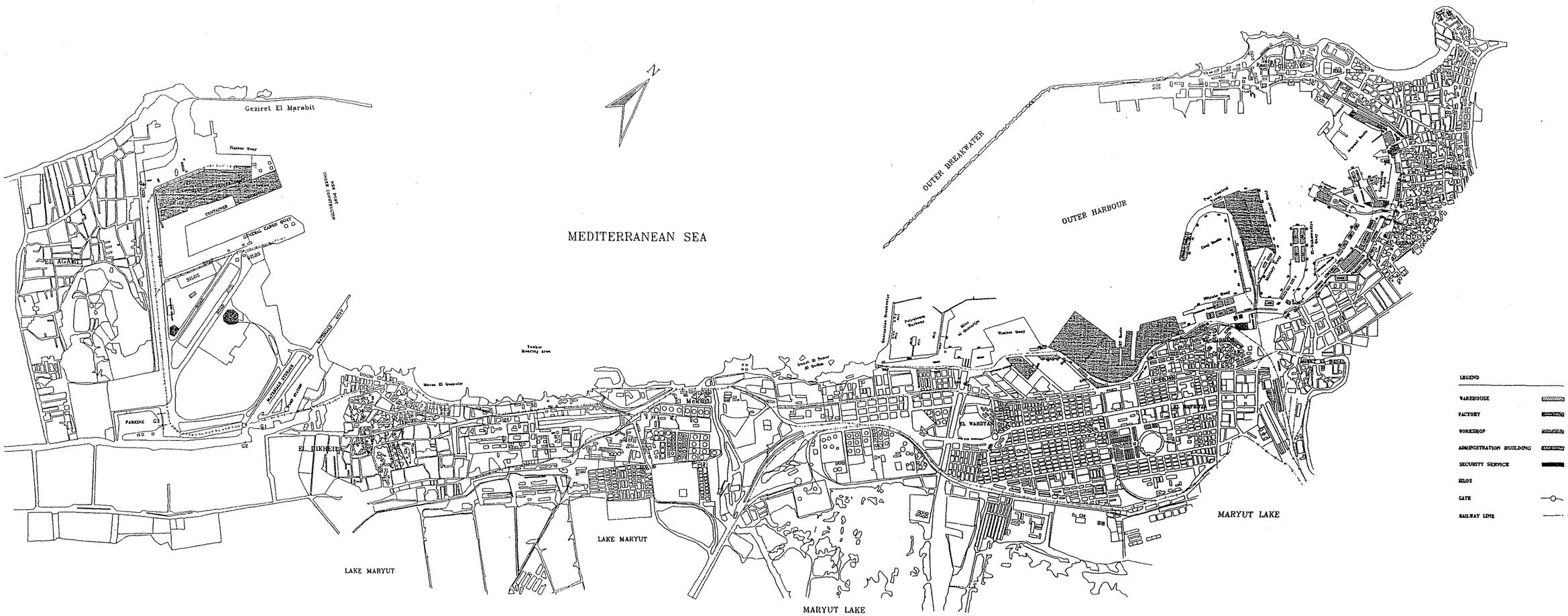


Figure 3.19 Land Use Map of the Greater Alexandria Port

Table 3.4.4 Land-use Outside the Port Area

Land Use	Zone							
	El Anfoushi & Rass El Tin	**El Gomrok**	**Mina El Basal**	**El Kabary & El Mafrowza**	**El Wardian**	**El Max Area**	**El Dekheila**	**El Agamy (El Betash & Shahr Assal)**
Major Land Use	Rass El Tin Palace & Residential Area	Residential Area	Industrial & Residential	Industrial Area	Industrial & Residential Area	Industial Area	Industrial & Residential Area	Residential Area
Land Use Classification (Ratio by % against Zone Area)								
1. Residential Area	74.5	90.0	35.0	10.0	46.0	4.0	15.0	85.0
2. Commercial Area	5.0	8.0	2.0	1.0	3.0		1.5	5.0
3. Industrial Area			37.0	84.5	44.0	95.0	75.0	
4. Port related Activities				1.5	1.0		2.0	
5. Services	0.5	0.5	6.0					
6. Health	2.0			0.5				
7. Educational Area	1.5	1.0		0.5	1.5	1.0		3.5
8. Recreation Area	1.0			0.5				5.0
9. Mosques, Churches and Cemeteries	0.5	0.5			0.5		3.0	1.5
10.Army Camp				1.5	4.0		3.5	
11.Railway Workshop			20.0					
12.Rass El Tin Palace	15.0							

3.4.5 Road Traffic Survey inside the Port

A field road traffic survey was conducted only within the port area for 48 hours continuously during 25 and 26 of May, 1998, staring from 6AM on Monday the 25th and finishing at 6AM on Wednesday the 27th and the number of classified type of vehicles were counted in terms of In/Out or Right/Left traffic of each survey station.

The traffic sampling stations are 27 in Alexandria port and 3 in Dekheila port. The 27 stations of Alexandria port comprised of all 15 normal functional gates of the port and 12 stations located within the internal road network of the port. The 3 Dekheila port locations are the 2 major functional gates of the port and the internal gate to the container terminal of the port.

For those port gates not operated for 24 hours continuously, the traffic count survey times were restricted to the actual operational times of gates.

The survey locations inside the port are shown in Figure 3.4.4. A summary of the gross traffic flow registered through each of the 17 gates (15 gates of Alexandria port and 2 gates of Dekheila port) during the 2 consecutive days (48 hours) of the survey is shown in Table 3.4.5. It is evident from Table 3.4.5 that Gate 14 registered the highest traffic volume (count) of 7966 which is almost twice that registered at Gate 10 (4190) that ranked second. It is also noted that both these gates are 24 hour operational. Of the seven (7) 24 hour operational gates of Gate 3(a), 3(b), 10, 14, 20, 27 and 54, the only gate that registered low traffic count of less than 3000 is Gate 27 (2484). It is also noted that the traffic counts through. Gate 9 and Gate 11, gates not operated for 24 hours, well exceeded 3000 mark with 3888 and 3842, respectively.

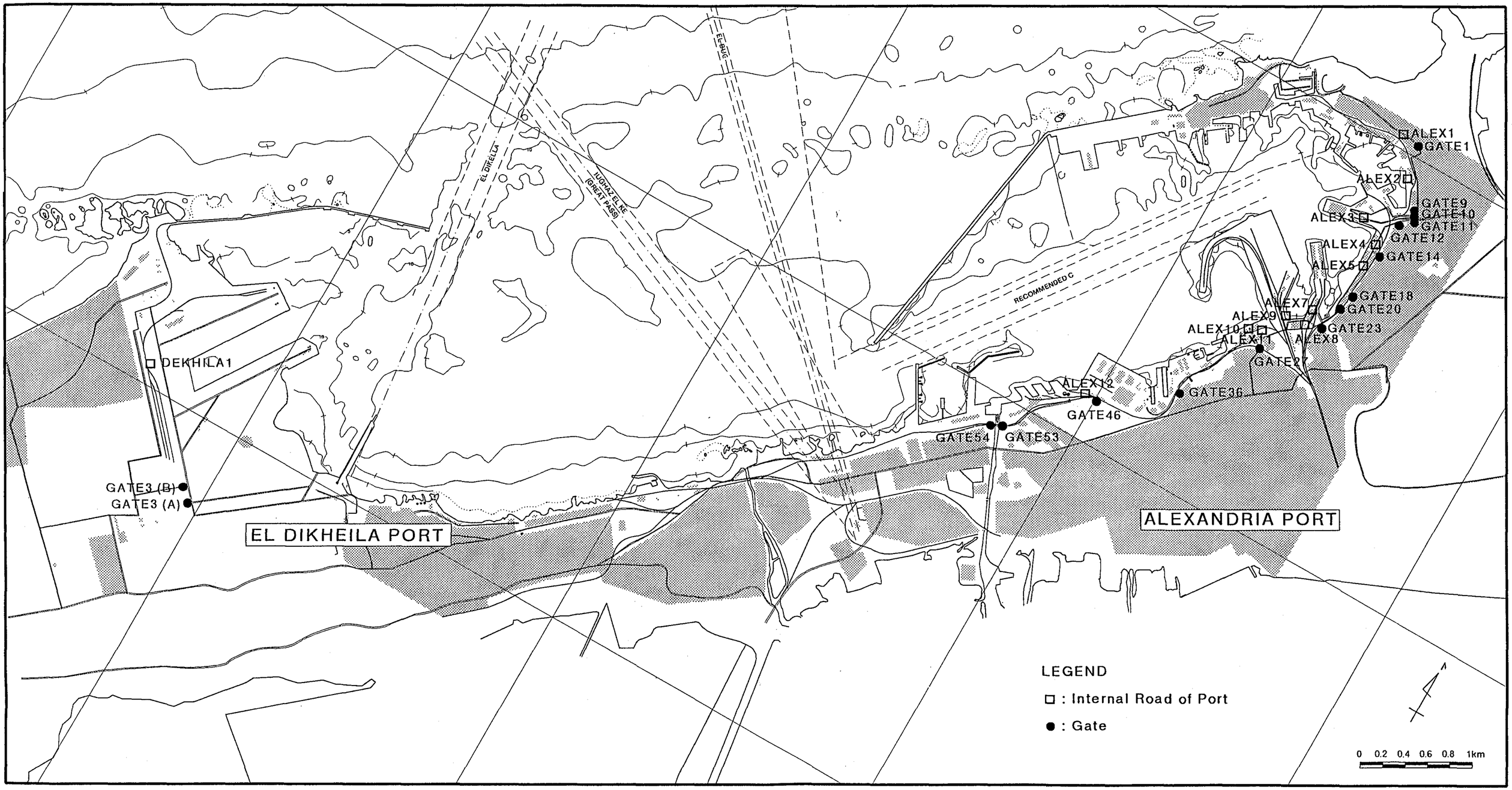


Figure 3.4.4 Survey Stations of Traffic Survey

Table 3.4.5 Gross Traffic Flow Through Port Gates for 2 Consecutive Days

POINT	VEHICLE TYPE								TOTAL
	TRAILER	TRUCK	SEMI TRUCK	CAR	TAXI	BUS	MINI-BUS	OTHERS	
GATE.1	0	40	682	1771	16	91	165	70	2835
GATE.3(a)	1185	549	216	495	1248	89	101	97	3980
GATE.3(b)	1014	370	249	515	1061	70	86	67	3432
GATE.9	469	329	584	1333	55	279	379	460	3888
GATE.10	0	23	444	1426	1640	346	175	136	4190
GATE.11	13	0	470	2020	15	653	355	316	3842
GATE.12	5	87	214	589	29	308	181	223	1636
GATE.14	1522	1205	1011	1345	952	785	557	589	7966
GATE.18	6	17	73	456	18	61	19	74	724
GATE.20	777	827	457	614	39	149	134	253	3250
GATE.22	499	226	21	87	0	12	2	35	882
GATE.23	515	168	165	105	1	23	12	46	1035
GATE.27	806	889	334	139	1	52	53	210	2484
GATE.36	430	241	139	482	7	97	89	56	1541
GATE.46	251	262	86	327	49	85	29	228	1317
GATE.53	90	65	238	1467	82	55	138	118	2253
GATE.54	1654	527	228	914	91	114	58	102	3688
TOTAL	9236	5825	5611	14085	5304	3269	2533	3080	48943

Note: Gate 3(a) and 3(b) are in Dekheila Port
All other gates are in Alexandria Port

3.5 Supplemental Environment Survey

3.5.1 Introduction

The objective of the supplemental environment survey was to determine the vertical depth profile variation in the heavy metal contamination level of the port seabed area targeted for deepening with dredging as per the short-term port development plan until the year 2007. It is noted that high heavy metal contamination level, in particular with respect to the metallic elements of cadmium (Cd) and copper (Cu), were measured in the surface layers of the seabed material throughout the Greater Alexandria Port area as per the sampling and analysis results of first field survey conducted in April-May 1998 (refer to foregone section 3.4.3 for details).

The target areas for this continuous seabed material boring followed with all-core sampling and subsequent analysis of bored seabed (soil) material quality are two (2) areas, the coal basin area and its vicinity and the area near the petroleum basin of the Alexandria Port. These are the off-shore areas planned for port deepening (dredging) by the short-term port development plan, until the year 2007, in the Alexandria Port (ref. Fig.3.5.1). The short-term port development plan is dealt with in Chapter 20 under Part IV of this report.

The determination of vertical depth profile variation of soil contamination of seabed is intended at delineating the potentially contaminated top layer of seabed from that of the rest of uncontaminated bottom layer, there-by limiting the quantity of contaminated dredged material requiring controlled disposal. This in effect would assist in economical management of the dredged material derived consequent to the planned seabed material dredging in the port.

3.5.2 Sampling and Analysis of Seabed Material

(1) General

The work included sampling by means of continuous soil boring using triple tube (Mazier) sampler to obtain all-core samples and subsequent laboratory analysis, including preservation of soil core (seabed material) samples and their transportation to the NRC (National Research Centre) laboratory in Cairo. The total number of soil all-core (seabed material) sampling locations were three (3), two (2) being located at the coal basin area and its vicinity and remaining one (1) being located near the petroleum basin of the Alexandria Port. The three (3) seabed material sampling locations are shown in Fig.3.5.1. The depth of all-core sampling for all three (3) locations was so as to obtain a minimum of 3.2m length of all-core soil samples. The sampling and analysis work was conducted in May 1999.

(2) Seabed material (soil all-core) sampling

Samples for laboratory analysis of soil contamination level were extracted at the following vertical depth profile length for each of the 3 seabed material samples of 3.2m length in order to determine the vertical depth profile variation in seabed material contamination level. The initial layer just below the surface, the layer at 0.5m depth, the layer at 1.0m depth, the layer

at 2.0m depth and the final layer at 3.0m depth. Accordingly, 5 vertical soil profile samples were extracted for each of the three (3) soil all-core (seabed material) resulting in a total of 15 samples for analysis.

(3) Parameters of analysis

The parameters of analysis of soil property and contaminant level for all fifteen (15) soil (seabed material) samples were as follows;
Water content, Ignition loss, Cyanide, and the 8 heavy metals of Cr (total chromium), Ni (nickel), Cu (copper), Zn (zinc), Cd (cadmium), Hg (total mercury), Pb (lead) and As (arsenic). These 8 heavy metal parameters are the principal constituents in determining the vertical depth profile variation in the seabed material contamination level. The laboratory analysis in the NRC Laboratory in Cairo was conducted conforming to the "Standard Methods for the Examination of Water and Wastewater, 19th Edition 1995 APHA, AWWA, WEF".

3.5.3 Results and Evaluation

The analysis results of vertical depth profile variation in seabed material quality up to 3m depth for all three (3) seabed sampling locations are summarized in Table 3.5.1. The results clearly indicated overall decrease in heavy metal content with increasing depth of seabed soil-core sample. The analysis results of Table 3.5.1 were evaluated for potential heavy metal contamination level and its vertical profile (depth-wise) variation using the Dredged Material Quality Standards of Netherlands (1987), also referred to in the forgone section 3.4.3.

The results of evaluation in depth-wise variation in seabed material contamination level with respect to each of the 8 heavy metal constituents for all 3 sampling locations are summarized in Table 3.5.2. It is noted that for the purpose of this evaluation the entire seabed area spanning all the three sampling locations is treated as one single entity in consideration to the proximity of the areas planned for deepening with dredging.
The definition of the 3 limits of heavy metal contamination level, namely, Reference Value, Testing Value and Signalling Value, as per the Netherlands Standards shown in Table 3.5.2 is as follows;

- **Reference Value** is the limit of metal content at which the dredged material could be classified as unpolluted (natural background level) and hence dredged material is amenable for any beneficial use and hence to unrestricted disposal as well. This state is referred to also as "no contamination" in Table 3.5.2.

- **Testing Value** is the allowable (permissible) limit in metal contamination level for open water disposal of dredged material, including that of unconstrained deep-sea disposal. Accordingly up to the Testing Value, heavy metal contamination level of dredged material could be considered as moderate. This state is referred to as "allowable contamination" in Table 3.5.2. Dredged material having any heavy metal constituent exceeding the Testing Value is subjected to controlled disposal with appropriate follow-up monitoring. Accordingly the state of a heavy metal constituent exceeding the Testing

Value is referred to as “unallowable contamination” in Table 3.5.2.

- **Signalling Value** indicates highly contaminated nature of the dredged material and has no further significance concerned to the disposal means of the contaminated dredged material beyond that specified by the Testing Value of above. It is noted that all the sampling results of Table 3.5.2 indicated heavy metal contamination level well within the Signalling Value.

As evident from Table 3.5.2 no contamination level at any depth was noted with respect to the heavy metal constituents of Arsenic (As), Nickel (Ni) and Zinc (Zn), and hence representing natural background level. On the other hand the maximum depth of unallowable contamination exceeding the Testing Value was determined as one (1) m for the heavy metal constituent of Copper (Cu) since a value of 209 mg/kg exceeding the Testing Value of 90 mg/kg was measured even at 0.5 m depth. Similarly the maximum depth of unallowable contamination with respect to Mercury (Hg) was determined as 0.5 m. The contamination level with respect to all the remaining heavy metals of Cadmium (Cd), Chromium (Cr) and Lead (Pb) fell within the allowable level and hence not exceeded the “Testing Value”.

Based on the above aspects it is concluded that dredged material derived from a depth up to one (1) meter in the objective deepening area of the port as per the short-term port development plan shall be considered as contaminated and hence not amenable for unconstrained deep sea disposal. This 1m top layer of the seabed material requires a minimum of controlled disposal in a designated/confined area as appropriate. It is further noted that this conclusion is basically based on the unallowably high contamination level with respect to the heavy metallic element of copper (Cu) in the seabed.

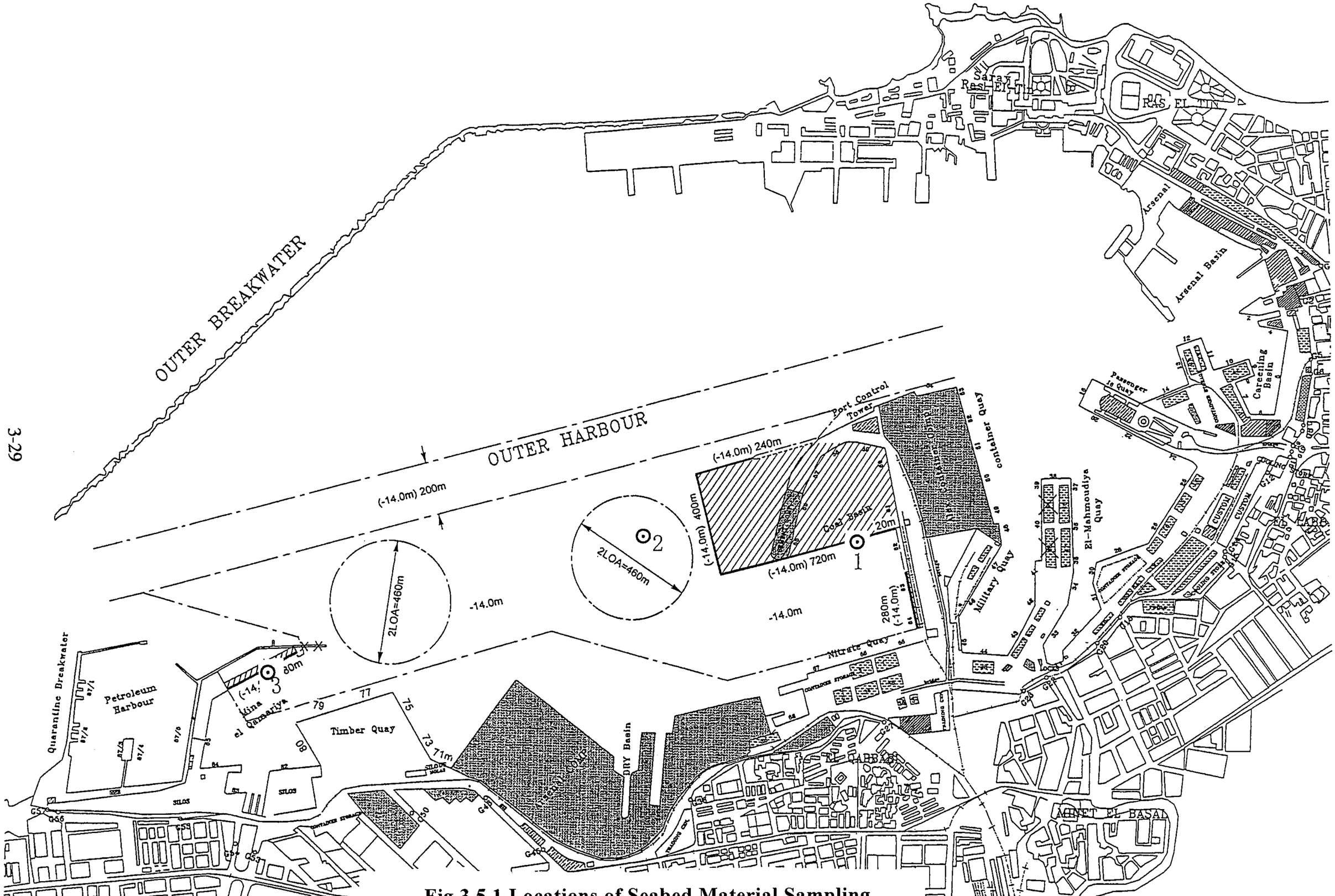


Fig.3.5.1 Locations of Seabed Material Sampling

Table 3.5.1 Port Seabed Material Sampling Results-Depthwise Variation

Parameter	Unit	Sampling Location														
		No-1					No-2					No-3				
		0.0m	0.5m	1.0m	2.0m	3.0m	0.0m	0.5m	1.0m	2.0m	3.0m	0.0m	0.5m	1.0m	2.0m	3.0m
Water Content	%	51.6	23.6	33.9	32.0	47.8	19.5	17.4	20.3	22.6	19.3	33.7	50.5	49.2	35.6	42.5
Ignition Loss	%	12.7	4.9	4.4	4.5	12.7	5.2	4.6	3.4	2.5	2.0	12.8	12.2	11.7	4.8	6.9
Cyanide	mg/kg	4.0	6.2	5.05	2.1	4.0	8.66	8.5	8.75	42.7	4.65	1.0	1.75	2.1	3.33	1.35
Copper	mg/kg	183	54.9	17.1	76.4	23.9	55.8	209	47.1	23.9	2.2	93.6	24.7	32.4	15.6	10.8
Cadmium	mg/kg	1.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	mg/kg	13.4	8.95	4.18	11.6	3.15	20.9	6.81	6.81	4.98	1.53	6.44	3.93	6.57	4.48	1.07
Chromium	mg/kg	65.3	20.5	14.7	27.0	26.5	54.7	37.8	15.7	17.7	5.24	164	22.1	31.2	10.3	23.7
Lead	mg/kg	483	134	49.2	148	119	45.6	80.9	80.9	59.9	0.7	242	59.9	180	26.8	0.68
Nickel	mg/kg	14.6	6.0	5.98	4.0	11.6	18.6	4.0	6.33	3.0	0.65	21.7	15.0	17.4	4.41	12.2
Zinc	mg/kg	125	90.8	47.7	110	53.3	67.1	105	76.1	63.1	5.9	98.6	57.7	52.9	16.6	20.9
Mercury	mg/kg	1.4	0.7	0.2	0.44	0.55	0.17	0.27	0.27	0.39	0.05	2.42	0.6	0.46	0.09	0.05

Table 3.5.2 Evaluation of Depthwise Variation in Seabed Material Quality

Parameter	Unit	Standards of Netherlands			Measured Range at Various Depths in all 3 Locations					Remarks
		Reference Value	Testing Value	Signalling Value	0m	0.5m	1.0m	2.0m	3.0m	
Copper	mg/kg	36	90	400	55.8～183	24.7～209	17.1～47.1	15.6～76.4	2.2～23.9	Maximum depth of unallowable contamination - 1.0m
Cadmium	mg/kg	0.8	7.5	30	< 0.2～1.8	< 0.2	< 0.2	< 0.2	< 0.2	Allowable contamination
Arsenic	mg/kg	29	85	150	6.4～20.9	3.9～9.0	4.2～6.8	4.5～11.6	1.1～3.2	No contamination
Chromium	mg/kg	100	480	1000	54.7～164	20.5～37.8	14.7～31.2	10.3～27.0	5.2～26.5	Allowable contamination
Lead	mg/kg	85	530	1000	45.6～483	59.9～134	49.2～180	26.8～148	0.7～119	Allowable contamination
Nickel	mg/kg	35	45	200	14.6～21.7	4.0～15.0	6.0～17.4	3.0～4.4	0.7～12.2	No contamination
Zinc	mg/kg	140.0	1000	2500	67.1～125	57.7～105	47.7～76.1	16.6～110	5.9～53.3	No contamination
Mercury	mg/kg	0.3	1.6	15	0.2～2.4	0.3～0.7	0.2～0.5	0.1～0.4	0.1～0.6	Maximum depth of unallowable contamination - 0.5m

Note : Reference value - natural background level
Testing value - allowable contamination limit for open water disposal
Signalling value - high heavy metal contamination

Chapter 4 Port Facilities of the Greater Alexandria Port

4.1 General

The Greater Alexandria Port of interest for this study includes the port areas of Alexandria and Dikheila districts and is located on the Mediterranean coast near the western part of the Nile River Delta. The port is naturally sheltered by a line of shoals and rocky points. Particularly, in the past development of the port expansion, the port area is well protected by a succession of man-made breakwater running roughly parallel to the shoreline to the west in Alexandria port district form Ras-El Tin peak and to the east in Dikheila port district from Tabiyet El Arassiya.

The port of Alexandria has long historical development over thousand years. Homer provides in his "Odyssey Song IV" the most ancient description about Pharous, an isolated island facing to the northern Egyptian coast which comprising a good natural harbor used as refuge for vessels. It is Ras El Tin region at present.

Mohamed Ali (1811-1849) was the new creator of modern Alexandria port, establishing Ros-El Tin Palace at Phares and supervised the port extension project for Alex yard. After he connected the port of Alexandria directly to the interior of Egypt by the excavation of the Mahoudia Canal, Alexandria port became the main harbor in Egypt as a gate port to the Mediterranean.

The long history of construction of the port of Alexandria is mainly divided into four phases: (extraction from "LE PORT D'ALEXANDRIE" by B. Malaval, chief engineer of ports & Lighthouses and G. Jondet, assistant chief engineer of ports & Lighthouses, Cairo-1912)

Phase I (1830-1870): The main projects in this phase consist of the construction of two arsenal jetties and basin including dry dock and floating dock.

Phase II (1870-1880): This phase provides the main breakwater (1870-1874) of 2,340 meters total length together with 2 branches to form navigational opening of 400 meters wide and the execution of interior quay walls.

Phase III (1890-1903): The execution of the Begaz Approach Pass of 1,600 meter length, 91 m width and 9.25 m depth. The Ras El Tin light house and quay nos. 15-16 of 240 m length, 25 m wide and 8 m water depth by adopting floating pontoon were executed. In addition, the construction of Gabbary quays (nos. 65-67) was initiated.

Phase IV (1904-1910): The extension and widening of coal mole was executed. Besides, the

construction of timber mole (nos.71-81), quarantine jetties, the widening of quay wall E (41-42) were carried out. At the end of this phase, a number of warehouses and hangars were completed.

The present existing port facilities of Alexandria port district are divided into two major parts as follows:

Interior Port: The area extending from the coal mole to the north-east of the port is the port area developed over many years and locate the nearest to the city. It contains the most of main offices and authorities buildings. The water area of this district is only 188 ha.

Exterior Port: The area extending from the coal mole to the southwest of the port is the newly developed district. This district comprises quay walls (nos.55-62), Gabbary quays with shallow depth (nos.64-68), timber quays and quarantine basin.

The port of Alexandria is divided into six custom zones for supervising and facilitating custom procedure under the Resolution No. 615/1979 for rules and Regulations. But the following six different zonings are organized and referred to this study to have better understanding the present conditions of port facilities and cargo handling activities as shown in Figure 4.1.1. A main inner port road links these six different zones of port. Among others, the service zone is utilized by the Alexandria ship repair company, the Egyptian Navy and the Alexandria Port Authority to accommodate service boats including floating crane and small vessels for repair and maintenance at berths nos.1 to 4.

-**Service Port Zone** (Berths nos. 1-4)
-**East Port Zone** (Berths nos. 5-17 and Gates nos. 3-9)
-**Middle East Zone** (Berths nos. 18-47 and Gates nos. 11-23)
-**Center Zone** (Berths nos. 48-68 and Gates nos. 24-36)
-**West Zone** (Berths nos. 69-85 and Gates nos. 46-53)
-**Oil Terminal Zone** (Berths nos. from 87-1 to 87-5 and Gates nos. 54-57)

In order to cope with the needs for upgrading the port services of Alexandria port, an economic study was carried out in 1980 for possible establishment of new port at El Dikheila. The study made it clear to be economically and financially feasible to newly develop the expansion of Alexandria port facilities at El Dikheila and the project of new port expansion at Dikheila was initiated its construction in 1982 by two phases of construction scheme.

The 1st phase construction was scheduled to implement from 1994 to 1999 for constructing raw

material berth (No. 1 pier), container berth and general cargo berth. Although the succeeding 2nd phase construction was included the second raw material berth (No.2), dangerous cargo berth and chemical berth, its implementation is being under suspension at present. Nevertheless, the Dikheila port now provides 2,210 meters total length of berths having 12 to 20 meters water depths which is capable of larger size of such vessels as 160,000DWT bulk carrier or Post-Panamax type container carrier.

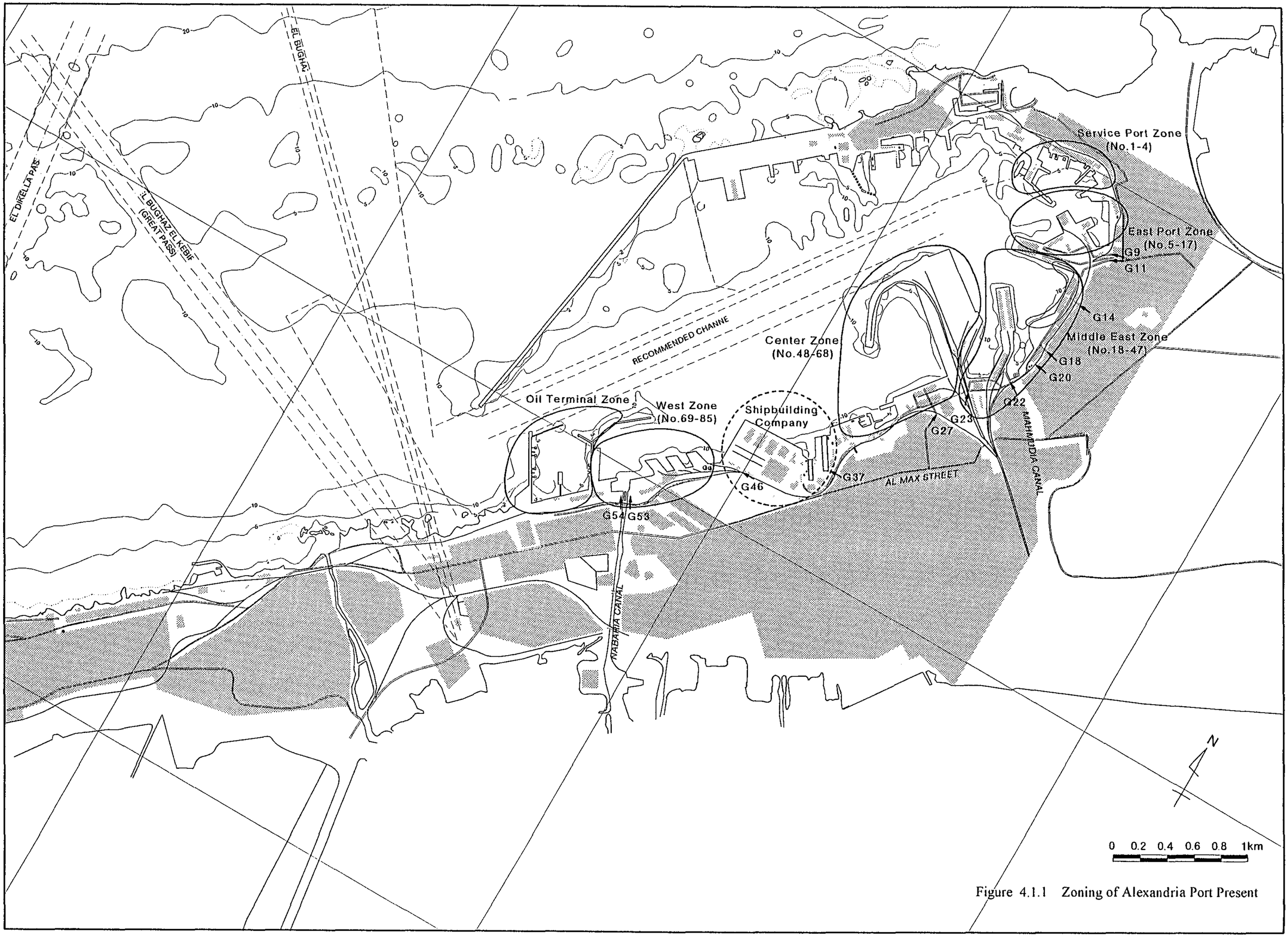


Figure 4.1.1 Zoning of Alexandria Port Present

4.2. Port Facilities

4.2.1 Quay Walls

The port of Alexandria has been developed over many years in the past and in consequence the features of series of berths and basins varies by district of the port in lengths, water depths and shapes. But, the most of quay wall structures are the gravity type of concrete blocks placed upon the rubble mound base on the sea bottom or on the replaced sandy soils for excavated loose sands or soft silty soils. This standard type of construction by means of concrete block wall structure are typically adopted by the APA to recent construction for expansion of existing berth at the Alexandria port as well as new construction at the Dikheila port. A typical section of the present quay wall structure is presented in Figure 4.2.1.

The berth facilities at each zone of Alexandria port together with those at Dikheila are listed into the Tables 4.2.1 as a summary of berth facilities.

Unlike those newly constructed quay wall structures at Dikheila district, the port facilities of Alexandria are constituted of an old complicated alignment with water depth full of variety. Due to the long history of construction, existing quay walls has narrow space of apron and back-up port area which are not considered wide enough and not suitable for modern cargo handling operation.

At present, the APA is implementing the modernization of quay wall structures. Among others, the quay walls from berth nos. 71 to 82 at west zone are rehabilitated to form new pier with wide back-port area. The construction for this rehabilitation was completed in summer 1998, by reclaiming of old fashioned comb shaped piers. The most of newly constructed quay wall except for those of old structures are set out at the elevation of quay wall face line of 2.4 meters above the lowest low water level which is equal to the Port Datum Level (D.L.).

The tables 4.2.2 (1) to (6) are a list of the existing quay wall facilities of the port of Alexandria by berth number as well as those of the port of Dikheila.

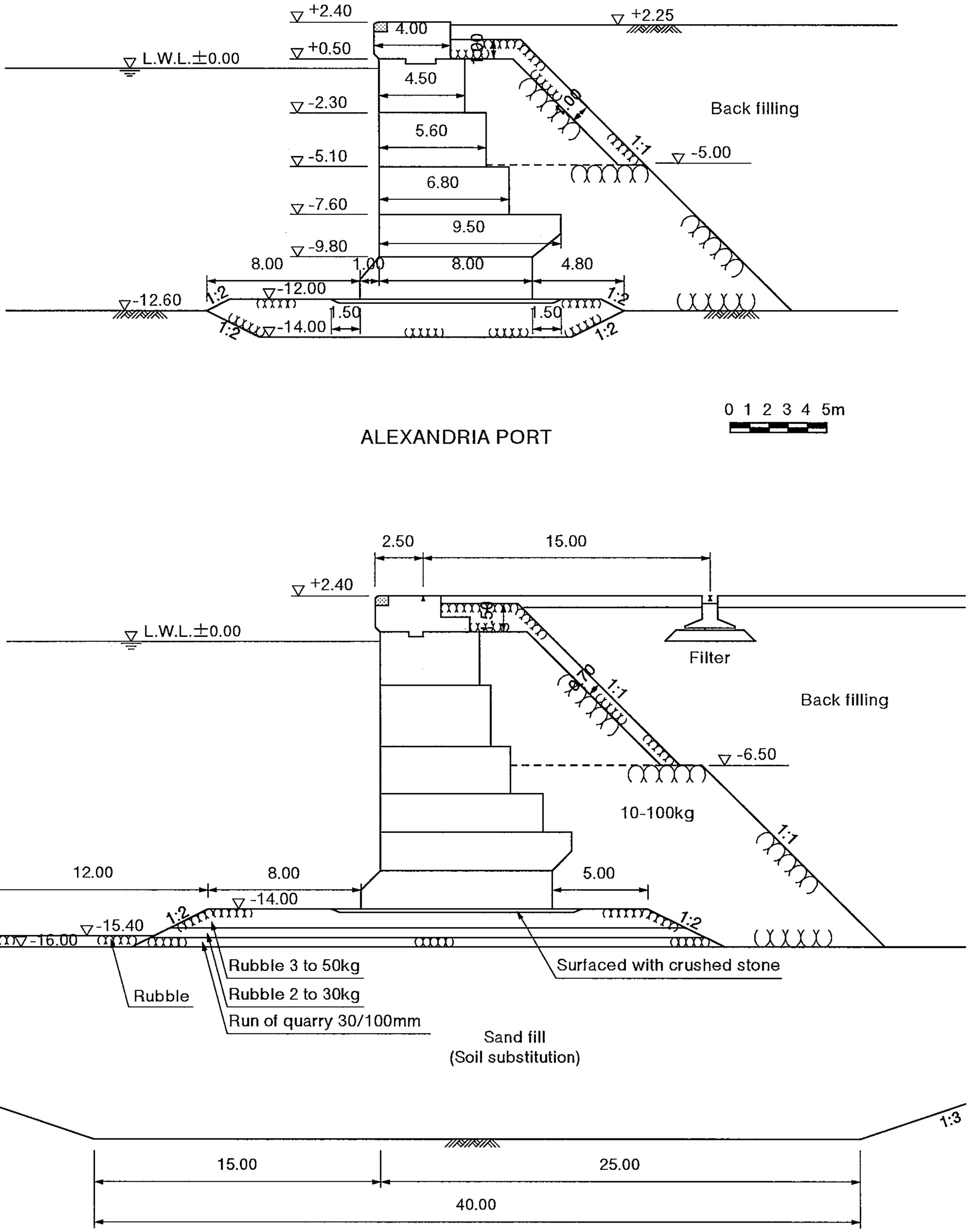


Figure 4.2.1 A typical Section of Existing Quay Wall

Table 4.2.1 Summary of Berth Facilities (Quay Wall)

Left : Number of Berth, Right : Berth Length (m)

Cargoes		Water Depth(m)	Alexandria by Zone												Dikheila		Total	
			East		Middle East		Center		West		Oil		Sub Total					
General Cargo		<-9	9	1,164	7	827	0	0	0	0	0	0	**16**	**1,991**	**0**	**0**	**16**	**1,991**
		9~12	2	390	14	2,096	2	320	0	0	0	0	**18**	**2,806**	**0**	**0**	**18**	**2,806**
		>12	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**
		Sub Total	**11**	**1,554**	**21**	**2,923**	**2**	**320**	**0**	**0**	**0**	**0**	**34**	**4,797**	**0**	**0**	**34**	**4,797**
Special Cargoes	Container	-14	0	0	0	0	5	530	0	0	0	0	**5**	**530**	**1**	**500**	**6**	**1,030**
	Cement	-11	0	0	0	0	2	265	0	0	0	0	**2**	**265**	**0**	**0**	**2**	**265**
	Coal	-9 ~ -11	0	0	0	0	5	790	0	0	0	0	**5**	**790**	**0**	**0**	**5**	**790**
	Fertilizer	-10	0	0	0	0	3	440	0	0	0	0	**3**	**440**	**0**	**0**	**3**	**440**
	Molasses	-9	0	0	0	0	0	0	1	280	0	0	**1**	**280**	**0**	**0**	**1**	**280**
	Grain	-10	0	0	0	0	0	0	3	485	0	0	**3**	**485**	**2**	**800**	**5**	**1,285**
	Livestock	-7.5	0	0	0	0	0	0	1	100	0	0	**1**	**100**	**0**	**0**	**1**	**100**
	Petroleum & Oil	-10 ~ -12	0	0	0	0	0	0	0	0	5	862	**5**	**862**	**0**	**0**	**5**	**862**
	Mineral	-16 ~ -20	0	0	0	0	0	0	0	0			**0**	**0**	**2**	**660**	**2**	**660**
	Timber	-12	0	0	0	0	0	0	0	0			**0**	**0**	**1**	**250**	**1**	**250**
	Others	-7.5 ~ -12	0	0	0	0	0	0	10	550	1	120	**11**	**670**	**0**	**0**	**11**	**670**
		Sub Total	**0**	**0**	**0**	**0**	**15**	**2,025**	**15**	**1,415**	**6**	**982**	**36**	**4,422**	**6**	**2,210**	**42**	**6,632**
Ro-Ro (including berths in common use)		<-9	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**
		9~12	1	210	6	888	1	160	0	0	0	0	**8**	**1,258**	**0**	**0**	**8**	**1,258**
		>12	0	0	0	0	1		0	0	0	0	**1**	**0**	**0**	**0**	**1**	
		Sub Total	**1**	**210**	**6**	**888**	**2**	**160**	**0**	**0**	**0**	**0**	**9**	**1,258**	**0**	**0**	**9**	**1,258**
Total			**11**	**1,554**	**21**	**2,923**	**18**	**2,505**	**15**	**1,415**	**6**	**982**	**71**	**9,379**	**6**	**2,210**	**77**	**11,589**

Table 4.2.2 Berth Facilities (1) Alexandria Service and East Zones

Berth No.	Year of Built	Water Depth (m)	Berth Length (m)	Apron Width (m)	Type of Structure	Design Loads (tf/m2)	Repair History	Usage	Remarks
No.1		2.0	n.a.						For repair
No.2		2.0	65						For repair
No.3		n.a.	60						Dry dock for small vessel
No.4		n.a.	90						Used for seawater pilot boat berthing
No.5	1900~1910	6.0	300	17.0	GWCB*	2.0	Periodical maintenance	General Cargo	
No.6	ditto	6.0	97	17.0	ditto	ditto	ditto	General Cargo	Small boat for repair
No.7	ditto	5.5	122	10.0	ditto	ditto	ditto	General Cargo	Used for barge repairing
No.8	ditto	5.5	76	8.0	ditto	ditto	ditto	General Cargo	Barge berth
No.9	ditto	5.5	68	11.0	ditto	ditto	ditto	General Cargo	
No.10	ditto	8.0	130	12.0	ditto	n.a.	ditto	General Cargo	
No.11	1910~1920	8.5	128	15.0	ditto	3.0	ditto	General Cargo	
No.12	ditto	8.5	100	17.0	ditto	ditto	partially repaired 1996	General Cargo	because of ships accident
No.13	ditto	8.75	143	20.0	ditto	ditto	ditto	General Cargo	ditto
No.14	1910	10.0	180	13.5	ditto	ditto		General Cargo	
No.15	Nil								
No.16	~1940	10.2	210	9.0	ditto	3.0	periodical maintenance	General Cargo +Ro/Ro	
No.17	Nil								

	Water Depth	No. of Berth	Berth Length(m)
Berth in Operation	<-9 m	9	1,164
	9~12	2	390
	>12 m	0	0
Sub Total		11	1,554

Note 1) : GWCB for Type of Structure is Gravity Wall of Concrete Blocks
Note 2) : Nil for Year of Built means blank on the roll

Table 4.2.2 Berth Facilities (2) Alexandria Middle East Zone

Berth No.	Year of Built	Water Depth (m)	Berth Length (m)	Apron Width (m)	Type of Structure	Design Loads (tf/m2)	Repair History	Usage	Remarks
No.18	~1940	10.2	110	30.0	GWCB*	3.0	periodical maintenance	General Cargo+Ro-Ro	
No.19	Nil				ditto				
No.20	~1950	12.0	476	9.0	ditto	4.0	ditto	General Cargo+Ro-Ro	
No.21									
No.22									
No.23	Nil(~1950)				ditto		ditto		
No.24	Nil								
No.25	~1950	10.2	145	n.a.	ditto	3.0	ditto	General Cargo	
No.26	ditto	10.2	145	11.0	ditto	3.0	ditto	General Cargo	
No.27	1978	12.0	380	74.0	ditto	4.0	ditto	General Cargo	
No.28	ditto								
No.29	Nil				ditto	4.0	ditto		
No.30	1930	7.0	70	n.a.	ditto	2.0	ditto	General Cargo	
No.31	~1880	6.5	108	n.a.	ditto	n.a.	periodical repair	General cargo	El Mahmoudia canal quays
No.32	Nil				ditto	n.a.	ditto		ditto
No.33	~1880	5.0	135	n.a.	ditto	n.a.	ditto	General Cargo	
No.34	n.a.	5.5	125	8.0	ditto	2.0	ditto	General Cargo	
No.35	n.a.	10.0	120	6.5	ditto	3.0	ditto	General Cargo	
No.36	n.a.	10.0	120	6.5	ditto	3.0	ditto	General Cargo	
No.37	n.a.	10.0	120	6.5	ditto	3.0	ditto	General Cargo	
No.38	~1910	10.0	118	20.0	ditto	3.0	ditto	General Cargo	
No.39	1910	10.0	151	12.0	ditto	3.0	ditto	General Cargo+Ro-Ro	
No.40	ditto	10.0	151	12.0	ditto	3.0	ditto	General Cargo+Ro-Ro	
No.41	1986	10.0	170	15.0	ditto	2.0	ditto	General Cargo	
No.42	1920	7.5		15.0	ditto	2.0	ditto		
No.43	1910	7.5	279	10.0	ditto	2.0	ditto	General Cargo	
No.44	1910	6.5	150	n.a.	ditto	2.0	ditto		
No.45	1910	6.5	120	n.a.	ditto	2.0	ditto		Military Quay

	Water Depth	No. of Berth	Berth Length(m)	
Berth in Operation	<-9 m	7	827	
	9~12	14	2,096	
	>12 m	0	0	
Sub Total		21	2,923	(Excluding Military Berth)

Note 1) : GWCB for Type of Structure is Gravity Wall of Concrete Blocks
Note 2) : Nil for Year of Built means blank on the roll

Table 4.2.2 Berth Facilities (3) Alexandria Center Zone

Berth No.	Year of Built	Water Depth (m)	Berth Length (m)	Apron Width (m)	Type of Structure	Design Loads (tf/m2)	Repair History	Usage	Remarks
No.46	~1910	10.0	160	n.a.	GWCB*	3.0	periodical maintenance		Military Quay
No.47	ditto	10.0	160	n.a.	ditto	3.0			Military Quay
No.48	ditto	9.5	63.5	n.a.	ditto	2.0		n.a.	for receiving Ro-Ro vessel
No.49	1984	14.0		250	ditto	4.0			used for Ro-Ro vessel as well
No.50	ditto	14.0		250	ditto	4.0			
No.51	ditto	14.0	530	250	ditto	4.0		Container	
No.52	ditto	14.0		250	ditto	4.0			
No.53	ditto	14.0		250	ditto	4.0			
No.54	ditto	12.0	160	n.a.	ditto	4.0		Ro-Ro	
No.55	1900~1910	11.0		17.0	ditto	2.0		Cement	
No.56	1910	11.0	265	20.0	ditto	3.0		Cement	
No.57	ditto	11.0	130	13.0	ditto	2.0			
No.58	n.a.	11.0	130	14.0	ditto	n.a.			No use due to deterioration
No.59	~1920	11.0	130	14.0	ditto	2.0			
No.60	ditto	11.0	190	18.0	ditto	3.0		Coal	
No.61	~1930	9.0	120	n.a.	ditto	3.0		Coal	
No.62	ditto	10.0	160	n.a.	ditto	3.0		Coal	
No.63	ditto	10.0	160	n.a.	ditto			Coal	
No.64	ditto	10.0	160	n.a.	ditto			Coal	
No.65	n.a.	10.0		13.0	ditto			Fertilizer	
No.66	n.a.	10.0	440	13.0	ditto			Fertilizer	
No.67	n.a.	10.0		13.0	ditto			Fertilizer	Used for Ro-Ro vessel as well
No.68	1969	8.7	n.a.	30.0	ditto				Used for barge

	Water Depth	No. of Berth	Berth Length(m)
	<-9 m	0	0
Berth in Operation	9~12	13	1975
	>12 m	5	530
Sub Total		18	2505

(excluding Military Berth & Berth nos. 48, 57-59)

Note 1) : GWCB for Type of Structure is Gravity Wall of Concrete Blocks
Note 2) : Nil for Year of Built means blank on the roll

Table 4.2.2 Berth Facilities (4) Alexandria West Zone

Berth No.	Year of Built	Water Depth (m)	Berth Length (m)	Apron Width (m)	Type of Structure	Design Loads (tf/m2)	Repair History	Usage	Remarks
No.69	n.a.	n.a.	n.a.		GWCB*				
No.70	n.a.	n.a.	n.a.		ditto				Ship Yard Facilities
No.71	1998	9.0	280		ditto			Molasses	
No.72									
No.73									
No.74									
No.75									Rehabilitated in
No.76	1998	12.0	375	200	ditto	4.0		under planning	1998 for one wharf
No.77									(old 72-80 Berths)
No.78									
No.79									
No.80									
No.81	1998	9.0	175	n.a.	ditto	3.0		n.a.	
No.82	1960	10.0	190	n.a.	ditto	3.0		Grains	
No.83	Nil				ditto	n.a.			
No.84	1969	10.0	165	n.a.	ditto	3.0		Grains	
No.85	1960	10.0	130	n.a.	ditto	3.0		Grains	New extension of 65 m width and 12 m depth
No.86	1986	7.5	100	n.a.	ditto	3.0		Livestock	

	Water Depth	No. of Berth	Berth Length(m)
	<-9 m	1	100
Berth in Operation	9~12	14	1,315
	>12 m	0	0
Sub Total		15	1,415

Note 1) : GWCB for Type of Structure is Gravity Wall of Concrete Blocks
Note 2) : Nil for Year of Built means blank on the roll

Table 4.2.2 Berth Facilities (5) Alexandria Oil Terminal Zone

Berth No.	Year of Built	Water Depth (m)	Berth Length (m)	Apron Width (m)	Type of Structure	Design Loads (tf/m2)	Repair History	Usage	Remarks
No.87	n.a.	7.5	120						
No.81-1	n.a.	10.0	236		Dolphin type			Petroleum and Oil	
No.81-2	n.a.	10.0	236		ditto			ditto	Mechanical Loading
No.81-3	n.a.	12.0	148		Jetty type			ditto	Arms out of order
No.81-4	n.a.	12.0	148		ditto			ditto	
No.81-5	n.a.	12.0	94		Dolphin type			ditto	

	Water Depth	No. of Berth	Berth Length(m)
	<-9 m	1	120
Berth in Operation	9~12	5	862
	>12 m	0	0
Sub Total		6	982

Table 4.2.2 Berth Facilities (6) Dikheila Port

Berth No.	Year of Built	Water Depth (m)	Berth Length (m)	Apron Width (m)	Type of Structure	Design Loads (tf/m2)	Repair History	Usage	Remarks
No.90/91	1986	16-20	660	40	GWCB*			Minerals	Mineral Jetty
No.92	1992	15.0	300	90	ditto			Grains	Nominated as General Cargo Berth
No.94	1992	14.0	500	90	ditto			Grains	
No.95		14.0	500		ditto		Extension for1,000m under construction	Grains	
No.96	1996	14.0	500	n.a.	ditto			Container	Container Berth
No.97		12.0	500		ditto		Extension for1,000m under construction	Container	
No.98	1992	12.0	250	88	ditto			Timber	Nominated as Dangerous Cargo Berth
No.99							Extension for 500 m under construction	Timber	
Ro/Ro-1	n.a.	12.0	35-50	n.a.	ditto		Under construction		
Ro/Ro-2	n.a.	12.0	35-50	n.a.	ditto				
Ro/Ro-3	n.a.	12.0	35-50	n.a.	ditto				

	Water Depth	No. of Berth	Berth Length(m)
	<-9 m	0	0
Berth in Operation	9~12	1	250
	>12 m	5	1,960
Sub Total		6	2,210

Note : GWCB for Type of Structure is Gravity Wall of Concrete Blocks

During the 2nd field survey in Egypt, the study team carried out a site survey for investigating present conditions of port facilities in the greater Alexandria Port. The following are a general view on the present conditions of quay wall facilities by port zones obtained through the site survey by the study team.

[The Port of Alexandria]

(1) Service/East Zones

Most of quay walls structures at these port zones are very old. Such portion of quay wall as coping and the front face of concrete wall are slightly deteriorated but kept relatively in sound conditions provably owing to periodical maintenance or repairs. Round tube type of rubber docking fender fixed by chains are generally provided along the front face of coping concrete in this zone. But, since there is loss or damages in places and consequently only two to eight numbers of fender units are provided per berth at present, docking fender system is seemed to be insufficient in quantity, particularly at berths 6, 8, 9, and 12.

Berth aprons are basically narrow except for berth nos. 5, 6, and 11 to 13. Quay aprons are mostly paved with pebble stones and overlaid with asphalt surfacing thereon. Although unevenness is observed in places on the surface of pavement, there seem to be no fatal hindrance for cargo handling operation substantially. Along the front face of berth, a number of water supply pits are installed for having fresh water supplied to ship. But, because each water supply pit is covered by very heavy concrete slab, a number of pit cover are removed and therefore the water supply pits are used as garbage dumping place. In these zones, all the railway lines near the berths are dead and are not utilized for cargo transportation at present.

Back-up-area behind berth no 5 is used as temporary parking for cargo handling equipment. The area for maintenance shop, which is located between fire brigade station and police building near the berth 6, seems to block the way for the cargo transfer operation from and/or to berths 8-14. It seems that each open storage yard is generally used in disorder by stocking various types of cargoes.

(2) Middle East Zone

Deterioration of coping concrete at quay walls seems to be in progress, indicating rusty exposure of reinforcing bars, de-lamination or peel off of surface concrete. In particular, partial damages or losses of coping concrete at berth nos.25 to 27 and 35, 39 are relatively remarkable. Southwest side corner of berth no 18, which was seriously damaged by a direct collision, had already been repaired completely. Each berth is equipped with round tube rubber fenders except for berth nos. 31 to 33.

Except for berth nos. 38, 41, 42 and 44, quay walls in this zone are provided with narrow apron. Narrow apron space considerably hampers trucks move between the quay wall and berth warehouse,

and in particular cargo handling operation by direct unloading from the ship to truck as well. Quay apron is paved with pebble stone surfacing. Paved surface is observed unevenness in places, which is seemed to be much remarkable than those in service/east zones. The apron surface for berths nos. 35 to 38 are covered by steel rubbish, split oils and garbage and it seems to seriously aggravate the present conditions of environment directly related to port operation.

As being observed at service/east zones, a number of water supply pit along quay wall face line are used as garbage dumping place due to removal of heavy concrete coverage. All railway lines are dead and unused. It is remarkable that the open space in front of quay wall warehouses are used for temporary stocking cargoes or heavy cargo handling equipment.

(3) Center Zone

This zone handles containers and such bulk cargoes as coal/coke, fertilizer by mechanized cargo handling operation. Berths nos. 48 to 54 are constructed in recent and therefore relatively in a good condition. Berths nos. 55 to 59 at hammer shaped mole are of shallow water depth without provision of bollards and fender systems. Deterioration on the coping concrete of these berths is heavily in progress. At these berths nos. 55 to 59 and 60/61 locating at the north side of coal/coke berths, unloading operation through offshore barge transportation is still adopted. These quay wall structures shows considerable damages or deterioration in places and such auxiliary facilities as bollards, docking fenders are lost or heavily damaged. The face line at berth nos. 60/61 is not straightly aligned, showing some roughness of face line of berth. Berth apron for these berths is unpaved. Berths nos. 65/66 shows many damages at the coping concrete of quay wall. The apron pavement is in a bad condition.

Berth no. 67 is provided with two units docking dolphins of floating type in front of quay wall to receive larger size grain carrier vessels. Berths no.68, which is used for direct unloading operation from barges, have lower coping height of quay wall without provision of docking fender system. Besides, deterioration to the coping concrete of quay wall is in progress.

(4) West Zone

Berths nos. 71 to 81 are recently rehabilitated. Water front structures have already completed with neatly arranged docking fenders and bollards at definite intervals on the face line of quay walls. The back of quay wall area is under paving construction at present. Berth no. 82 has damages on the surface of pavement and there is observed much unevenness in places. Mechanical grain unloaders are now used at berth no.82 for unloading bulk grains.

Although 3 sets of grain unloaders are provided at berth 84, two units thereof including belt conveyor are now out of order due to the occurrence of ship collision. Berth no 85 are in good

condition despite of some deterioration on the coping concrete of quay walls. The offshore area of berth no 85 is already reclaimed partially for the area of 69 meters length by 75 meters wide and is utilized as timber cargo unloading from barges at present. Berth no. 86, which is used for livestock, has wide space behind the quay wall but no docking fender is provided onto the face line of quay wall.

Oil berths nos. 1 to 5 are old structures, but these berth seems to be capable of receiving ship's docking without difficulty. In particular, all the unloading mechanical arms including pipelines provided to these oil berths are out of order at present. The platform of berth no.1 is used for stocking oil pipeline materials. Since berth nos. 1 and 2 are provided along west breakwater alignment, approaching by maintenance vehicles to these berths is substantially difficult. Although pipelines and pipe supporting racks for berths 1 and 2 are under progress of steel corrosion, necessary maintenance works would be troublesome because of impossibility of truck access. No. 5 berth is provided with unpaved access roads as well.

[Dikheila District]
Since quay walls at the port of Dikheila are recently constructed, quay wall structures are in good condition with such neatly arranged auxiliary facilities as bollards and fender systems. Fender systems to these berths are of V-shaped rubber fender. Berths nos.95-1 to 3, 97-1 and 2, and 99-1 and 2 are under construction at present. Quay wall structures of these berths have already completed and the works for paving, crane rail foundation at the back-of-berth area are now implemented.

4.2.2 Utilities Facilities

(1) Electric Power Supply

The Electrical Distribution Company provides electric power supply through the electric substations to the port of Alexandria. There are 8 number of stations inside port to supply electrical power to the port of Alexandria as follows:

1- Workshop Station at Gate no. 1
2- Passenger Terminal Station
3- C-Station at Gate no. 18
4- B-Station at Gate no.22
5- No. 40 Station at Berth no.40
6- The Academy Station at Gate no. 27
7- The Radar Tower Station
8- The Timber Station

Each station of the above has 2 electrical sources of supply by electrical cable of 300 KVA for power supply and by generator of 500 KVA power supply for the use of emergency in case of shortage in electrical current. The electric cable network is buried in culvert or laid directly under the ground. The lightening of the port area is provided by lighting tower with sodium lamps along with the main internal roads, at quay wall apron and cargo handling yards.

(2) Water Supply

The water supply to the port of Alexandria is provided by Alexandria Water Supply Authority through water pipelines to various berths and on-land facilities supplemented with supply by tanker barges. The water pipelines of 3 to 12 inches are connected at various points to the main supply pipes in the city area. The water pipeline network provides water outlets and hazardous hydrants installed at quay walls and yard apron along the water pipelines.

The quay walls equipped with water pipeline are the berth nos. 9-25, 34-41, 50-54, old 71-81, 83, 85 and 87-1&-2 at Alexandria and all the berths at Dikheila. In addition, the Water Supply Company operates by using a number of self-propelled water supply barges. The average quantity of water supply in recent 3 months was 85,000 cubic meters to the APA account consumption only (excluding supply to private company) for the port of Alexandria and 129,000 cubic meters for the port of Dikheila.

(3) Bunkering

Bunkering to ships is done by a fleet of bunker barges, which are operated by one company selected from the lowest bidder among the following three companies:

Shell Company
Egyptian Corporation Company
MISR Petroleum Company

4.2.3 Onshore Facilities

(1) Warehouses and Open Storage

All the warehouses inside the port of Alexandria are managed by the General Egyptian Warehouse Company (G.E.W.C.). But the ownership of warehouses had been transferred to the APA in 1965 by declaration by the relevant law. Besides, the open storage areas are still owned by the APA. The cargoes are allowed to stock in the warehouses for maximum 30 days. The cargoes stocked for additional 15 days maximum storage are transferred to the annex area that is provided outside the port. The cargoes, which are not withdrawn from warehouse within the allowed period, will be considered as neglected cargo and will be stacked onto special yard.

The open storage areas inside the port are utilized by a number of private cargo handling or stevedoring companies. A list of these warehouses owned by G.E.W.C. and open storage at the Alexandria port are tabulated in Table 4.2.3 for warehouse and in Table 4.2.4 for open storage area. As shown in the Table, allocation of these warehouses is concentrated at the Middle West zone in the port of Alexandria. The total area of warehouses and open storage is reported as follows, although these figures are inconsistent with those provided in the said Tables provably due to errors or omission of data: (data source: the APA)

[Alexandria Port]

a) Warehouse within the Port used by G.E.W.C.: 164,000 sq. m (about 188,800 ton capacity)
b) Open Storage inside the Port: 190,000sq. m
c) Annex outside the Port at El Nobaria: 247,000sq. m (about 140,000 tons capacity)
d) Annex outside the Port at El Mex: 600,000sq. m

[El Dikheila Port]

a) Total Capacity of 10,300,000 tons
b) Pallets Yard: 36,000sq. m (about 2,000,000 tons capacity)
c) Coal Stacking Yard: 18,000sq. m (about 1,200,000tons capacity)
d) Scrap Yard: 23,000sq. m (800,000 tons capacity)
e) Container Yard: 380,000sq. m (25,000 TEU capacity)
f) Timber Yard: 22,000sq. m (about 500,000 tons capacity)
g) General Cargo Yard: 220,000 sq. m (2,000,000 tons capacity)

During the 2nd field survey in Egypt, the study team carried out site survey on the present conditions of warehouses and the following general view thereof are obtained.

1) Service/East Zones

Most of existing warehouses in these zones were constructed before 1920. Therefore, a number of the these warehouses are old fashioned type of structure with provision of supporting inner pillars and generally in bad conditions except for warehouse no. 40 near the berth 14. The structural constraint of the existing warehouse hamper cargo-handling operation inside of the warehouse. But unlike the exterior conditions of the structures, interior thereof is well maintained or repaired.

Some of the existing warehouses are ineffectively utilized or being subject to rehabilitation. Warehouses nos. 1 & 2 are particularly old and no. 1 warehouse is now under rehabilitation for one-third portion of the structure. Warehouse no. 2 is used for agricultural products but most entrances facing to the roadside are closed and heavy cargoes are stocked in front of the warehouse.

One side of entrance for coming and going mostly uses Quay warehouses. There is a tendency that the entrance facing quay wall is generally unused for cargo handling operation provably due to stocktaking or security purpose. Outside open space beside warehouse which is facing to quay wall is used for stocking handling cargoes in particular.

2) Middle East Zone

One beside quay wall and the other at back-of-port area will classify warehouses in this zone into two categories. In general, warehouses in this zone are very old and some of these warehouses are ineffectively used.

The berths from 25 to 27 at the middle-east zone are provided a number of warehouses, i.e. nos.14 to 16. Those warehouses are relatively in good conditions. But these warehouses are very old and constructed too close to the quay wall face line. Besides, back entrance facing to the inner port main road are never used for outgoing cargo handling operation, though these warehouses are well designed for loading cargoes onto trucks from the entrance. Warehouses nos.44 to 48 at berths 35 to 40 are very old of 2 stories heavy construction by adopting reinforced concrete framing and bearing walls and therefore interior space are divided into small rooms by interior pillars. Dim interior space like a cellar room thereof hampers the cargo handling operation. Berths nos. 42-44 are provided with very old warehouses in critical structural conditions. Warehouse no.28 is now under rehabilitation and warehouse nominated by “boiler” is used for insect extermination.

Warehouses at back-of-port area are very old fashioned with provision of many inside small pillars. In particular, Tobacco and Homs warehouses are adopted heavy type of 3-story construction but cargoes inside the warehouses are shipshape stocked. Warehouses nos. 19 and 22 are steel framed structures and the roofing thereof started leaks in places. These warehouses including no. 25 are observed to accommodate minimal volume of cargoes and still have empty space. There is also definite tendency that the cargo movement for coming and going is done only through one entrance of the warehouse.

3) Center Zone

At berths 65-67, there are several warehouses located behind the berth apron in suitable shape and neatly arranged. Warehouses nos. 32/35 and 65/66 handle fertilizer products. Although showing progress of deterioration at present, these warehouses are relatively in good conditions with wide interior space owing to high roofing design. Very old warehouse no. 34 is divided into five rooms by partition walls and is heavily deteriorated. Warehouses 36/37 beside of main port road are in good condition with wide interior space because of larger spanning of pillar installation, but most of the spaces are not effectively utilized.

4) West Zone

This zone is provided with no warehouse except for two units of grain silos located at berths nos. 84 and 85. Behind the main port road at berth nos. 82, there are container-stocking yards for receiving empty containers. Due to time spending custom inspection at the gate 53, a number of trucks loaded timber products are constantly stand-by along the side of the main port road.

(2) Other Storage Facilities

The west zone of the port of Alexandria is equipped with two grain silos of 100,000 tons capacity for export and 48,000 tons capacity for import. These are provided behind berths 84 and 85 together with unloading facilities. A 100,000 tons capacity silo was built in 1984 while 48,000 tons capacity silo in 1965.

(3) Railways inside the Port

The following are a summary of railways inside the port of Alexandria.

- 2 railways serving military quay
- 2 railways serving the coal company
- 3 railways serving the Alexandria Container Terminal Company
- Railway lines at west zone serving for grain transport
- Railway lines passing in front of gate no. 27 serving for timber materials
- 2 railways behind berth nos. 65/66

The railway lines serving for hammer-shaped pier at west zone are actively utilized for handling coal cargoes in particular. But, in many places inside port area, the railway lines are interrupted or buried by the overlaying asphalt paving of roads. It seems that the maintenance of the railway lines is not effectively carried out in view of recent transition of inner transportation mode from railway to road network. In addition, railway lines would rather hamper the road traffic inside port area at some places, resulting in the unnecessary road traffic congestion due to unavoidable exaction of low-speed traffic.

Table 4.2.3 Warehouses & Sheds at Alexandria

Data Source : APA

Zone/Location	Nomination	Type	Year Built	Dimensions (m)				Type of Structures	Remarks
				L (m)	W(m)	Story	Fl. Area		
[Service Zone & East Zone]									
Berths 5	1	B	~1920	n.a.	n.a.			bearing wall type	Under reconstruction
Berths 5	2	B	ditto	75	33	1	2,475		Agricultural products
Berth 14	40	Q	ditto	96	36	1	3,456	ditto	General cargoes
Berth 8-10	41	Q	ditto	90	45	1	4,050	ditto	ditto
Berth 11 & 12	42	Q	ditto	100	20	1	2,000	ditto	ditto
Berth 13 & 14	43	Q	ditto	100	27	1	2,700	ditto	ditto
[Middle East Zone]									
Berth 25	14	Q	~1920	56	30	1	1,680	bearing wall type	General cargoes
Berth 26	15	Q		72	30	1	2,160	ditto	ditto
Berth 27	16	Q		96	30	1	2,928	ditto	ditto
Berth 27	19	B		92	25	1	2,300	steel hamger covered with asbestos	general cargoes
near Gate 20	25	B		73	23	2	3,358	bearing wall type	ditto
near Gate 14	A	B		228	32	1	7,296		
near Gate 14	C	B	1977	125	25	3	3,125	concrete skeleton	
near Gate 17	21	B		50	30	1	1,500		For office car
near Gate 17	22	B		85	26	1	2,217		
near Gate 10	Hanger	B	~1920	45	38	1	1,710	wooden hanger	Paper product
ditto	Gate 10	B		20	38	1	760		Temp. imported car
at Gate 13	Tabacco	B	1975	120	50	3	17,040	concrete skeleton	Tabacco
near Gate 14	Tabacco	B	~1920	180	50	3	25,560	bearing wall type	Tabacco
near Gate 13	Homs	B	~1920	90	28	3	7,560		General cargoes
at Gate 14	New Refrigerator	B	1984	90	35	1	3,150	concrete skeleton	Reefer products
Berths 42 &43	26	Q	~1920	48	22	1	1,056	steel hanger covered with asbestos	General cargoes
Berths 42 &43	27	Q	~1920	92	22	1	2,024	bearing wall type	ditto
Berth 44	28	Q	~1920	80	42	1	3,360	bearing wall type	ditto
Berth 39	44	Q	~1920	145	35	2	8,120	bearing wall type	ditto
Berth 40	45	Q	~1920	145	35	2	8,120	bearing wall type	ditto
Berth 37	46	Q	~1920	145	35	2	8,120	bearing wall type	ditto
Berth 35	47	Q	~1920	145	35	1	5,075	bearing wall type	ditto
Berth 35	48	Q	~1920	145	21	1	3,045	bearing wall type	ditto (2nd fl.of W47)
Berth 43	Boiler	Q	~1920	48	22	1	1,056	to be demolished	Insect extermination
[Center Zone]									
at Gate 27	32	B	~1920	80	50	1	4,000	bearing wall type	Fertilizer
near railway at Gate 27	Dangerous	B	~1920	appr. 50*20		1	2,000	steel hanger covered with galvanized steel	Dangerous cargoes (2 units)
Berth 68	34	Q	~1920	120	30	1	3,600	bearing wall type	divided into 5 parts
Behind Berth 66	35	B	~1920	80	50	1	4,000	bearing wall type	Dangerous materials & chemicals
at Gate 27	36	B	~1920	30	32	1	976	bearing wall type	
at Gate 27	37	B	~1920	30	32	1	960	bearing wall type	
Berth 65	65	Q	~1920	80	50	1	4,000	bearing wall type	fertilizers(2 units)
Berth 66	66	Q	~1920	80	50	1	4,000	bearing wall type	fertilizers (2 units)
Total Floor Area (m2)							**160,537**		

Type : Q=Quay side, B=Back up Area

Table 4.2.4 Open Storage Yard at Alexandria

Data Source : APA

Zone/No.	Location	Type	Year of Built	Area (m2)	Remarks
[East Zone]					
1	Berths 5	open yard		2,500	General cargoes
2	behind stevedoring workshop	ditto		1,260	For Repair
3	Berth 7	ditto		1,000	ditto
4	Berth 11	ditto		3,500	General cargoes
5	in front of APA (1)	ditto		2,300	ditto
6	in front of APA (2)	ditto		2,500	ditto
7	Berth 14/16	ditto		3,550	ditto
	Sub Total			**16,610**	
[Middle East Zone]					
8	beside Terminal Road Bridge	open yard		3,000	Containers
9	back of warehouses 14	ditto		5,400	Container & General cargoes
10	in front of warehouse 15	ditto		6,000	ditto
11	Berth 27 (back of warehouse 16)	ditto		3,000	General cargoes
12	at Gate 14	ditto		900	ditto
13	Berth 27/28	ditto		2,800	Container & General cargoes
14	Berth 28/30	ditto		15,000	ditto
15	beside warehouse 21	ditto		300	General cargoes
16	near warehouse New Refrigerator	ditto		400	ditto
17	Berth 34	ditto		420	Stocking handling equipment
18	at warehouse 45/47	ditto		2,700	Container & General cargoes
19	Berth 41	ditto		3,000	Container
20	at warehouse 44/46	ditto		2,480	Container & General cargoes
21	back of berth 34	ditto		4,000	Container
22	at warehouse 26	ditto		2,760	ditto
23	at warehouse 27	ditto		2,200	ditto
24	beside warehouse 28 (1)	ditto		1,000	ditto
25	beside warehouse 28 (2)	ditto		1,200	ditto
	Sub Total			**56,560**	
[Center Zone]					
26	Alexandria Container	Terminal		163,000	(Container Terminal Area)
27	Berth 62/64	open yard		17,800	Coal & Coke
28	Berth 55/58	ditto		16,500	Timber
29	Berth 60/61	ditto		4,300	Timber & Container
30	beside warehouse 36	ditto		1,250	Stocking handling equipment
31	beside warehouse 37	ditto		1,400	Containers
32	Berth 65	ditto		7,500	ditto
33	Berth 65	ditto		5,200	ditto
34	Berth 67	ditto		5,200	Stocking handling equipment
35	Berth 67	ditto		5,500	ditto
36	beside Dangerous Cargo warehouse	ditto		1,100	Containers
37	near Gate 30	ditto		1,400	ditto
38	near Gate 33	ditto		4,800	Petroleum products
39	near Gate 34	ditto		4,500	General cargoes
40	near Berth 68	ditto		1,000	Miscellaneous
	Sub Total			**77,450**	(excluding Container Terminal)
[West Zone]					
41	near Gate 51	open yard		28,200	Container(Alex. Container Co.)
42	near Gate 51	ditto		7,200	Car
43	near grain silo	ditto		3,500	Container(Alex. Container Co.)
44	near Berth 82	ditto		1,000	Container & Others
	Sub Total			**39,900**	
	Total Area of Alexandria Port			**190,520**	(excluding Container Terminal)

4.3 Cargo Handling Equipment

4.3.1 Equipment Owned by Private Sectors

Most of all cargo handling equipment utilized in the port belong to the private sectors except for such equipment necessary for port supporting service and maintenance. Among others, United Arab Stevedoring Company holds the biggest share of the ownership of these cargo handling equipment to carried out cargo handling operation in the port. Such specialized cargoes as container, grain bulk or coal, etc. are handled by their own equipment owned by the terminal operators who are specialized for these cargoes.

The table 4.3.1 tabulates the list of cargo handling equipment utilized by the private companies in operation at the Greater Alexandria Port at present.

In particular, the Dikheila district is provided with cargo handling equipment for accommodating larger size ocean-going vessels as making special mention of the following.

a) No.90/91 for coal handling for accommodating 160,000DWT
   2-gantry cranes (1,000 t/hr/unit)
   Belt conveyor of 5 km length
   2-stockers (200t/hr/unit)
   2-reclaimer (800t/hr/unit))
b) No.96 for handling container for Post Panamax container carrier
   3-quay side gantry cranes for post Panamax (45 t/lift)
   380,000 sq. m container handling yard
c) No.92/94 (general cargo berth) for handling grains
   3-unloader (500t/hr)
   3-silos (130,000 tons and others)

4.3.2 APA Service Supporting Equipment

A number of cargo handling equipment are owned by the Alexandria Port Authority for maintenance or clearance service and supplemental cargo handling which will be carried out based on the requests by the private operation company. Among others, the following is a list of equipment and workshop facilities owned by the APA.

[Floating Equipment]
-Weighing equipment (100 tones): 9 units

-Floating cranes 4 units (2-35, 1-100, 1-150 GRT capacity)
-Ship tugboats: 13 vessels (500-3,000Hp)
-Service tugboats: 5 vessels
-Dredger: 1 unit
-Barge: 2units
-Grub Crane: 5 units
-Oil Scraper: 1 unit
-Pilot Launch: 13 units
-Service Launch: 19 units

[On-land Equipment]
-Transfer Cranes (5 tons capacity): 10 units
-Loader: 5 units

[Workshop]
-Electrical and Mechanical Workshops
-Auxiliary Workshops
-Dry Dock for 1,200 tons vessels
-Mechanical Lifts for 600 GRT

Table 4.3.1 (1) Cargo Handling Equipment

Data Source : APA

Item	Q'ty	Berth No.	Usage	Capacity	Year Built	Manufacturer Maker/Country	Remarks
1 United Arab Stevedoring Company							
Tractors	54	Indefinite	stevedoring		1980	/Japan	
Loader	10	ditto	ditto	less than 5 tons	1985	/ditto	
Druger	18	ditto	ditto	more than 5 tons	1985	/ditto	
Trailer	55	ditto	ditto		1985	/ditto	
Top lift container	51	ditto	ditto	more than 5 tons	1985	/ditto	
Heavy Crane	34	ditto	ditto	2-100t, 3-140t, 15-140t, 9-40t, 3-10t, 2-90t	1985	/ditto	
Crane	53	ditto	ditto	12-12t, 8-16t, 12-18t, 9-20t, 6-30t, 5-40t, 1-50t	1980	/ditto	
Fork Lift Truck	76	ditto	ditto	3 tons	1980	/ditto	
Lorry	165	ditto	ditto		1980	/ditto	
Dump Truck	2	ditto	ditto		1985	/ditto	
2 El NASRE Coal & Coke Company							
Gantry Crane	1	61-64	unloading /loading	6 tons (150 t/h)	1958	/Germany	rail -mounted
Gantry Crane	2	ditto	ditto	10 t/lift (240 t/h for coal, 180-200 t/h	1974	/ditto	rail -mounted
3 Gudasons Stevedoring Company							
Top Lift Container	4	Indefinite	stevedoring	16 tons	1980	/Japan	
4 Tolibah Stevedoring Company							
Crane	1	Indefinite	stevedoring	35 tons	1980	/Japan	
5 El Salan Stevedoring Company							
Top Lift Container	3	Indefinite	stevedoring	8 tons	1985	/Japan	
6 Egyptian Company for Marine Supplies							
Car	6	Indefinite		less than 5 tons	1990	/Japan	
7 Heliopolis Navigation Marine Services Company							
Fork Lift Truck	5	Indefinite	stevedoring	less than 5 tons	1980		
Top Lift Container	1	Indefinite	stevedoring	10 tons	1985		
8 El Nasr Salt Works Company							
Belt Conveyor	2	Indefinite	stevedoring		1985		
Loader	1	Indefinite	stevedoring	8 tons	1985		
9 El Nasr Stevedoring Company							
Top Lift Container	8	Indefinite	stevedoring	10 tons	85/86	/Japan	
Fork Lift Truck	6	Indefinite	stevedoring	less than 5 tons	85/86	/Japan	
10 General Egyptian Warehouse Company							
Fork Lift Truck	30	Indefinite	stevedoring	less than 5 tons	85/86	/Japan	
Top Lift Container	12	Indefinite	stevedoring	4-35t, 8-25t	85/86	/Japan	
Trailer	20	Indefinite	cargo transfer				
11 El Salan Import & Export Office							
Fork Lift Truck	6	Indefinite	stevedoring	less than 5 tons	1980	/Japan	
Top Lift Container	1	Indefinite	stevedoring	10 tons	1976	/Japan	
12 El Bahreia Stevedoring Company							
Top Lift Container	5	Indefinite	stevedoring	2-30t, 2-20t, 1-40t	1980	/Japan	
Fork Lift Truck	7	Indefinite	stevedoring	less than 5 tons	1980	/Japan	
13 Jeston Avg.(Sweden Lines)							
Top Lift Container	14	Indefinite	stevedoring	6-12t, 4-16t, 4-35t	1985	/Germany	

Table 4.3.1 (2) Cargo Handling Equipment

Data Source : APA

Item	Q'ty	Berth No.	Usage	Capacity	Year Built	Manufacturer Maker/Country	Remarks
14 El Fath International Trade							
Top Lift Container	3	Indefinite	stevedoring	10 tons	1974	/Japan	
Fork Lift Truck	2	Indefinite	stevedoring	less than 5 tons	1974	/Japan	
15 Deem Line Egypt							
Top Lift Container	3	Indefinite	stevedoring	2-16t, 1-12t		/Japan	
Fork Lift Truck	2	Indefinite	stevedoring	less than 5 tons		/Japan	
(Mavy) Dredger	2	Indefinite	cargo handling				
Lorry	2	Indefinite	cargo handling				
Top Lift Container	2	Indefinite	stevedoring	1-16.5t, 1-35t			
16 Soseteh De Jipson Avg.							
Top Lift Container	3	Indefinite	stevedoring	2-12t, 1-16t	1990	/Germany	
Fork Lift Truck	2	Indefinite	stevedoring	less than 5 tons	1990	/Germany	
17 Port Said Engineering Company							
Lorry	2	Indefinite	cargo handling	less than 5 tons	1985	/Japan	
18 General Organization for Imports & Exports Observation							
Truck	4	Indefinite	cargo handling		1990	/Japan	
19 National Development Stevedoring Company							
Top lift container	4	Indefinite	stevedoring	2-12t, 2-20t	1984	P&H /Japan	
Fork Lift Truck	3	Indefinite	stevedoring	less than 5 tons	1984	P&H /Japan	
20 Fawzy Hned Masod Company							
Top lift container	5	Indefinite	stevedoring	20 tons	1985	/Japan	
21 Arab Union Stevedoring Company							
Top lift container	2	Indefinite	stevedoring	10 tons	1980	/ditto	
Fork Lift Truck	8	Indefinite	stevedoring	less than 5 tons	1980	/ditto	
22 El Ekhlass Stevedoring Company							
Top lift container	2	Indefinite	stevedoring	1-8t, 1-6t	1980	/ditto	
Fork Lift Truck	3	Indefinite	stevedoring	less than 5 tons	1980	/ditto	
23 El Tawfeek Navigation & Marine Service Company							
Lorry	6	Indefinite	stevedoring		1981	/ditto	
Fork Lift Truck	4	Indefinite	stevedoring	less than 5 tons	1981	/ditto	
24 General Stores and Silos Company							
Tractors	2	Indefinite	stevedoring	less than 5 tons	1980	/ditto	
Top lift container	5	Indefinite	stevedoring	3-12t, 2-20t		/ditto	
Loader	1	Indefinite	stevedoring	less than 5 tons		/ditto	
Lorry	1	Indefinite	stevedoring			/ditto	
Portable Sucker	2	82	unloading grains	150t/h (=3,000t/d)	1998	Niro/Germany	
Unloader	3	84	unloading grains	50,000 tons	1983	Miageb /Germany	one unit damaged
Unloader	2	85	unloading grains	250t/h(100,000 t)	1983	Fofarze/USA	with 2-belt conveyors
25 El Onda Stevedoring Company							
Top Lift Container	4	Indefinite	stevedoring	2-10t, 2-20t	1980	/Japan	
Fork Lift Truck	4	Indefinite	stevedoring	less than 5 tons	1980	/ditto	
26 Mosco Company							
Top lift container	1	Indefinite	stevedoring	35 tons	1985	/ditto	

Table 4.3.1 (3) Cargo Handling Equipment

Data Source : APA

Item	Q'ty	Berth No.	Usage	Capacity	Year Built	Manufacturer Maker/Country	Remarks
27 Alexandria Container Terminal Company							
Gantry Crane	3	49-54	container	2-32t, 1-40 t	83/84	LebHar/Ireland	out reach 35 m
Gantry Crane	3	96	container	45 tons	1996	Tanifani/Italy	out reach 45 m
Top lift container	31	49-54	stevedoring	less than 5 tons	1985	/Japan	
Transfer Crane	6	49-54	container	32 tons	1985	Reggiene/Italy	
Tructor	11	49-54	stevedoring		1985	/ditto	
Crane	6	49-54	stevedoring	8 tons	1985	/ditto	
Top lift container	2	49-54	container	more than 35 tons	1985	/ditto	
Fork Lift Truck	6	Indefinite	stevedoring	less than 5 tons	1980	/Japan	
Top Lift Container	1	Indefinite	stevedoring	10 tons	1976	/Japan	
28 Modern Egyptian Stevedoring Company							
Crane	4	Indefinite	stevedoring	10 tons	1985	/Japan	
Fork Lift Truck	4	92-94	grain bulk	8 tons	1991	Shipyard/Egypt	
Unloader	3	92-94	grain bulk	2 m3(500t/hr)	1991	/Japan	
29 Arab Industriazation Organization							
Top lift container	4	Indefinite	stevedoring	less than 5 tons	1990	/Japan	
30 United Stevedoring Company							
Fork Lift Truck	3	Indefinite	stevedoring	less than 5 tons	1980	/Japan	
Owl Crane	1	Indefinite	stevedoring	10 tons	1980	/Japan	
31 Masekh Company for Trade & Contractors							
Fork Lift Truck	5	Indefinite	stevedoring	less than 5 tons	1980	/Japan	
Crane	2	Indefinite	stevedoring	10 tons	1980	/Japan	
32 Masood Modern Company for Transportation and Stevedoring							
Top lift container	5	Indefinite	stevedoring	less than 5 tons	1985	/Japan	
Top lift container	7	Indefinite	stevedoring	less than 10 tons	1985	/Japan	
33 El Nagah Office for Stevedoring							
Top lift container	6	Indefinite	stevedoring	3-10t, 3-16t	1985	/Japan	
Fork Lift Truck	6	Indefinite	stevedoring	less than 5 tons	1985	/ditto	
34 Sugar & Distribution Company							
Loader	3	71	charging molases	1-150t/h, 2-200t/h	58/74	/Germany	
35 Alexandria National Irons & Steel Company							
Gantry Crane	2	90-91	coal and pallet	1,000t/hr/unit	1985	/France	rail-mounted
Reclamer	2	90-91		800t/hr/unit	1985	/France	
Stacker	2	90-91		2,000t/hr/unit	1985	/France	
Belt Conveyor	5 km	90-91					

4.4 Facility Design and Cost Estimate

4.4.1 Design of Port Facilities

Such Egyptian design code of practice as for reinforced concrete, the basis and conditions of masonry structures and soil mechanics and foundations are collected by the Study Team. In principal, these Egyptian design codes of practice are based on the European codes and are purposed to provide basis for comprehensive understanding for carrying out investigation and design. For instant, the code for masonry structures consists of eight parts while one for soil mechanics and foundations consists of 10 parts of content and these codes provide basis of designing the related structures containing descriptions from site investigations, loads to the technical term definition.

But, what code of practice is applied for designing structures are depend upon the designer's judgment. Such design codes of practice in developed countries as of British standards, those of any other European countries or American standards are equally applied in the most cases of the designing of structures in Egypt. Therefore, in considering these code of practice currently used in Egypt, preliminary design for the port facilities envisaged in this study will be done on the basis of the Japanese design and construction standards since these are deemed to be equivalent to the code of practice frequently adopted in Egypt.

4.4.2 Project Cost Study

(1) Basic Considerations

The project cost for constructing infrastructures may include such cost components as construction cost, procurement of equipment and machinery, engineering services and contingencies. The cost of construction, which constitutes large portion of the project cost, will be obtained through combining such major direct cost components for construction as materials cost, depreciation of construction equipment and machinery, labor wages and indirect cost components. The indirect cost components will be estimated as a sum of overhead expenses required to providing temporary works for the site, mobilization cost, managing and operational overheads for site and in common needs and overhead profits.

In principle, such cargo handling equipment or machinery as port infrastructure of cranes, forklift trucks, trailer trucks will be procured locally or through importation from the countries manufacturing these equipment and machinery.

The project cost will be basically divided into the foreign and local currency components of the cost in consideration of possible sources of procurement of necessary input materials and work forces.

The recent data and survey results related to the construction and cost estimation will be obtained through the first field survey and will be summarized for the use of cost estimation. Preliminary cost estimation of the Master Plan will be carried out based on the preliminary engineering design and construction plan of port facilities. Considering the site situation of projects, manpower and construction materials cost, project cost will be estimated to meet the requirements for possible finance of the project in line with international standards. The project cost will be broken down into foreign and local currency portions.

A cost estimate of the Short-term Development Plan will be performed on the basis of the preliminary design of proposed facilities and construction program. The cost estimate will include a thorough examination of construction equipment and materials obtained locally and/or through importation, construction methods, unit price of construction works, labor costs, engineering services, taxes and duties etc. The project cost will be broken down into foreign and local currency portions.

(2) Project Cost Components

The project cost estimate will be broken down into the following cost components below which are approximately obtainable by adopting certain ratio of indirect cost component against direct cost of construction for estimating the total cost of the project. The ratio to be applicable for certain project will be obtained through the scrutiny on the precedent of other project costing for similar project.

1) Direct Cost

The major components of direct cost are materials, construction equipment and labor costs which are estimated based currently prevailing cost thereof.

2) Indirect Cost

The following rates for indirect cost components were obtained from the interview of marine contractors who are carrying out on-going projects in the Greater Alexandria Ports.

Common Temporary Cost	3% of Direct Cost
Field (site) Expenses	12% of Direct Cost
Common Overhead	10% of Direct Cost

Since the mobilization cost for construction works varies by the construction program and structural designing of facilities, the mobilization cost may be obtained by applying the same procedures as for estimating of direct construction costs. In case of the project being financed by a private sector, the necessary cost to procure engineering services will be added by about 7 % into the above overhead expenses and therefor the total overhead will be increased to the possible ratio of 32 %.

3) Procurement Cost for Equipment and Machinery

For the port construction or other marine related projects in principal, the procurement of equipment such cargo handling and storage equipment as cranes, forklift trucks, trailer-trucks, belt conveyors, weight and truck scale etc. will be imported from the manufacturing countries. The cost for procurement of these equipment consists of equipment cost on CIF basis, installation cost, mobilization cost and the overhead and basically the cost of procurement of equipment and machinery will include additional costs for the spare parts for three (3) years operation. But the construction machinery and equipment which are not available in Egypt and are temporary imported from abroad for construction purpose are estimated as mobilization cost or machinery cost of direct cost item. The cost for these items will be included in the depreciation cost items of the direct construction cost.

4) Engineering Service Cost

In common infrastructure projects, engineering services will be required to carry out basic and detailed design of proposed facilities, preparation of tender documents and construction supervision. The Egyptian port authorities under the Ministry of Maritime Transport, in principal, undertake engineering services necessary for repair and maintenance of their own marine facilities and the construction projects as well. When a project require professional technique or judgment on their inexperienced structural design or method of execution, they may employ fully experienced professional consultants.

Therefor in this study, the engineering services will be included in the project cost estimate and the cost thereof will be estimated 10 % of the construction cost and 3 % for the procurement of equipment. In engineering services, General Technical & Department Tax of 6 to 9 % against the contract amount must be borne by the consulting firms who will undertake the engineering services.

5) Contingencies

The contingencies for the project consist of physical and price contingencies. Physical contingency for the project will be taken as 10 % of the construction cost and 3 % for the procurement of equipment, which is deemed a proper ratio for preliminary design stage to be carried out for master planning study for the project formulation.

For price escalation, annual inflation rate is considered to be 5 % for local currency portion, while 0 % for foreign currency portion considering the recent stable climate of international market.

(3) Other Factors affecting the Project Cost

1) Exchange Rate

Recently, exchange rate of Egyptian Pound (L.E.) is stable against US dollars (US$) since middle of 80's. No shadow price is therefor considered to be necessary for cost estimate for the project in Egypt. In this study, the following exchange rate of L.E. against US$ is used for the cost estimate. The project cost is expressed in US$ for foreign currency portion and in L.E. for local currency portion and the total amount of the project cost will be expressed in L.E.

US$ 1.00 = 3.40 L.E. as of May, 1998

2) Sources of Unit Price obtained

There is no bulletined data regarding the unit prices for the construction industry in Egypt. Therefore, the related prices of materials, construction machinery and equipment available in the country and labor wages were obtained from such various sources of local markets as Alexandria Port Authority, private construction contractors and consultants, etc. The results of construction cost survey are tabulated in Tables 4.4.2 for construction material unit costs and Table 4.4.2 for fuel cost, labor wages and construction work costs executed.

3) Extra Quantity of Materials

Based on the investigation done by contractors, major materials specially for the use of underwater works in marine construction will be better to consider possible extra quantity required for the work execution. The following information has been obtained through the interview to the contractor.

(a) Stones / Filling materials

Stones and filling materials will be considered by extra ratio as follows:

Table 4.4.1 Extra Ratio for Material Costing

NO.	Material / Place to use	Extra ratio
1	Rubble stone for foundation (underwater)	25%
2	Armor/riprap stone for protection (underwater)	10%
3	Rubble banking	15%
4	Filling sand (or stone) for replacement	20%
5	Filling soil for reclamation (under water)	5%
6	Ditto, but(above water), to be compacted	20%
7	Stones ; stone revetment/breakwater	20%

(b) Steel Bar (Re-Deformed or Round Bar)

In consideration of non-standardized work procedures, cutting loss due to limited available length in market, poor conditions before delivery on site, steel bars will be considered to estimate an extra quantity by 10 %.

Table 4.4.2 Unit Price of Construction Materials

As of May, 1998

NO.	Item	Spec.	Unit	Price(L.E.)	Remarks
	Road/Fill material				
1	1)Fill material	sand	cu.m	23	
2	Fill material	fertile	cu.m	60	for land scape
3	2)Rock & Stone	0-50kg	cu.m	40	
4	Ditto	10-50kg	cu.m	60	
5	Ditto	50-200kg	cu.m	50	
6	Ditto	0.2-1ton	cu.m	55	
7	Ditto	2-5ton	cu.m	60	
8	3)Road/Pavement	run 0-50mm	cu.m	n.a.	
9	crusher/grabel	5-50mm	cu.m	82	
10	crusher/grabel	5-25mm	cu.m	n.a.	
11	Ditto	Bitumen	kl	1	
	Concrete/Steel				
12	1)Cement	type 1	tons	220	
13	Ditto	type 5	tons	270	
14	2)Steel bar	rebar <13mm	tons	1,300	
15	Ditto	rebar >12mm	tons	1,200	
16	3)Aggregate fine	sand	cu.m	18	
17	Coarse grabel	25mm	cu.m	35	
18	Ditto	50mm	cu.m	32	
19	4)Round bar	<13mm	tons	n.a.	
20	Ditto	>12mm	tons	n.a.	
21	Shaped steel	H,L,I shape	tons	5,000	
22	Steel plate		tons	n.a.	
23	Steel pile		tons	4,000	
	Concrete product				
24	1)Concrete	pavement	cu.m		
25	Ready mixed	300 KN/sq.cm	cu.m	200	
26	Ditto	240 KN/sq.cm	cu.m	185	
27	Ditto	180 KN/sq.cm	cu.m	170	
	2)Asphalt concrete				
28	Coarse as-con		cu.m	120	
29	Dense as-con		cu.m	150	
30	Tug/prime coat		kl	4	
	3)product				
31	Block concrete		cu.m		
32	RC shaped con.		cu.m		
33	RC pipe	D=300mm	lin.m	700	
34	Ditto	D=600mm	lin.m	1,000	
35	Ditto	D=900mm	lin.m	1,200	
36	Concrete brick		pcs	1.3	
37	Brick soil		pcs	0.3	
	4)Piles				
38	RC pile	D=350mm	lin.m	200	
39	Ditto	D=500mm	lin.m	250	
40	Power pile	D=400mm	lin.m	350	
41	Ditto	D=600mm	lin.m	450	

Table 4.4.3 Fuel, Labor Wages and Work Cost Executed

As of May, 1998

NO.	Item	Spec.	Unit	Price(L.E.)	Remarks
	Fuel				
1	Marine Diesel	heavy	Liter	0.4	
2	Lighter Oil	gas	Liter	0.4	
3	Gasoline	benzine	Liter	1.0	
	Execution Work Cost				
4	Place concrete	mass con	cu.m	60	
5	Ditto,but wall,beam etc	for RC	cu.m	70	
6	Form works	easy case	sq.m	12	
7	Ditto,high,arc shape	intricate	sq.m	18	
8	Staging/supporting		sq.m		
9	As-con road pave.	10cm thick	sq.m	17	
10	ditto	15cm thick	sq.m	26	
11	Base coarse	40cm	sq.m	36	
12	Excavation	hard	cu.m	50	
13	ditto	medium	cu.m	30	
14		soft	cu.m	20	
15	ditto		cu.m		
16	Material transport	by road	cu.m	10	
17	ditto	waterway	cu.m	10	
18	piling works land	D=400 - 600mm	Lin.m	250	
19	ditto for offshore		lin.m	400	
20	Steel Bar Placement	<13mm	tons	2,200	
21		>12mm	tons	2,200	
	Wages of Manpower				
22	1) Foreman	8hours	day	48	
23	2) Mechanic	8hours	day	42	
24	3) Electrician	8hours	day	40	
25	4) Welder	8hours	day	50	
26	5) Carpenter	8hours	day	36	
27	6) Diver	1hours	hr	20	Per Day 200
28	7) Other skilled	8hours	day	30	
29	8) Captain	8hours	day	40	
30	9) offshore work	extra	day	1.00	Against Land Works
	Unskilled worker				
31	1) Normal Labor	8hours	day	25	
32	2) Ditto, offshore	extra	day	30	
33	3) Watchman	8hours	day	30	
34	4) Guard man	8hours	day	30	
	Special skilled				
35	1) Diver with mason	8hours	day	n.a.	
36	2) Steel fixer	8hours	day	48	
37	3) Mason	8hours	day	40	
38	4) Crane operator	8hours	day	60	
39	5) Bar bender	8hours	day	48	
40	Superintendent	8hours	day		
41	assist. engineer	8hours	day	60	
42	site/office clerk	8hours	day		