Fertilizer Consumption by Crop in the Southern Province 1986, 1987

(Unit: Tons)

		Tea	Rubber	Coconut	Paddy	Other	Total
	Galle	16,785	3,078	1,344	11,995	3,961	37,172
1	Matara	16,337	1,637	758	8,541	1,310	28,583
9	Hambantota	805	87	249	7,126	737	9,004
8	Sub Total	33,927	4,811	2,351	27,662	6,008	74,759
6	Share(%)	26.3	18.3	7.5	11.9	7.7	15.0
	Sri Lanka	128,800	26,300	31,500	232,600	77,700	496,900
	Galle	21,728	2,392	1,813	8,272	3,557	37,762
1	Matara	18,791	664	1,370	7,905	1,779	30,509
9	Hambantota	18	0	417	14,362	402	15,199
8	Sub Total	40,537	3,056	3,600	30,539	5,738	83,470
7	Share(%)	29.7	13.2	8.5	14.1	6.6	16.5
	Sri Lanka	136,700	23,200	42,200	217,100	87,200	506,400

Source: National fertilizer Secretariat, Ministry of Policy Planning and Implementation

Cement Statistics

Year	Production (000 Tons)	Import (000 Tons)	Consumption (000 Tons)	Population (000)	Per Capita Consumption (Kg)
1983	506	440	946	15,416	61.4
1984	403	456	859	15,599	55.1
1985	380	363	743	15,837	46.9
1986	558	415	973	16,117	60.4
1987	641	362	1,003	16,361	61.3
1988	633	383	1,016	16,586	61.3
1989	596	387	983	16,806	58.5

Source: 1) Annual Report & Review of the Economy, Central Bank of Sri Lanka

2) Statistical Pocket Book of Sri Lanka, Department of Census & Statistics, Ministry of Policy Planning & Implementation

3) Port Statistics, Sri Lanka Ports Authority

Appendix II-3-8

Per Capita Consumption of Cement and per Capita GNP in the World

	1947	1955	1965	1975		1980		1986	
	Cement (Kg)	Cement (Kg)	Cement (Kg)	Cement (Kg)	GNP (US$)	Cement (Kg)	GNP (US$)	Cement (Kg)	GNP (US$)
Japan	16	106	313	565	4,490	704	9,870	666	12,840
U.S.A.	210	306	326	287	7,400	287	12,000	341	17,530
England	125	213	327	301	3,900	256	7,940	244	9,010
France	104	227	443	543	6,010	524	11,900	392	10,780
Germany	65	328	573	514	6,670	528	13,340	399	12,000
Italy	70	230	398	608	3,700	723	7,480	635	8,570
Belgium	215	321	450	594	6,040	570	12,410	415	9,330
Canada	161	275	377	401	7,330	352	10,710	301	14,160
U.S.S.R.	25	111	306	470		460		476	
Indonesia	1	6	7	21	210	36	470	57	490
Thailand	3	22	39	79	360	118	670	152	800
Taiwan	32	75	142	405		748		493	
Korea	1	5	52	243	580	345	1,630	490	2,550
China	2	7	22	54	180	80	300	153	310

Source: Cement- Concrete Journal Vol.27 No.1, Japan Concrete Institute
GNP- World Tables, the World Bank (IBRD)

Appendix II-3-9

The Volume of Other Break Bulk Cargo

(Unit: Tons)

	Potatoes	Onions	Chillies	Other Drycargo		Total
				Containerized	Conventional	
1980	10,642	14,387	12,369	91,088	797,222	925,708
1981	0	5,090	2,049	198,710	524,648	730,497
1982	2,046	2,288	612	276,719	481,481	763,146
1983	2,418	3,166	688	338,939	494,518	839,729
1984	2,858	48,499	3,786	370,408	635,186	1,060,737
1985	1,232	56,543	2,947	438,086	546,039	1,044,847
1986	0	51,100	2,400	526,194	617,461	1,197,155
1987	0	33,750	1,879	578,184	620,134	1,233,947
1988	0	32,007	13,042	650,588	618,706	1,314,343
1989	0	22,310	6,946	761,200	487,031	1,277,487

Source: Sri Lanka Ports Authority, Ministry of Ports & Shipping

Statisitics on Tea Sector

No.	1	2	3	4	5	6	7		8	9
Item	Production	Registered Extent under Tea	Fertilizer Issues	3 / 2	Yield per Hectare	Cost of Production	Average Price Colombo Net	Average Price Export F.O.B.	Exports	Domestic Consumption
Unit	000 Tons.	Ha.	000 Tons.	Kgs./Ha.	Kgs./Ha.	Rs./Kg	Rs./Kg	Rs./Kg	000 Tons.	000 Tons.
1980	191.0	244,714	109.9	449.1	781	18.71	17.73	33.41	184.3	20.6
1981	210.0	244.918	103.3	421.8	857	18.79	17.71	35.14	192.0	21.0
1982	187.8	242,141	102.6	423.7	776	22.68	22.52	35.03	181.0	21.3
1983	179.3	230,065	115.5	502.0	779	26.37	36.96	52.52	157.8	25.3
1984	208.0	227,875	137.2	602.1	913	34.00	46.45	77.20	204.0	24.5
1985	214.1	231,650	149.9	647.1	924	35.00	35.39	60.62	198.0	25.0
1986	211.3	222,905	128.8	577.8	948	N.A.	30.28	44.52	207.8	23.0
1987	213.3	221,498	136.7	617.2	963	N.A.	38.06	52.97	201.1	23.0
1988	226.9	221,683	138.0	622.5	1,024	43.98	41.59	55.95	219.8	22.7
1989	207.0	222,110	124.6	561.0	932	49.70	52.16	66.91	204.2	23.0

Source: 1) Annual Report 1988, Sri Lanka Tea Board

2) National Fertilizer Secretariat, Ministry of Policy Planning and Implementation

3) Review of the Economy and Annual Reports, Central Bank of Sri Lanka

Area under Tea Cultivation in the Southern Province

(Unit: Hectare)

	Galle	Matara	Hambantota	Southern Province	Share (%)	Sri Lanka
1982	15,292	15,877	117	31,286	12.9	242,141
1983	15,306	15,875	117	31,298	13.6	230,065
1984	15,480	16,217	117	31,814	14.0	227,875
1985	16,415	16,033	120	32,568	14.1	231,650
1986	16,554	16,156	129	32,839	14.7	221,905
1987						221,498
1988	16,823	16,342	135	33,300	15.0	221,683

Source: Ministry of Agriculture

Statistics on Rubber Sector

No.	1	2	3	4	5	6	7	8		9	10
Item	Production	Total Extent under Rubber	Area under Tapping	Fertil-izer Issues	4 / 3	Yield per Hectare	Cost of Production	Average Price		Exports	Domestic Consump-tion
								Colombo RSS 1	Export F.O.B.		
Unit	Tons.	Ha.	Ha.	000 Tons.	Kgs./Ha.	Kgs./Ha.	Rs./Kg	Rs./Kg	Rs./Kg	Tons.	Tons.
1980	133,151	227,335	185,573	22.0	118.6	781	8.20	10.62	21.42	120,943	14,926
1981	123,945	205,605	175,855	16.8	95.5	705	8.92	10.04	21.80	132,523	16,216
1982	125,230	205,690	170,738	16.5	96.6	729	9.66	10.18	17.68	131,302	16,360
1983	139,997	205,650	170,482	18.5	108.5	818	9.90	13.95	22.77	125,230	16,449
1984	141,924	205,589	168,768	23.5	139.2	840	12.06	14.40	26.16	126,212	15,061
1985	137,493	204,293	154,436	24.2	156.7	894	13.67	15.90	21.34	120,448	15,089
1986	137,810	202,771	149,918	26.3	175.4	919	13.70	16.62	23.83	110,401	16,382
1987	121,806	201,861	147,484	23.2	157.3	826	13.95	19.87	27.63	106,048	19,357
1988	122,393	200,248	145,495	25.1	172.5	841	13.41	24.40	37.33	99,303	19,860
1989	110,742	199,648	144,416	21.7	150.3	767	15.01	22.63	36.17	86,020	20,875

Source: 1) Sri Lanka Rubber Statistics 1985-1986, Rubber Control Department

2) National Fertilizer Secretariat, Ministry of Policy Planning and Implementation

3) Department of Census & Statistics, Ministry of Policy Planning and Implementation

4) Review of the Economy and Annual Reports, Central Bank of Sri Lanka

Appendix II-3-13

Production of Rubber in the Sourtern Province

Year	Rubber		
	S/Province (000 Tons)	Sri Lanka (000 Tons)	Share (%)
1980		133.2	
1981		123.9	
1982	17.7	125.2	14.1
1983	19.3	140.0	13.8
1984	19.6	141.9	13.8
1985	18.8	137.5	13.7
1986	18.7	137.8	13.6
1987	16.5	121.8	13.5

Source: Marga Institute

Appendix II-3-14

Area under Tapping of Rubber in the Southern Province

(Unit: Hectare)

	Galle	Matara	Hambantota	Southern Province	Share (%)	Sri Lanka
1982	20,562	8,433	85	29,080	14.1	205,690
1983	20,229	8,084	85	28,398	13.8	205,650
1984	20,162	8,251	85	28,498	13.9	205,589
1985	19,927	8,350	87	28,364	13.9	204,293
1986	19,760	8,011	87	27,858	13.7	202,771

Source: Ministry of Agriculture

Statistics on Coconut Sector

No.	1	2	3	4	5	6	7
Item	Production	Extent under Coconut	Fertilizer Issues	Cost of Production	Ave.Price Export F.O.B.	Exports	Domestic Consumption
Unit	Mn.Nuts	Ha.	000 Tons.	Rs./Nut	Rs./Nut	Mn.Nuts	Mn.Nuts
1980	2,026	N.A.	55.8	0.40	3.15	239	1,784
1981	2,258	416,238	37.7	0.55	2.52	401	1,819
1982	2,521	N.A.	30.3	0.57	1.76	569	1,893
1983	2,312	N.A.	35.6	0.60	2.42	582	1,740
1984	1,942	419,201	50.0	0.63	4.75	327	1,660
1985	2,958	N.A.	41.0	0.64	2.55	935	2,027
1986	3,039	N.A.	31.6	0.66	1.46	1,105	1,877
1987	2,291	N.A.	42.2	0.73	2.64	538	1,731
1988	1,936	N.A.	42.0	0.81	4.00	224	1,701
1989	2,486	N.A.	37.5	0.85	3.35	572	N.A.

Source: 1) Sri Lanka Coconut Statistics 1988, Coconut Development Authority, Ministry of Coconut Industries
2) National Fertilizer Secretariat, Ministry of Policy Planning and Implementation
3) Review of the Economy and Annual Reports, Central Bank of Sri Lanka
4) Economic & Social Statistics of Sri Lanka, Central Bank of Sri Lanka

Production, Consumption & Exports of Coconuts & Coconut Products

Year	Export Volume				(Nuts per Tons)	Production		Consumption	
	Solid (Tons)	Oil (Tons)	Total (Tons)	(Mn.Nuts)		(Tons)	(Mn.Nuts)	(Tons)	(Mn.Muts)
1980	121,754	10,001	131,755	239	1,814	740,495	2,206	652,045	1,784
1981	146,692	17,203	163,895	401	2,447	825,290	2,258	664,838	1,819
1982	190,699	29,675	220,374	569	2,582	921,416	2,521	691,884	1,893
1983	193,633	31,404	225,037	582	2,586	845,027	2,312	635,963	1,740
1984	126,155	6,563	132,718	327	2,464	709,794	1,942	606,724	1,660
1985	242,041	57,662	299,703	935	3,120	1,081,138	2,958	740,861	2,027
1986	250,843	75,355	326,198	1,105	3,388	1,110,743	3,039	686,036	1,877
1987	180,431	7,940	188,371	538	2,856	837,352	2,291	632,674	1,731
1988	89,482	0	89,482	224	2,503	707,601	1,936	621,709	1,701
1989	227,372	2,400	229,772	572	2,489	908,623	2,486	662,645	1,813
Av.	176,910	23,820	200,731		2,736	868,748		659,538	

Ratio of Containerization in Sri Lanka (Import)

Year (X)	Breakbulk Cargo (000 Tons) ①	Container Cargo (000 Tons) ②	Container Ratio ②/①	Forecast ln(γ/Y(t) -1) (Y)		Estimated Results (%)
1980	2,051	91	4.44	2.8978303	γ =	9.31
1981	1,566	199	12.69	1.7400033	85	10.74
1982	1,472	277	18.81	1.2584737	α =	12.36
1983	1,882	339	18.00	1.3139706	323.110	14.17
1984	2,087	370	17.75	1.3323475	β =	16.19
1985	2,376	438	18.44	1.2836318	-0.1621	18.42
1986	2,526	526	20.83	1.1248241	r =	20.87
1987	2,524	578	22.91	0.9972177	0.816	23.53
1988	2,802	651	23.22	0.9787911		26.38
1989	2,756	761	27.62	0.7311317		29.42
1990	2,883	940				32.61
1995	3,151	1,562				49.58
1997	3,307	1,854				56.05
2001	3,617	2,421				66.93
2005	4,118	3,067				74.49
2010	4,969	3,974				79.98

Results of Correlation Analysis

Constant:	323.10990
Standard Error oh Y:	0.3686386
Coefficient of Determinants:	0.6660785
Number of Sumple:	10
Degree of Freedom:	8
Coefficient of X:	-0.162128
Standard Error of X:	0.0405857

Equation of the Logistic Curve

$$Y = 85 / \{1+e^{(323.110 - 0.162128X)}\}$$

Ratio of Containerization in Sri Lanka (Export)

Year (X)	Breakbulk Cargo (000 Tons) ①	Container Cargo (000 Tons) ②	Container Ratio ②/①	Forecast ln(γ/Y(t) -1) (Y)		Estimated Results (%)
1980	1,003	177	17.63	1.4788884	γ =	22.83
1981	986	330	33.49	0.6079352	95	27.45
1982	1,132	399	35.26	0.5271716	α =	32.58
1983	1,028	383	37.24	0.4387976	496.663	38.12
1984	1,035	470	45.45	0.0862162	β =	43.95
1985	1,037	506	48.74	-0.052184	-0.2503	49.89
1986	1,200	648	53.95	-0.273464	r =	55.75
1987	1,052	659	62.61	-0.658867	0.979	61.36
1988	987	652	66.09	-0.826911		66.58
1989	1,072	761	70.94	-1.081481		71.30
1990	1,232	930				75.47
1995	1,513	1,338				88.45
1997	1,659	1,508				90.92
2001	2,058	1,923				93.46
2005	2,559	2,416				94.43
2010	3,428	3,251				94.84

Results of Correlation Analysis

Constant:	496.66251
Standard Error oh Y:	0.1683033
Coefficient of Determinants:	0.9579851
Number of Sumple:	10
Degree of Freedom:	8
Coefficient of X:	-0.250258
Standard Error of X:	0.0185295

Equation of the Logistic Curve

$$Y = 95 / \{1+e^{(496.663 - 0.250258X)}\}$$

Tonnage per TEU and Ratio of Empty Containers

(Import)

	Port Handled (Tons)	Loaded (TEUs)	Empty (TEUs)	Weight of Loaded per TEU (Tons)	Weight of Total per TEU (Tons)	Ratio of Empty Containers (%)
1980	91,088	9,190	5,955	9.91	6.01	39.3
1981	198,710	13,960	12,394	14.23	7.54	47.0
1982	276,719	19,935	17,625	13.88	7.37	46.9
1983	338,939	26,903	11,838	12.60	8.75	30.6
1984	370,408	28,742	17,418	12.89	8.02	37.7
1985	438,086	33,054	19,688	13.25	8.31	37.3
1986	526,194	38,426	21,963	13.69	8.71	36.4
1987	578,184	42,074	23,100	13.74	8.87	35.4
1988	650,588	48,004	20,800	13.55	9.46	30.2
1989	761,200	55,062	23,339	13.82	9.71	29.8

Avrage Weight of Loaded Containers per TEU = 13.4 Tons

Avrage Weight of Total Containers per TEU = 8.8 Tons

Average Ratio of Empty Containers = 33.9 %

(Export)

	Port Handled (Tons)	Loaded (TEUs)	Empty (TEUs)	Weight of Loaded per TEU (Tons)	Weight of Total per TEU (Tons)	Ratio of Empty Containers (%)
1980	176,862	12,376	2,050	14.29	12.26	14.2
1981	330,249	21,494	2,139	15.36	13.97	9.1
1982	399,026	29,860	3,563	13.36	11.94	10.7
1983	382,863	29,692	8,576	12.89	10.00	22.4
1984	470,311	37,722	9,497	12.47	9.96	20.1
1985	505,639	41,024	9,547	12.33	10.00	18.9
1986	647,642	51,373	9,188	12.61	10.69	15.2
1987	658,638	53,466	10,436	12.31	10.31	16.3
1988	652,314	53,728	12,907	12.14	9.79	19.4
1989	760,637	60,444	20,135	12.58	9.44	25.0

Avrage Weight of Loaded Containers per TEU = 12.5 Tons

Avrage Weight of Total Containers per TEU = 10.0 Tons

Average Ratio of Empty Containers = 19.6 %

Future Volume of Containerizable Cargo in Bangladesh

(Unit: '000 tons)

Year	Import	Export	Total
1983	1,162	964	2,126
1984	1,389	864	2,253
*1985	1,432	877	2,309
*1986	1,478	889	2,367
*1987	1,525	902	2,427
*1988	1,573	915	2,488
1995	1,954	1,013	2,967
2000	2,705	1,224	3,929
2005	3,626	1,477	5,103

Source: F/S of Dhaka-narayanganj Port (1990), JICA

Note: Figures in the Year of "*" were estimated based on figures in the year of 1984 & 1995.

Containers Handled in Bangradesh

	Chittagong			
	TEU			Tonnage
	Loaded	Empty	Total	
1983	8,704	3,072	11,776	130,083
1984	14,045	4,334	18,379	175,152
1985			39,056	372,204
1986			50,133	477,767
1987	39,910	10,109	50,019	455,460
1988	47,285	8,107	55,392	548,679

Source: Containerisation International Year Book

Container Cargo Throughput in India

Year	West India		East India		Total	
	TEUs	Tons	TEUs	Tons	TEUs	Tons
1980	122,181	1,166,360	23,489	186,395	145,670	1,352,755
1981	164,721	1,364,508	43,132	367,507	207,853	1,732,015
1982	163,371	1,336,860	52,291	454,859	215,662	1,791,719
1983	173,702	1,466,209	60,912	451,721	234,614	1,917,930
1984	211,715	1,950,647	84,173	667,507	295,888	2,618,154
1985	255,128	2,220,728	138,217	1,144,151	393,345	3,364,879
1986	307,671	2,915,848	172,690	1,522,360	480,361	4,438,208

Containers Handled in East India

	Calcutta				Haldia			
	TEU			Tonnage	TEU			Tonnage
	Loaded	Empty	Total		Loaded	Empty	Total	
1977	67	546	613					
1978			558				1,318	
1979			2,048				2,430	
1980			7,838	58,326			7,630	54,328
1981			21,126	186,784			6,826	49,044
1982			28,353	231,341			5,013	35,583
1983	15,965	9,984	25,949	194,414	3,752	2,941	6,693	41,509
1984	20,169	9,054	29,223	248,065	5,869	3,805	9,674	76,927
1985	31,928	13,864	45,792	396,524	5,591	2,444	8,035	64,529
1986	37,773	16,993	54,766	488,523	10,269	5,124	15,393	124,641
1987	40,864	19,378	60,242	543,457	18,735	13,775	32,510	214,153
1988	46,715	25,920	72,635	638,973	17,857	11,875	29,732	204,782

Source: Containerisation International Year Book

Madras				Visakhapatnam			
TEU			Tonnage	TEU			Tonnage
Loaded	Empty	Total		Loaded	Empty	Total	
2,463	1,092	3,555	34,081				
		8,021	73,740				
10,660	4,420	15,080	131,100	50	50	100	579
13,431	5,126	18,557	185,062	197	171	368	2,873
21,558	6,569	28,127	215,183	36	107	143	615
33,358	11,797	45,155	341,502	88	33	121	1,013
64,857	19,005	83,862	680,111	248	280	528	2,987
84,153	16,547	100,700	890,286	1,211	620	1,831	18,910
64,323	21,905	86,228	902,581	639	580	1,219	9,685
71,788	18,864	90,652	960,009				

Containers Handled in West India

	Bombay				Cochin			
	TEU			Tonnage	TEU			Tonnage
	Loaded	Empty	Total		Loaded	Empty	Total	
1977	9,347	4,252	13,599	109,142				
1978	25,046	13,834	38,880	361,812	2,446	1,880	4,326	34,800
1979	59,997	17,835	77,832	857,392	8,063	5,766	13,829	116,400
1980	69,210	32,071	101,281	1,027,870	11,392	9,508	20,900	138,490
1981	98,541	33,359	131,900	1,169,805	15,115	12,363	27,478	138,605
1982	95,753	34,942	130,695	1,175,332	16,920	15,038	31,958	158,884
1983	104,600	36,728	141,328	1,280,487	19,023	12,279	31,302	180,250
1984	135,115	39,982	175,097	1,756,934	19,950	15,435	35,385	183,791
1985	155,945	58,746	214,691	1,983,802	22,548	14,703	37,251	211,275
1986	193,464	50,111	243,575	2,457,440	23,408	16,407	39,815	210,632
1987	211,823	44,795	256,618	2,718,875	22,886	16,036	38,922	211,574
1988	227,117	50,241	277,358	2,870,387	25,075	17,939	43,014	251,550

Source: Containerisation International Year Book

Kandla				Tuticorin			
TEU			Tonnage	TEU			Tonnage
Loaded	Empty	Total		Loaded	Empty	Total	
				3,840	1,503	5,343	56,098
				337	381	718	2,644
				577	495	1,072	5,472
				923	310	1,233	9,922
				1,944	1,242	3,186	25,651
		17,089	170,870	4,036	3,156	7,192	76,906
19,028	9,255	28,283	335,156	5,094	2,944	8,038	84,169
25,137	10,796	35,933	423,952	5,678	3,104	8,782	81,140

Appendix II-3-25

Containers Handled in Pakistan

	Karachi			
	TEU			Tonnage
	Loaded	Empty	Total	
1979			40,137	
1980	52,052	8,118	60,170	419,735
1981	70,044	19,468	89,512	806,301
1982	100,902	23,327	124,229	1,033,692
1983	107,741	32,629	140,370	1,301,631
1984			169,415	
1985	180,887	63,199	244,086	2,213,398
1986	220,695	71,473	292,168	2,713,595
1987	222,091	59,346	281,437	2,762,367

Source: Containerisation International Year Book

Appendix II-3-26

Container Cargo Throughput at 10 Ports
in the Gulf and Red Sea

Year	TEU	Tonnage	Tons/TEU
1977	395,646	2,712,289	6.86
1978	779,869	6,132,629	7.86
1979	1,087,679	8,728,666	8.03
1980	1,314,174	10,251,127	7.80
1981	1,592,141	12,157,154	7.64
1982	1,751,644	13,560,605	7,74
1983	1,969,814	14,977,855	7.60
1984	2,077,635	16,134,911	7.77
1985	1,945,692	15,918,337	8.18
1986	1,974,464	17,337,178	8.78
1987	2,108,670	19,265,548	9.14
1988	2,239,216	20,119,987	8.99

Note: Tons/TEU are including Empty Containers

Containers Hadled in Gulf and Red Sea

	Mina Sulman				Aqaba			
	TEU			Tonnage	TEU			Tonnage
	Loaded	Empty	Total		Loaded	Empty	Total	
1977	1,037	1,163	2,200	11,830	4,342	0	4,342	49,781
1978	20,129	18,824	38,953	324,940	10,076	0	10,076	93,567
1979	25,001	17,568	42,569	335,191	16,742	16,700	33,442	193,940
1980	41,339	18,857	60,196	496,054	21,256	20,500	41,756	258,662
1981			121,621	1,056,000	41,644	35,200	76,844	529,966
1982	48,412	30,515	78,927	1,185,399	54,175	49,523	103,698	719,753
1983	55,232	39,612	94,844	1,208,642	43,360	43,138	86,498	584,889
1984	66,597	45,212	111,809	1,395,096	52,420	50,065	102,485	669,703
1985	68,760	35,321	104,081	1,266,300	55,462	53,429	108,891	704,180
1986	49,725	30,668	80,393	1,026,445	62,430	59,184	121,614	742,874
1987	44,043	25,456	69,499	918,907	51,854	46,801	98,655	656,795
1988	43,975	22,819	66,794	922,340	62,132	54,540	116,672	776,254

Source: Containerisation International Year Book

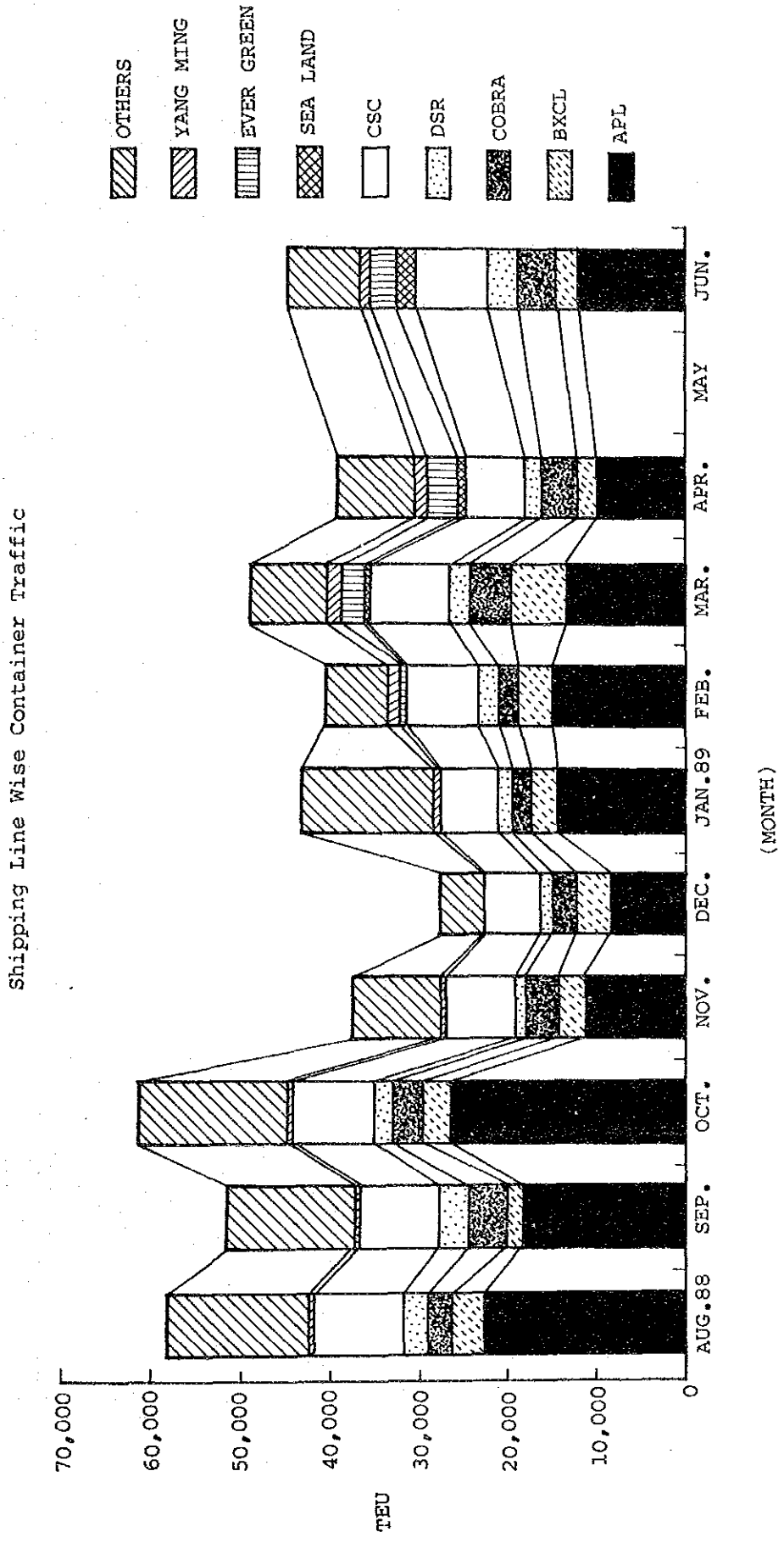
Shuwaikh				Shuaiba			
TEU			Tonnage	TEU			Tonnage
Loaded	Empty	Total		Loaded	Empty	Total	
19,038	40,336	59,374	166,010				
47,613	43,633	91,246	414,574				
64,511	57,745	122,256	852,543				
91,256	79,540	170,796	908,556				
114,543	108,683	223,226	1,153,762				
121,418	106,476	227,894	1,080,020	21,003	22,178	43,181	273,039
55,723	48,898	104,621	514,561	76,291	68,665	144,956	774,098
68,880	59,311	128,191	636,300	69,757	59,985	129,742	708,195
71,707	57,437	129,144	671,991	57,058	49,591	106,649	579,560
60,661	48,860	109,521	761,547	52,112	38,966	91,078	530,843
66,126	45,284	111,410	818,670	50,981	37,643	88,624	562,899
		117,178	684,120	61,138	41,605	102,743	679,683

Mina Qaboos				Dammam			
TEU			Tonnage	TEU			Tonnage
Loaded	Empty	Total		Loaded	Empty	Total	
						55,264	359,209
		4,566	52,100			158,445	932,103
6,390	5,557	11,947	83,100			211,250	1,392,375
9,577	8,960	18,537	127,021			250,956	1,650,935
15,270	13,638	28,908	187,660			286,510	1,936,546
23,359	20,753	44,112	293,817			344,062	2,270,588
36,257	29,644	65,901	430,602			400,273	2,640,362
52,705	37,470	90,175	619,689			363,741	2,446,348
65,955	45,641	111,596	798,387			253,288	1,895,242
71,572	39,063	110,635	829,725			206,707	1,793,615
112,502	26,754	139,256	1,183,021	154,578	68,052	222,630	1,983,400
117,813	30,069	147,882	1,113,785	148,471	59,807	208,278	1,927,313

Jeddah				Port Rashid			
TEU			Tonnage	TEU			Tonnage
Loaded	Empty	Total		Loaded	Empty	Total	
		219,128	1,445,806	35,254	20,084	55,338	679,653
		340,537	2,644,449	81,888	54,158	136,046	1,670,896
		496,390	3,785,752	98,195	71,630	169,825	2,085,765
		562,792	4,241,261			209,141	2,568,638
		618,012	4,420,585	137,697	99,323	237,020	2,872,635
		688,398	4,728,227	139,306	82,066	221,372	3,009,762
396,711	378,548	775,259	5,270,589	191,463	105,363	296,826	3,552,567
413,465	391,151	804,616	5,459,465	187,172	107,476	294,648	3,618,896
367,384	310,474	677,858	4,683,386	247,290	124,342	371,632	4,383,997
349,097	255,951	605,048	4,390,258	257,968	125,221	383,189	4,672,394
329,546	267,376	596,922	4,357,319	375,151	147,994	523,145	6,479,830
353,892	241,139	595,031	4,405,216	435,131	122,390	557,521	6,847,389

Appendix II-3-27
(Continued)

Fujairah				Khor Fakkan			
TEU			Tonnage	TEU			Tonnage
Loaded	Empty	Total		Loaded	Empty	Total	
121	515	636	1,545				
38,261	13,967	52,228	581,219				
66,450	16,103	82,553	935,294				
64,600	18,679	83,279	960,170			183,000	1,629,307
		188,129	1,651,295	50,676	19,724	70,400	653,412
145,073	57,820	202,893	1,684,500	86,351	37,873	124,224	1,079,387


Shipping Line Wise Container Traffic
OTHERS
YANG MING
EVER GREEN
SEA LAND
CSC
DSR
COBRA
BXCL
APL
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
TEU
AUG.88
SEP.
OCT.
NOV.
DEC.
JAN.89
FEB.
MAR.
APR.
MAY
JUN.
(MONTH)

Shipping Line Wise Container Traffic (Monthly)

(UNIT: TEU)

SHIPPING LINES	ITEMS	AUG.88	SEP.	OCT.	NOV.	DEC.	JAN.89	FEB.	MAR.	APR.
APL	NO.OF VESSELS	18	14	15	10	10	14	16	17	21
	NO.OF CONTAINERS	22,804	18,720	27,022	11,842	9,029	15,315	15,864	14,187	10,971
	SHARE(%)	39%	36%	43%	31%	32%	35%	38%	28%	27%
	PER VESSEL	1,267	1,337	1,801	1,184	903	1,094	992	835	522
BXCL	NO.OF VESSELS	9	4	7	8	9	11	11	17	7
	NO.OF CONTAINERS	3,848	1,642	3,170	3,128	3,868	2,843	3,760	6,112	1,966
	SHARE(%)	7%	3%	5%	8%	14%	6%	9%	12%	5%
	PER VESSEL	428	411	453	391	430	258	342	360	281
COBRA	NO.OF VESSELS	3	5	3	4	5	4	3	10	7
	NO.OF CONTAINERS	2,657	4,612	3,292	3,651	2,716	2,133	2,278	4,873	4,104
	SHARE(%)	5%	9%	5%	9%	10%	5%	5%	10%	10%
	PER VESSEL	886	922	1,097	913	543	533	759	487	586
DSR	NO.OF VESSELS	6	6	5	3	3	6	5	5	5
	NO.OF CONTAINERS	2,904	3,187	2,108	987	1,474	1,551	2,191	2,262	1,726
	SHARE(%)	5%	6%	3%	3%	5%	4%	5%	5%	4%
	PER VESSEL	484	531	422	329	491	259	438	452	345
CSC	NO.OF VESSELS	14	13	16	11	11	12	12	15	12
	NO.OF CONTAINERS	9,839	9,140	9,184	8,310	6,465	6,628	8,003	9,172	6,724
	SHARE(%)	17%	18%	15%	22%	23%	15%	19%	18%	17%
	PER VESSEL	703	703	574	755	588	552	667	611	560
SEA LAND	NO.OF VESSELS	2	2	1	1		2	2	2	3
	NO.OF CONTAINERS	442	381	296	478		469	309	327	1,120
	SHARE(%)	1%	1%	0%	1%		1%	1%	1%	3%
	PER VESSEL	221	191	296	478		235	155	164	373
EVER GREEN	NO.OF VESSELS							3	10	11
	NO.OF CONTAINERS							717	2,738	3,242
	SHARE(%)							2%	5%	8%
	PER VESSEL							239	274	295
YANG MING	NO.OF VESSELS						6	9	9	9
	NO.OF CONTAINERS						451	1,344	1,481	1,574
	SHARE(%)						1%	3%	3%	4%
	PER VESSEL						75	149	165	175
OTHERS	NO.OF VESSELS	58	42	54	38	39	48	49	49	50
	NO.OF CONTAINERS	16,282	14,289	17,096	10,108	5,023	14,655	7,160	8,874	8,885
	SHARE(%)	28%	27%	27%	26%	18%	33%	17%	18%	22%
	PER VESSEL	281	340	317	266	129	305	146	181	178
TOTAL	NO.OF VESSELS	110	86	101	75	77	103	110	134	125
	NO.OF CONTAINERS	58,776	51,971	62,168	38,504	28,575	44,045	41,626	50,026	40,312
	SHARE(%)	100%	100%	100%	100%	100%	100%	100%	100%	100%
	PER VESSEL	534	604	616	513	371	428	378	373	322

Appendix II-4-1 Newly Introduced Vessels with More Than 3000 TEU in 1989

Operator	TEU	ROUTE
K LINE	3,450	FE, J/E
ditto	3,450	ditto
MAERSK	4,000	FE/PSW/ECNA/E
ditto	4,200	ditto
ditto	4,200	ditto
NOL	3,502	FE, J/E
ditto	3,300	ditto
OOCL	3,800	ditto
ditto	3,494	ditto
P & OCL	3,610	J, KO,TW,HK/E
ditto	3,610	TW,HK,SP,MY/E

Note:

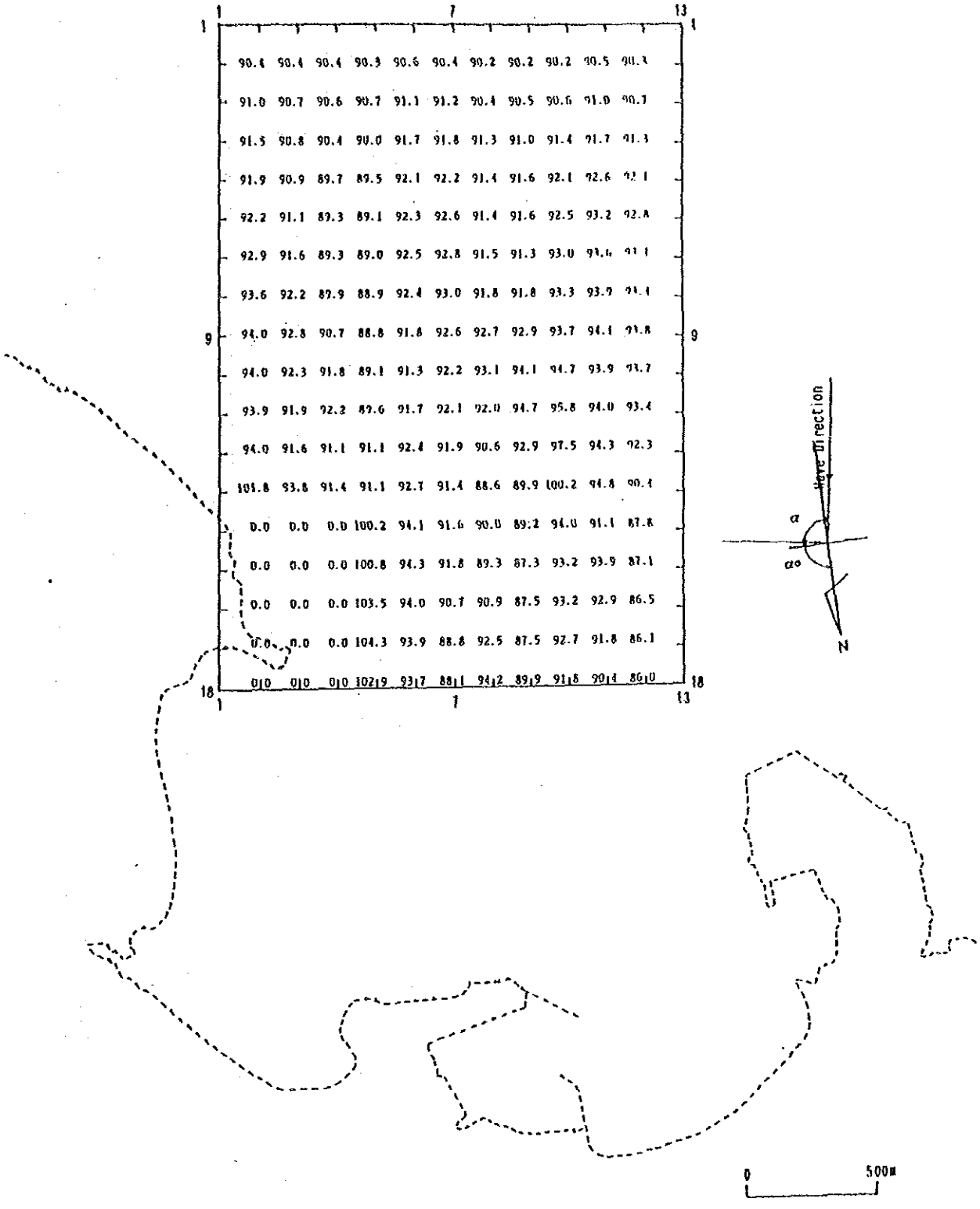
FE: Far East
J: Japan
E: Europe
PSW: Pacific South West
ECNA: East Coast of North America
KO: Korea
TW: Taiwan
HK: Hong Kong
SP: Singapore
MY: Malaysia

Appendix II-4-2 New Building Orders of Container Vessel by Size

	1987			1988			1989		
TEU Class	VSL (%)	DWT	TEU (%)	VSL (%)	DWT	TEU (%)	VSL (%)	DWT	TEU (%)
Under 1000	35 (47)	436,310	15,995 (13)	21 (34)	234,136	12,321 (13)	29 (22)	463,560	14,528 (6)
1000 ~1999	6 (8)	174,200	11,080 (9)	20 (33)	315,810	21,498 (22)	56 (42)	1,081,820	73,319 (32)
2000 ~2999	19 (26)	741,840	46,930 (37)	10 (16)	385,000	27,140 (28)	30 (23)	1,224,760	78,300 (34)
3000 ~3999	11 (15)	563,400	38,484 (31)	7 (12)	322,587	24,550 (25)	11 (8)	547,860	37,100 (16)
4000 ~over	3 (4)	165,000	12,000 (10)	3 (5)	181,917	12,000 (12)	6 (5)	330,000	26,425 (12)
Total	74 (100)	2,080,750	124,489 (100)	61 (100)	1,439,450	97,509 (100)	132 (100)	3,648,000	229,672 (100)

Deep Water Wave Direction S 6°W

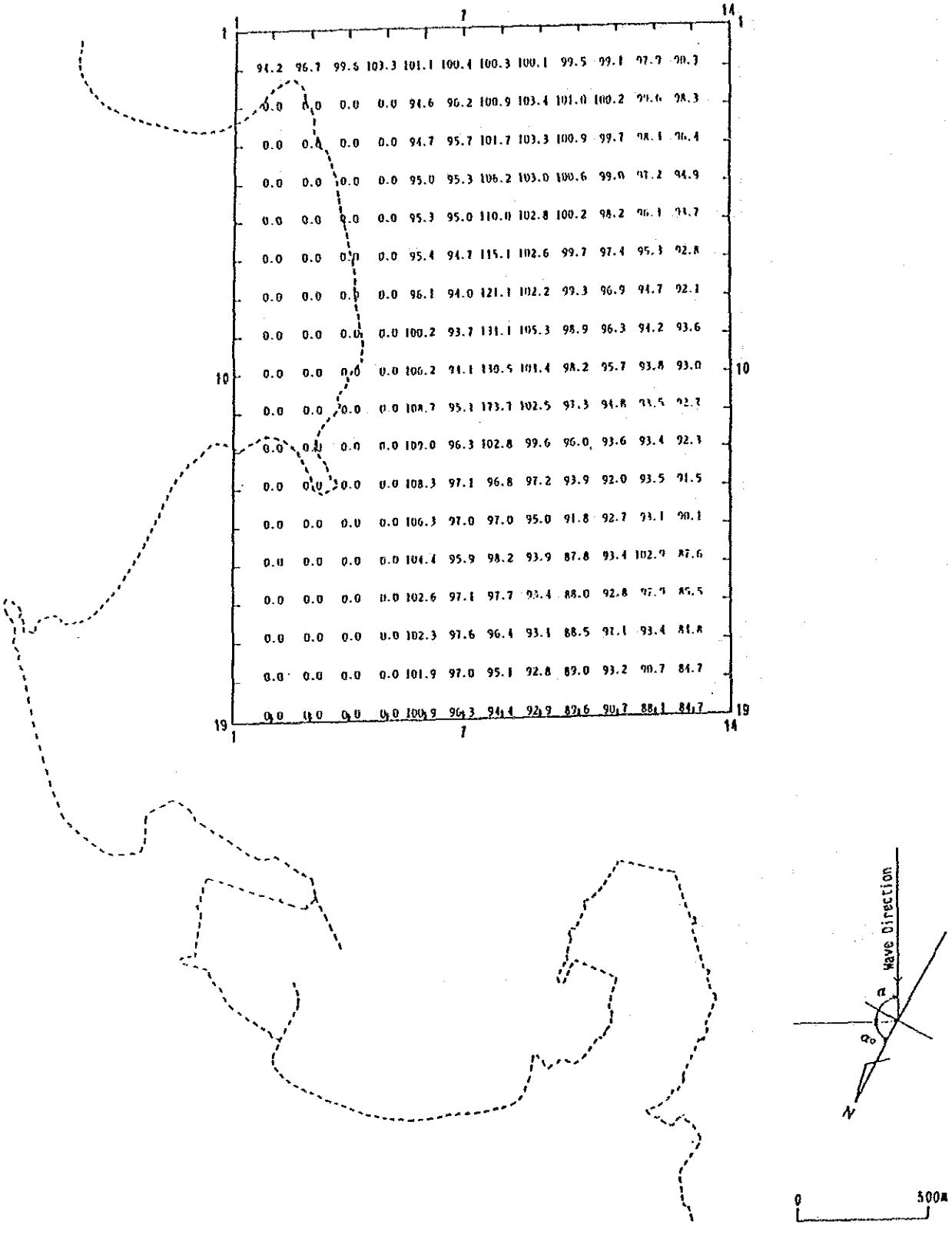
$T_{1/3}$=13.0sec, α_0=99.0°



Appendix II-4-3(1) Refraction Diagram

Deep Water Wave Direction ESE

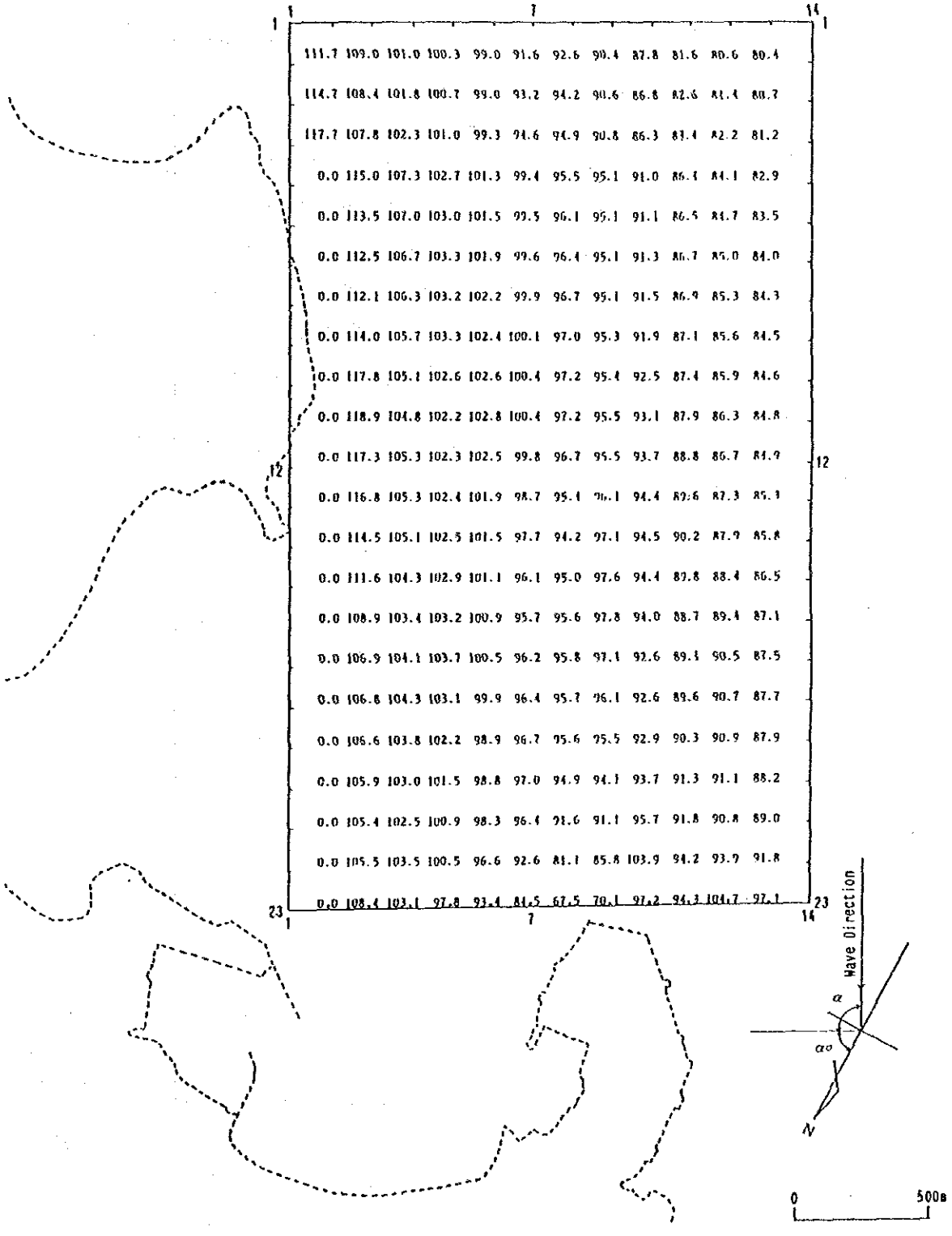
$T_{1/3}$= 7.0sec, α_0=61.0°



Appendix II-4-3(2) Refraction Diagram

Deep Water Wave Direction SE

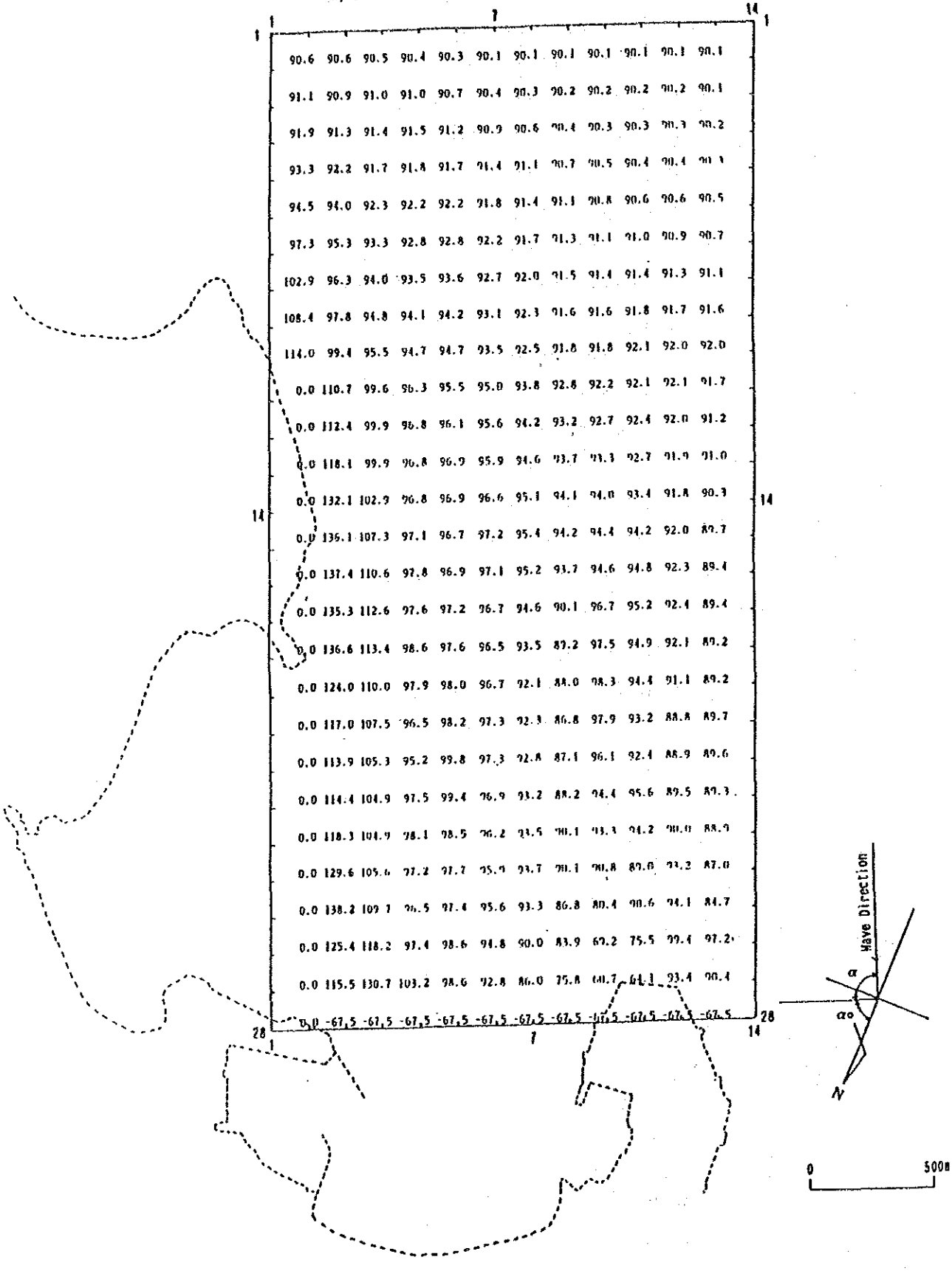
$T_{1/3}$= 7.0sec, α_0=62.0°



Appendix II-4-3(3) Refraction Diagram

Deep Water Wave Direction SSE

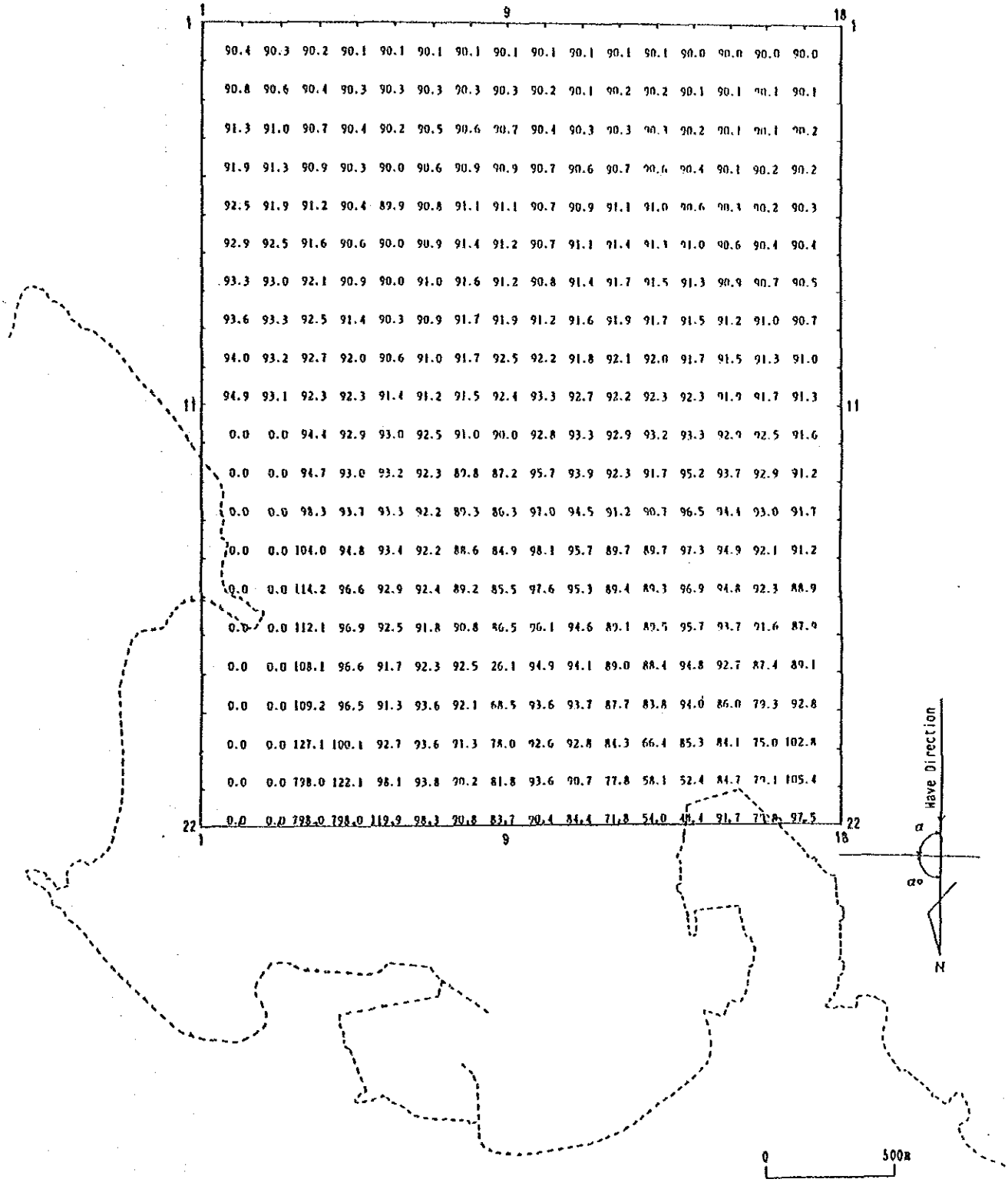
$T_{1/3}$= 7.0sec, α_0=67.5°



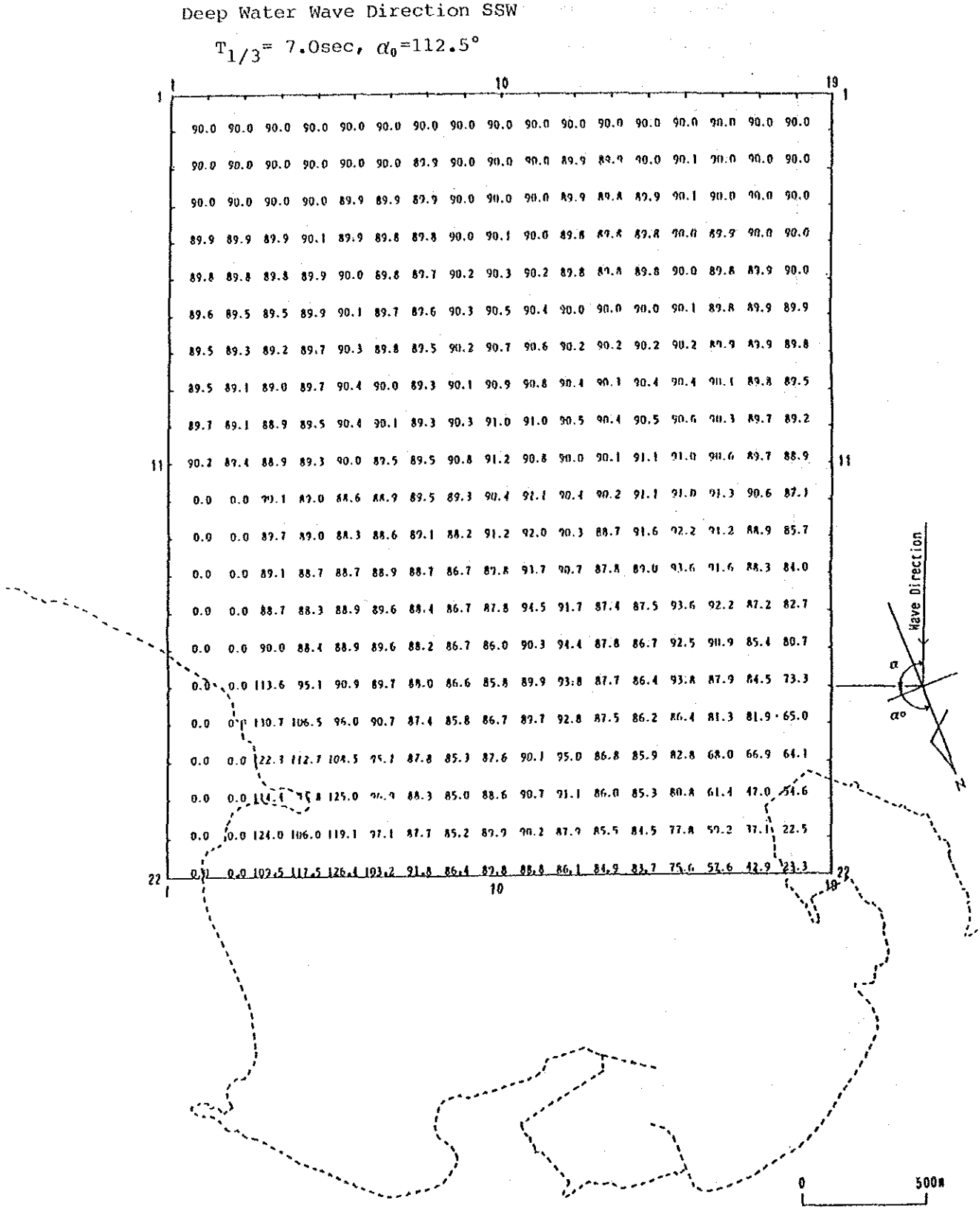
Appendix II-4-3(4) Refraction Diagram

Deep Water Wave Direction S

$T_{1/3}$=13.0sec, α_0=90.0°



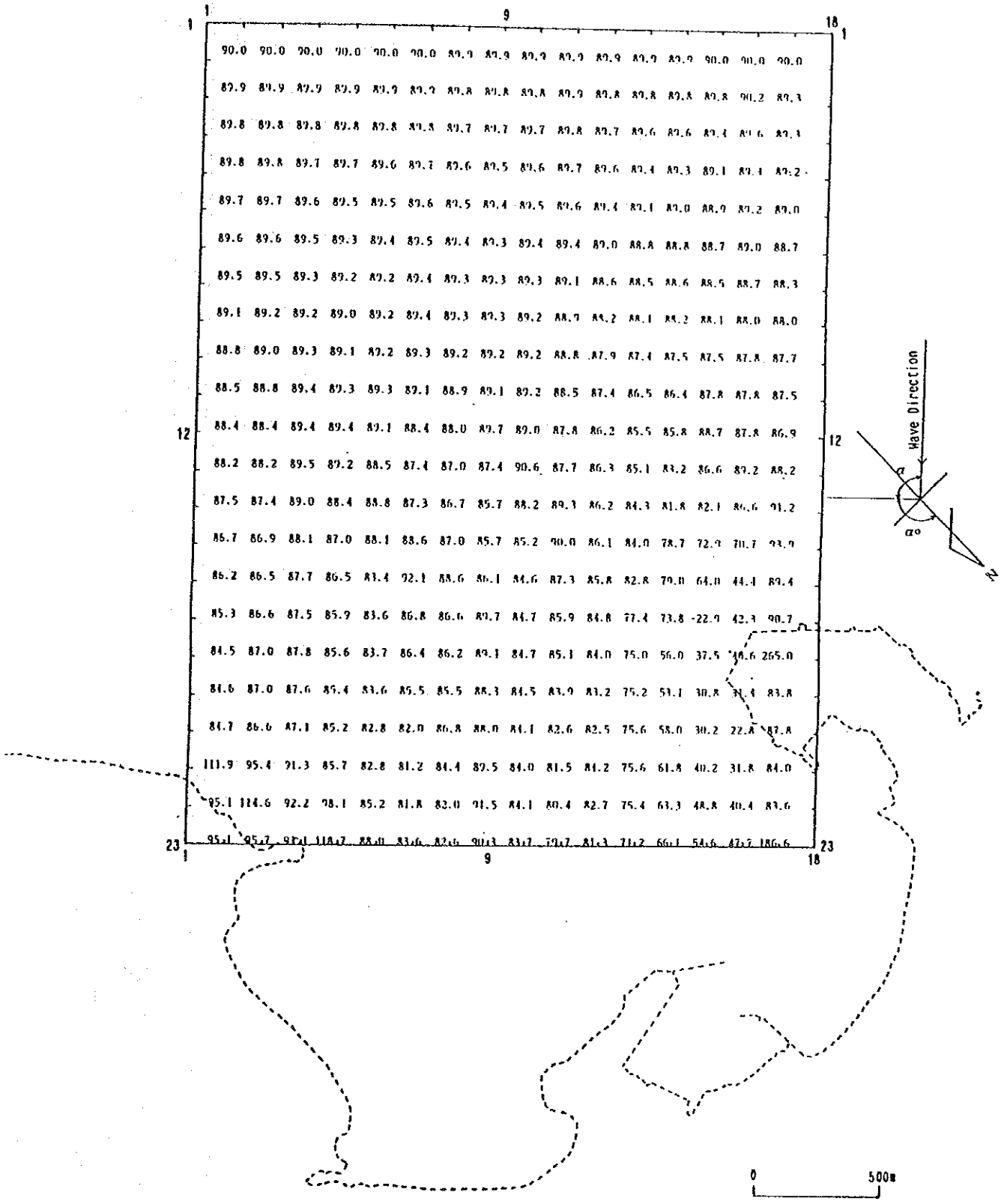
Appendix II-4-3(5) Refraction Diagram



Appendix II-4-3(6) Refraction Diagram

Deep Water Wave Direction SW

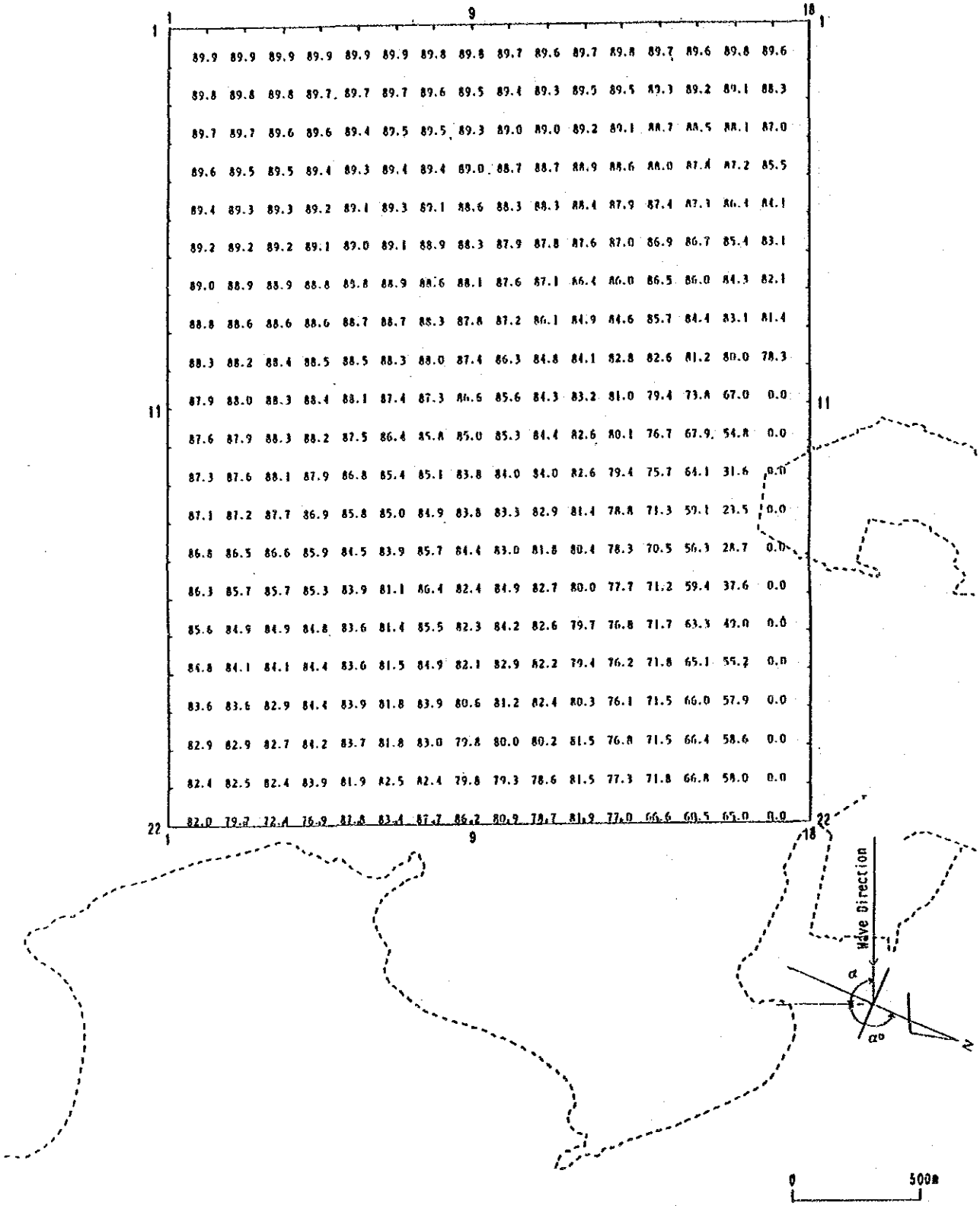
$T_{1/3}$= 7.0sec, α_0=135.0°



Appendix II-4-3(7) Refraction Diagram

Deep Water Wave Direction WSW

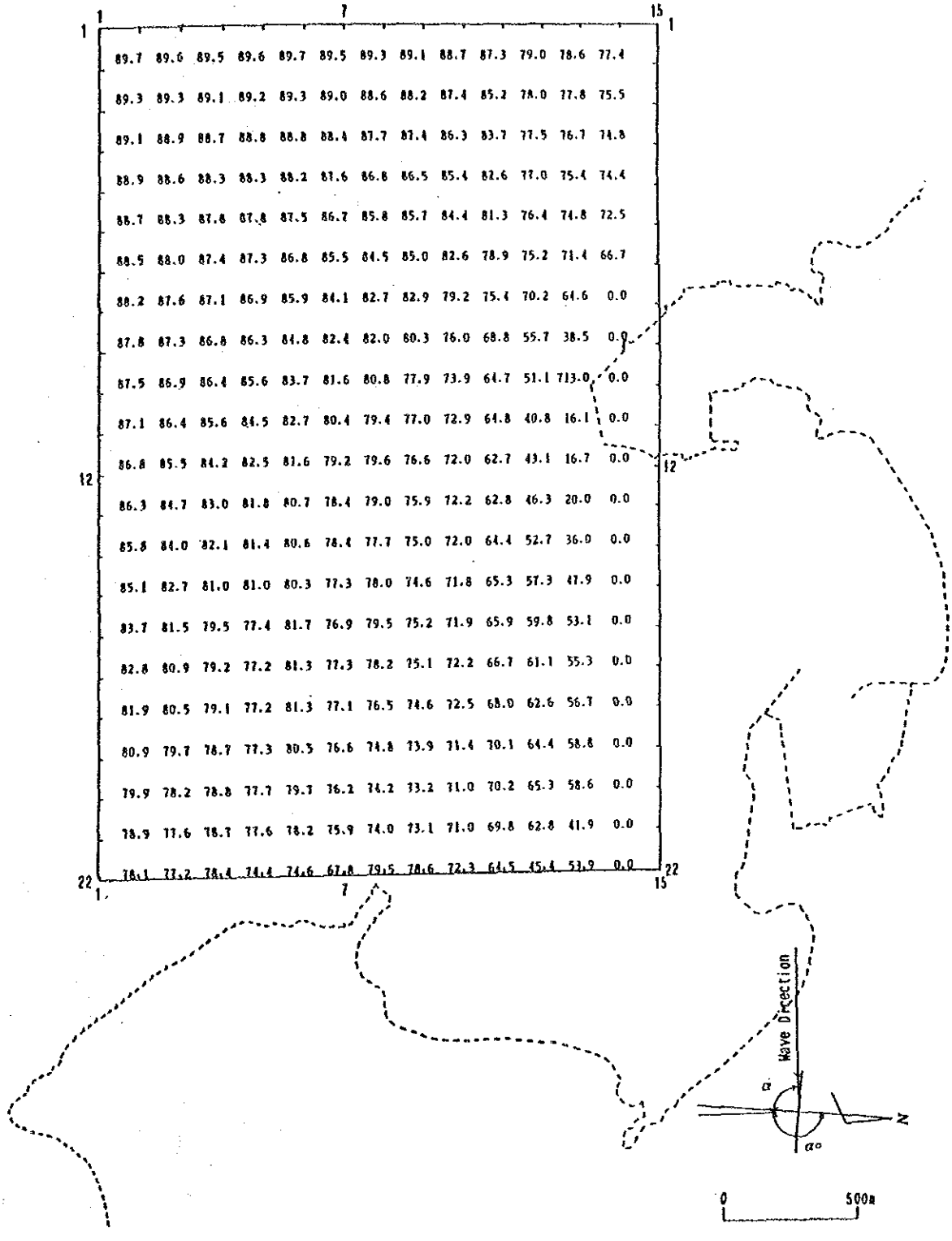
$T_{1/3}$= 7.0sec, α_0=157.5°



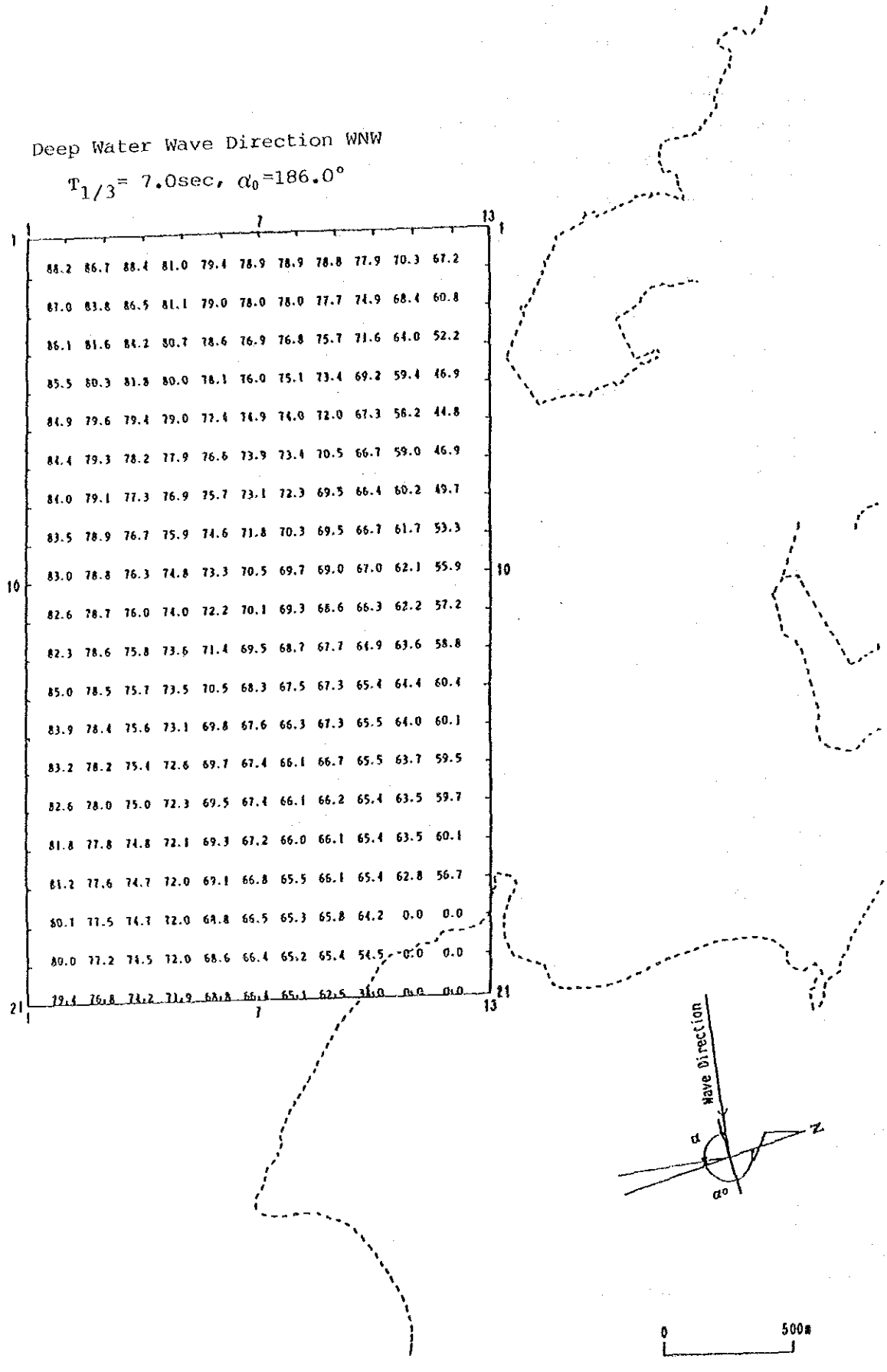
Appendix II-4-3(8) Refraction Diagram

Deep Water Wave Direction W

$T_{1/3}$= 7.0sec, α_0=175.0°



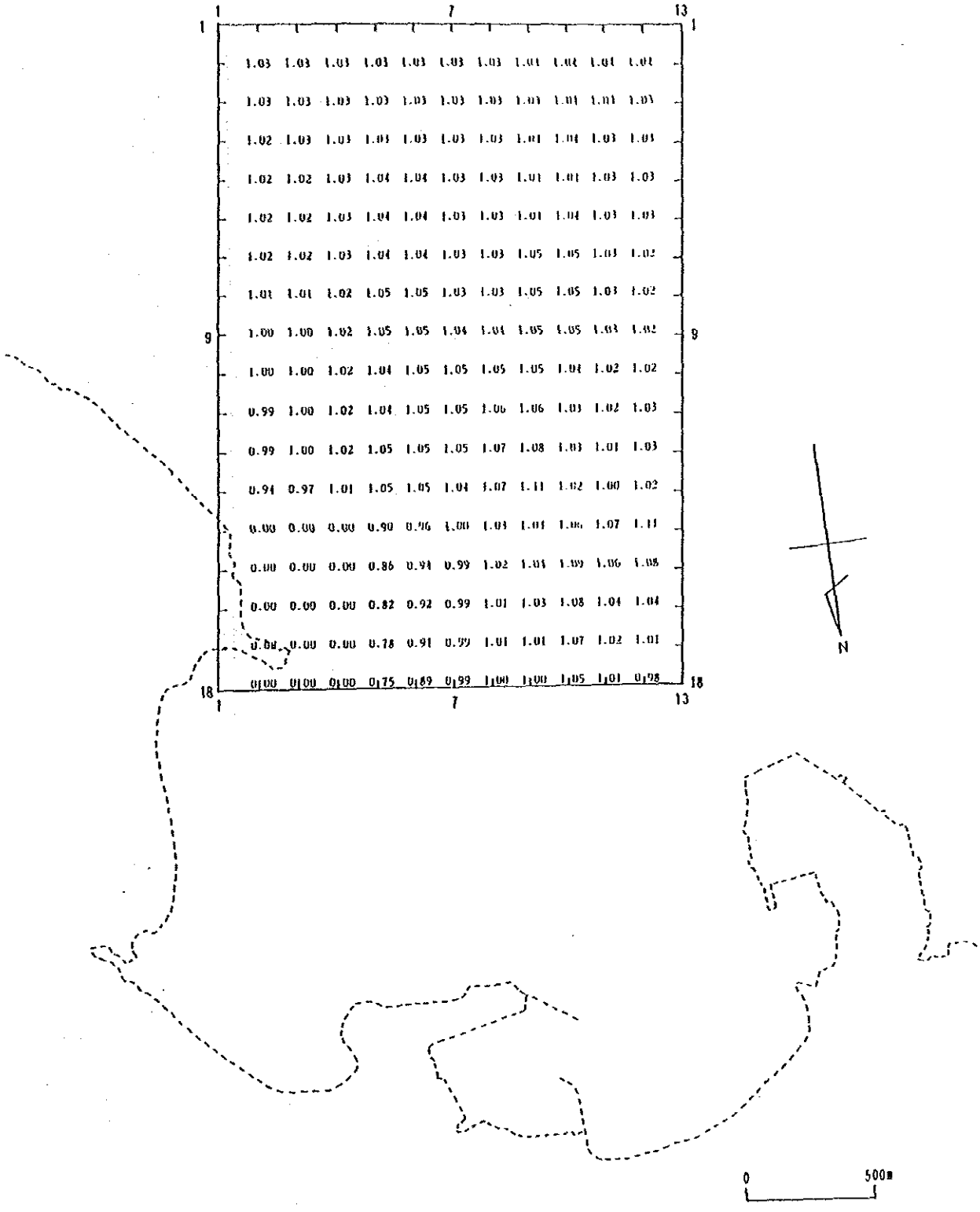
Appendix II-4-3(9) Refraction Diagram



Appendix II-4-3(10) Refraction Diagram

Deep Water Wave Direction S 6°W

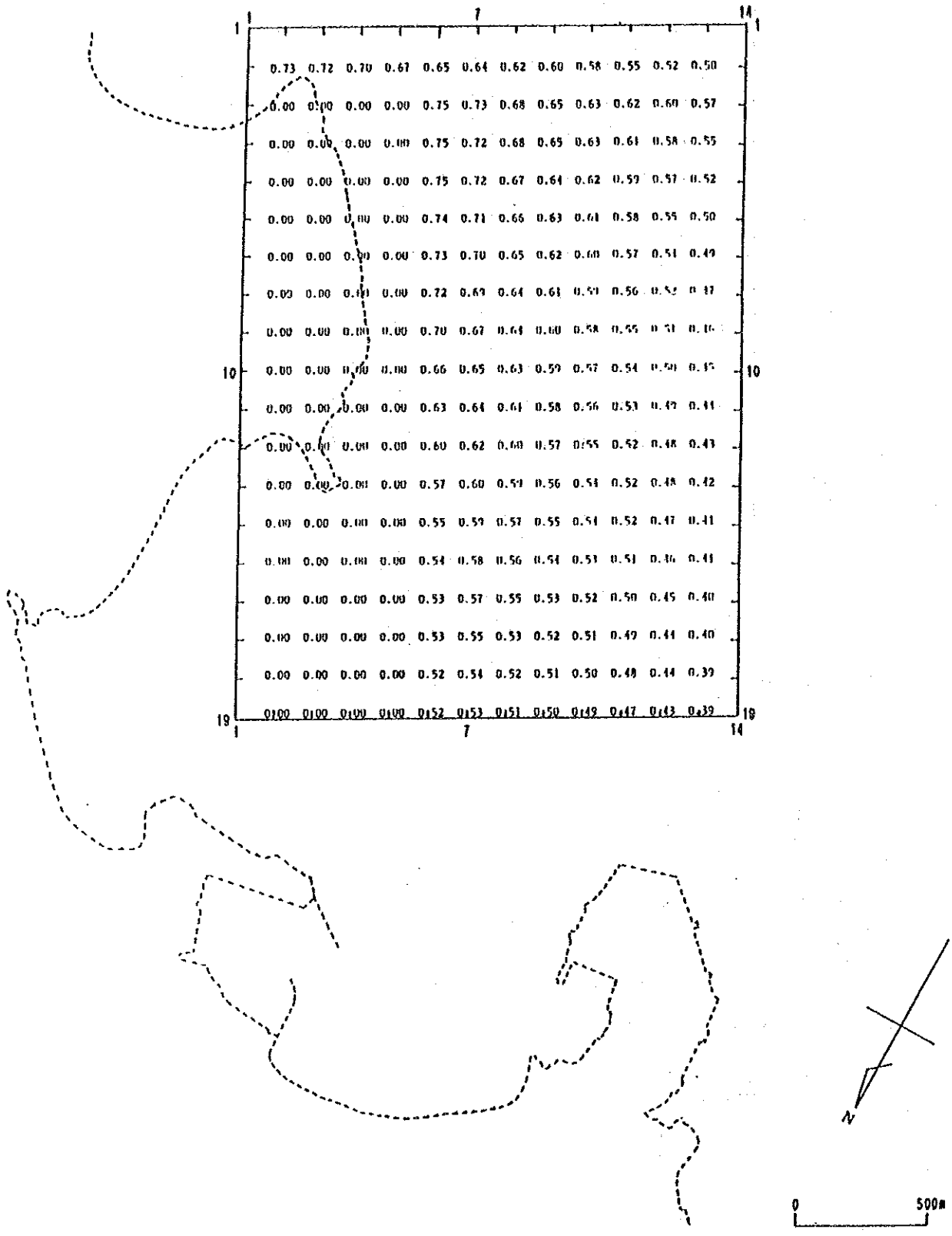
$T_{1/3}$=13.0sec



Appendix II-4-4(1) Coefficient of Refraction

Deep Water Wave Direction ESE

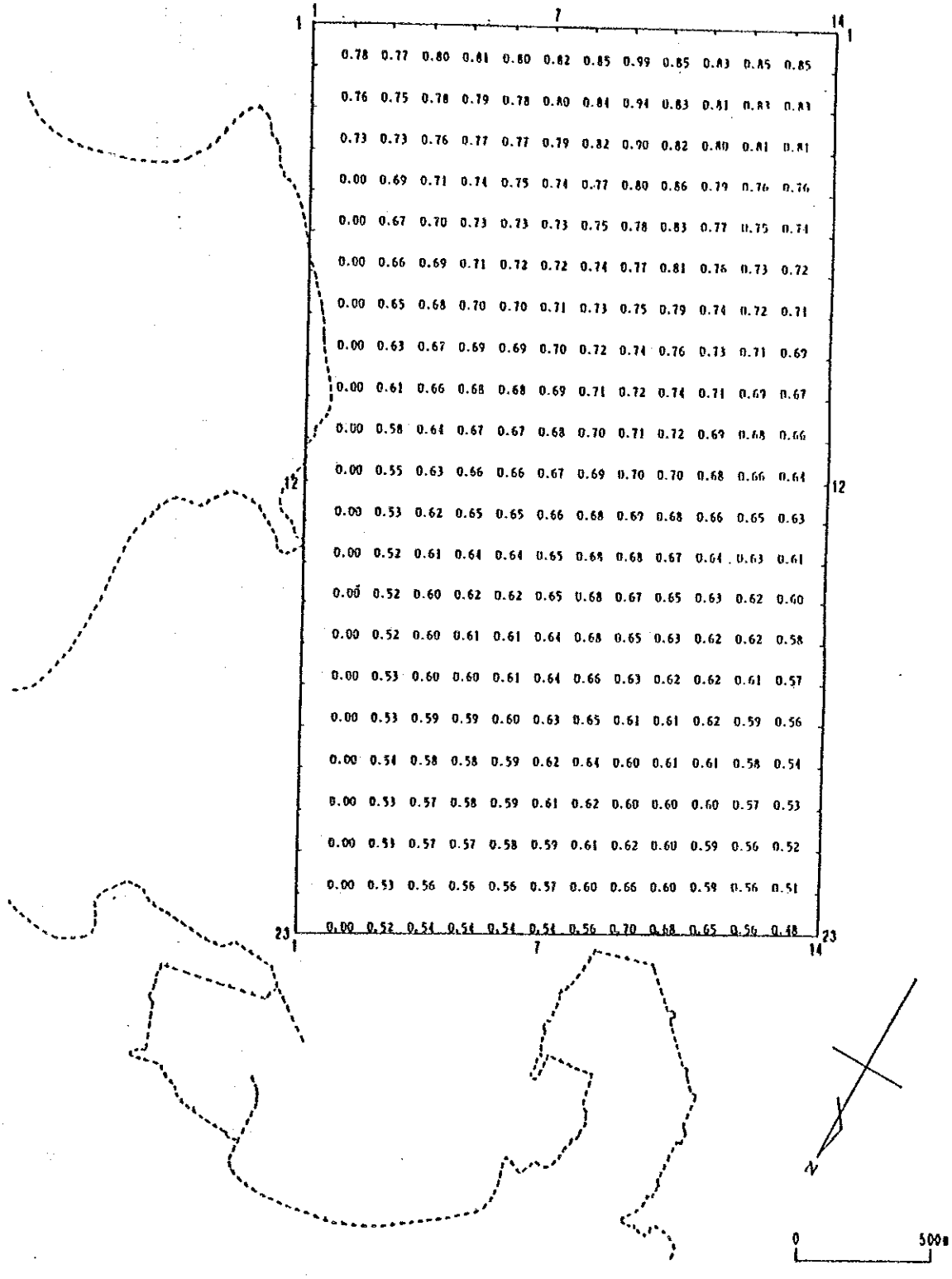
$T_{1/3}$= 7.0sec



Appendix II-4-4(2) Coefficient of Refraction

Deep Water Wave Direction SE

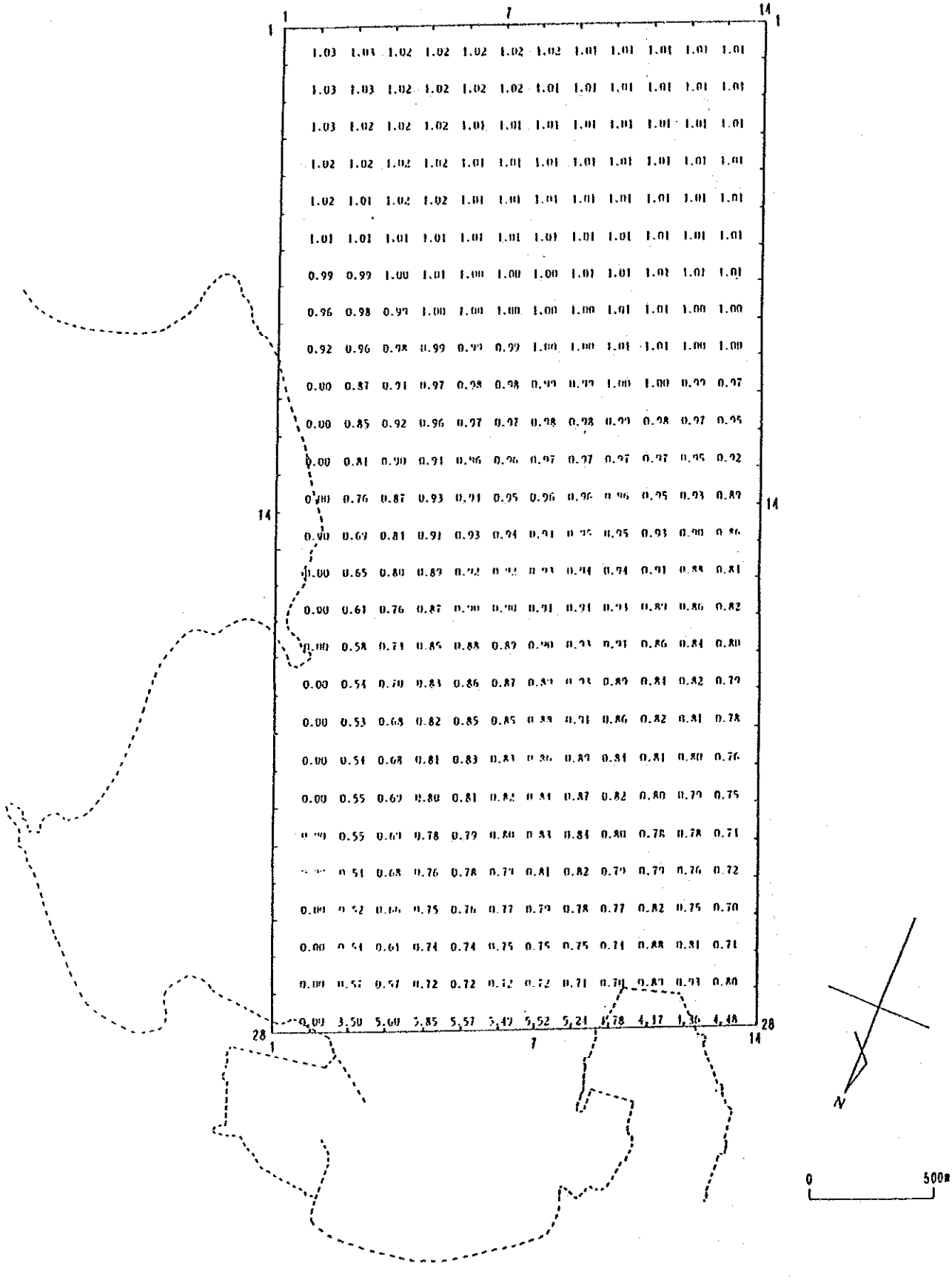
$T_{1/3}$= 7.0sec



Appendix II-4-4(3) Coefficient of Refraction

Deep Water Wave Direction SSE

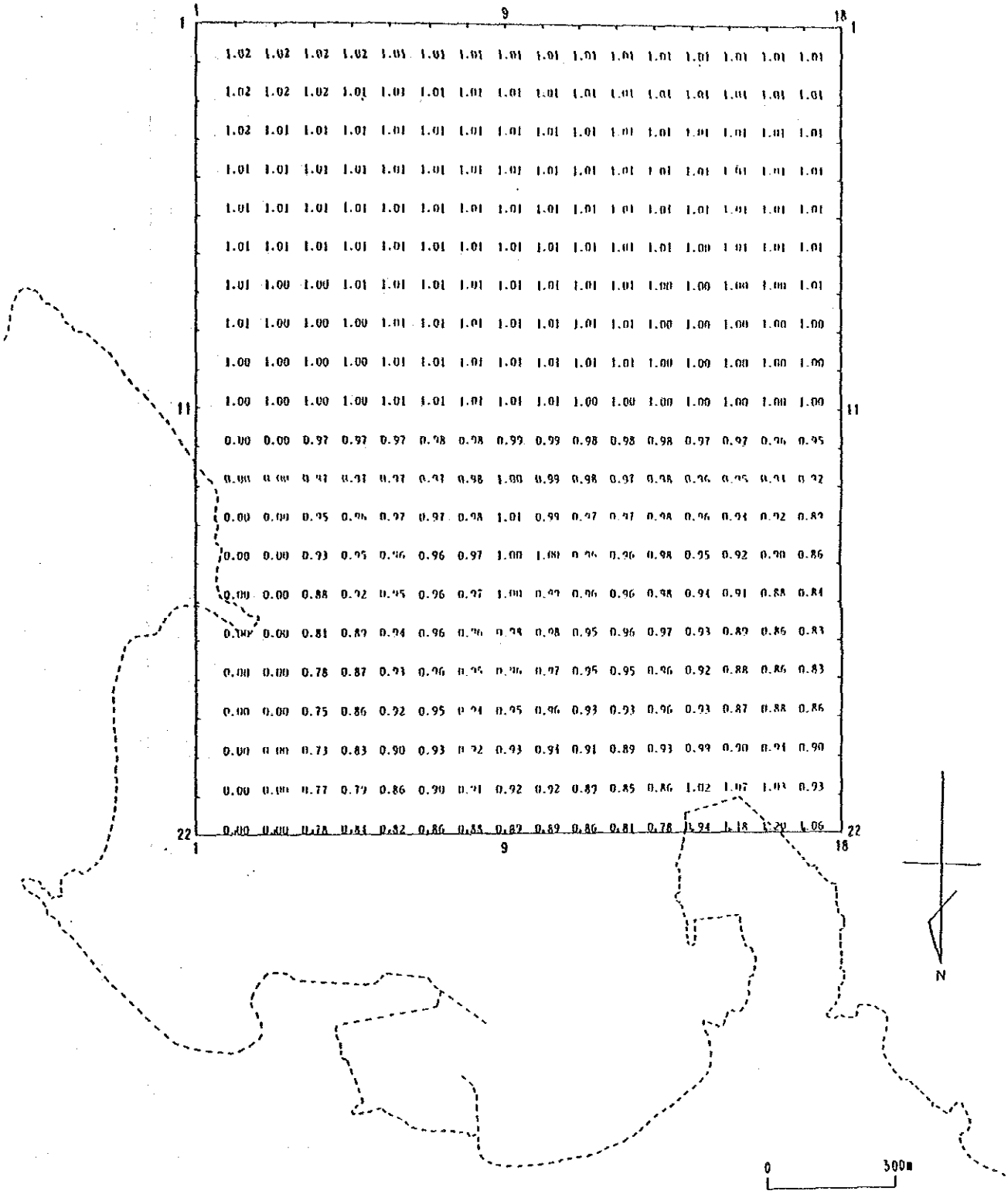
$T_{1/3}$= 7.0sec



Appendix II-4-4(4) Coefficient of Refraction

Deep Water Wave Direction S

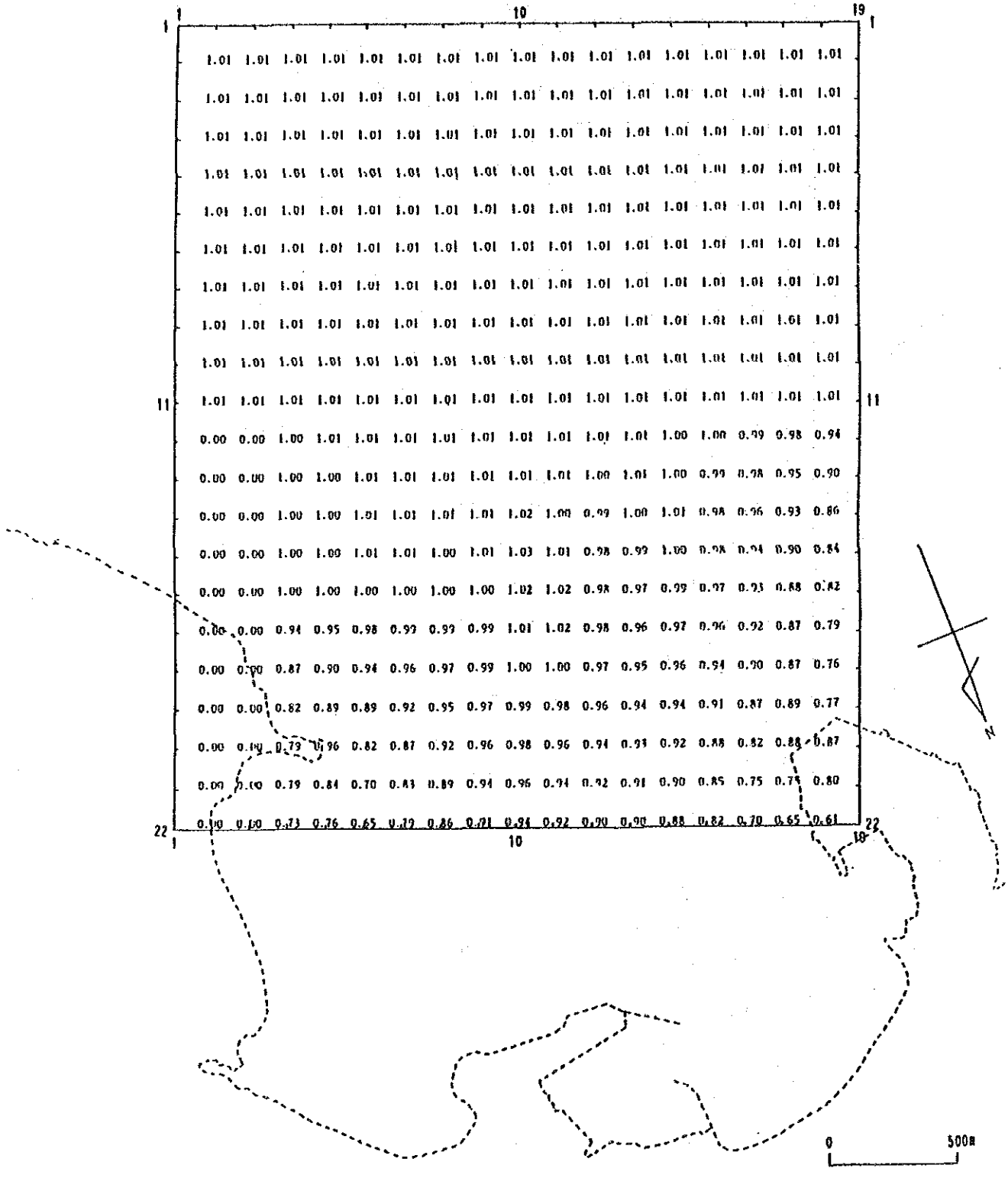
$T_{1/3}$=13.0sec



Appendix II-4-4(5) Coefficient of Refraction

Deep Water Wave Direction SSW

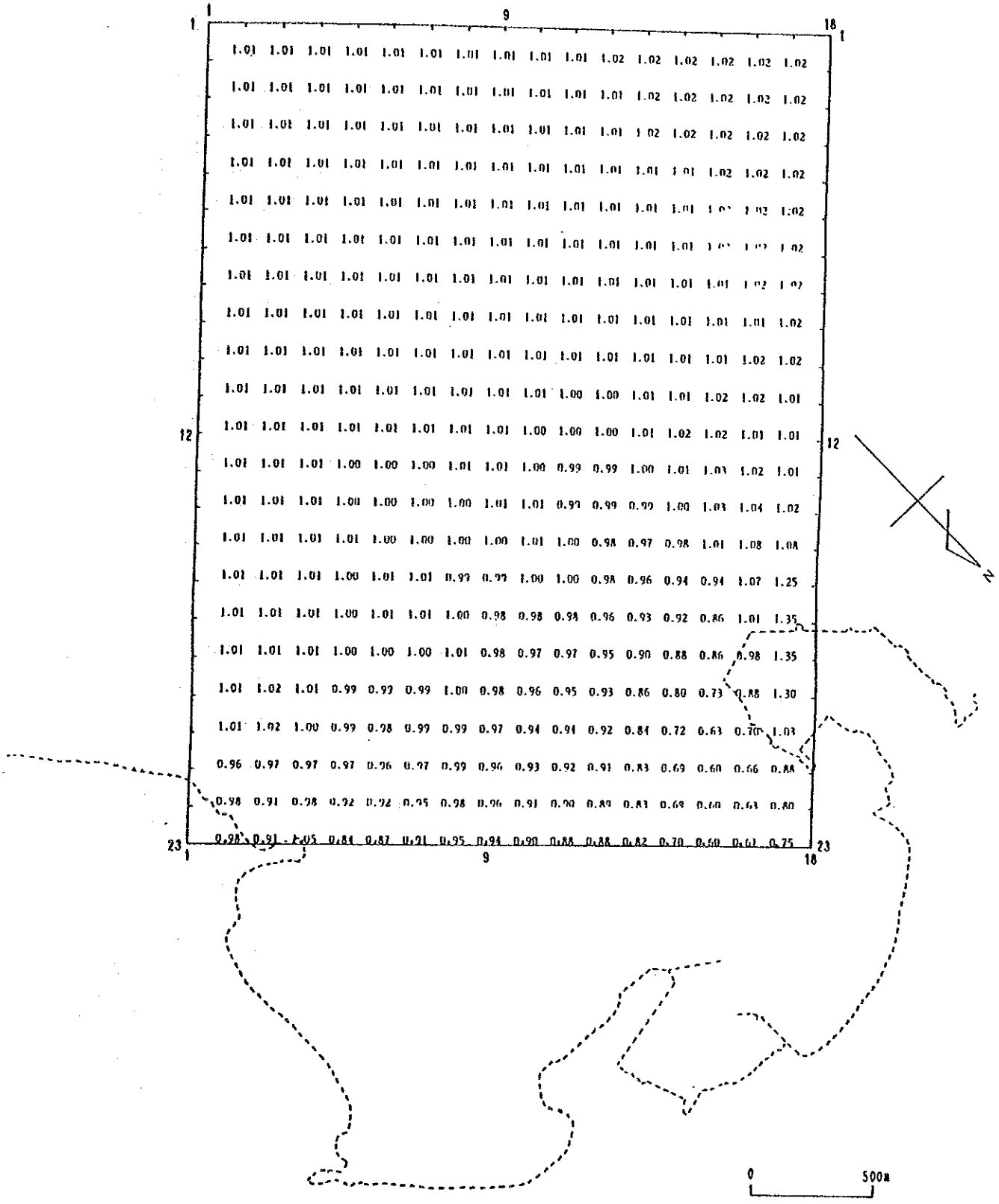
$T_{1/3}$= 7.0sec



Appendix II-4-4(6) Coefficient of Refraction

Deep Water Wave Direction SW

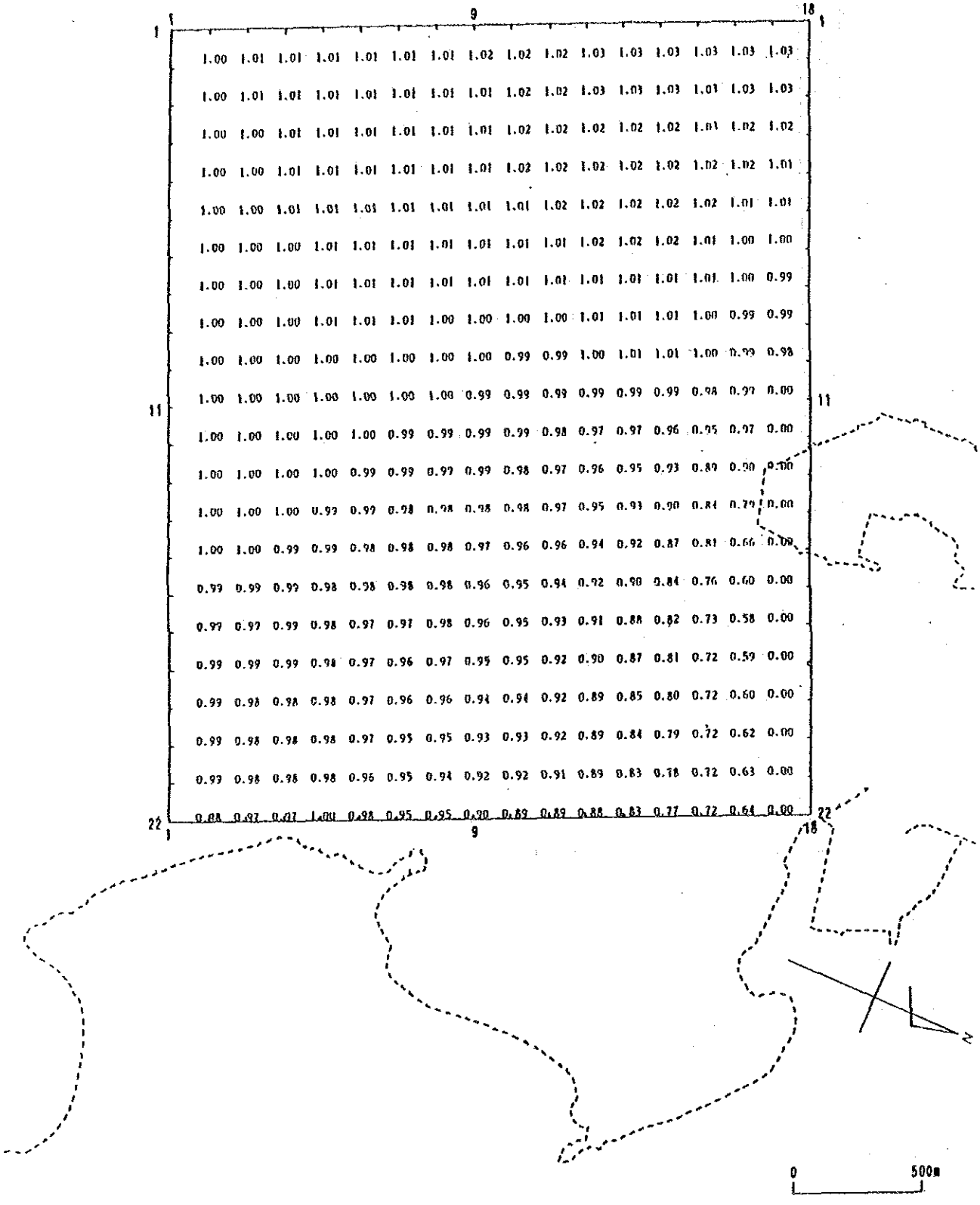
$T_{1/3}$= 7.0sec



Appendix II-4-4(7) Coefficient of Refraction

Deep Water Wave Direction WSW

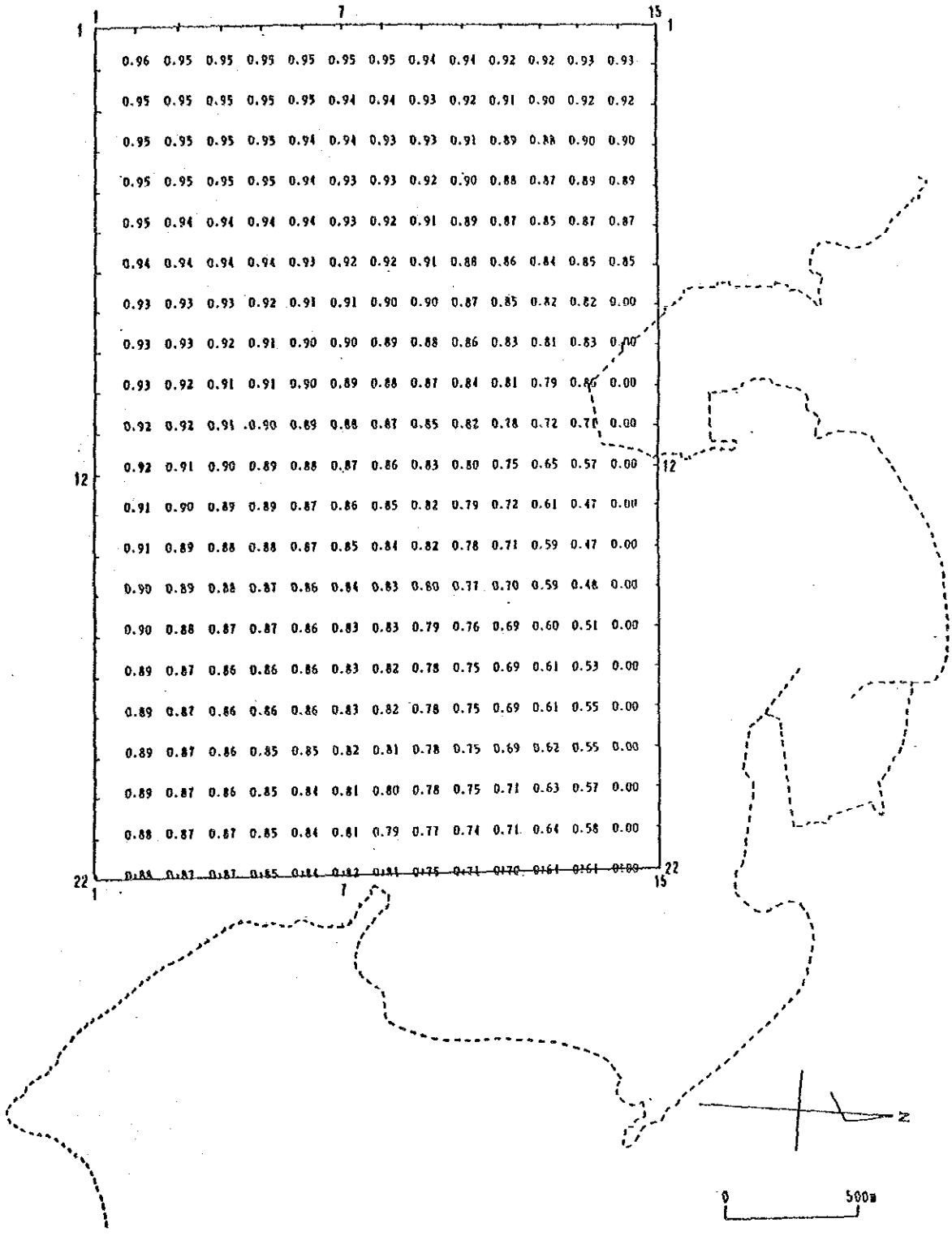
$T_{1/3}$= 7.0sec



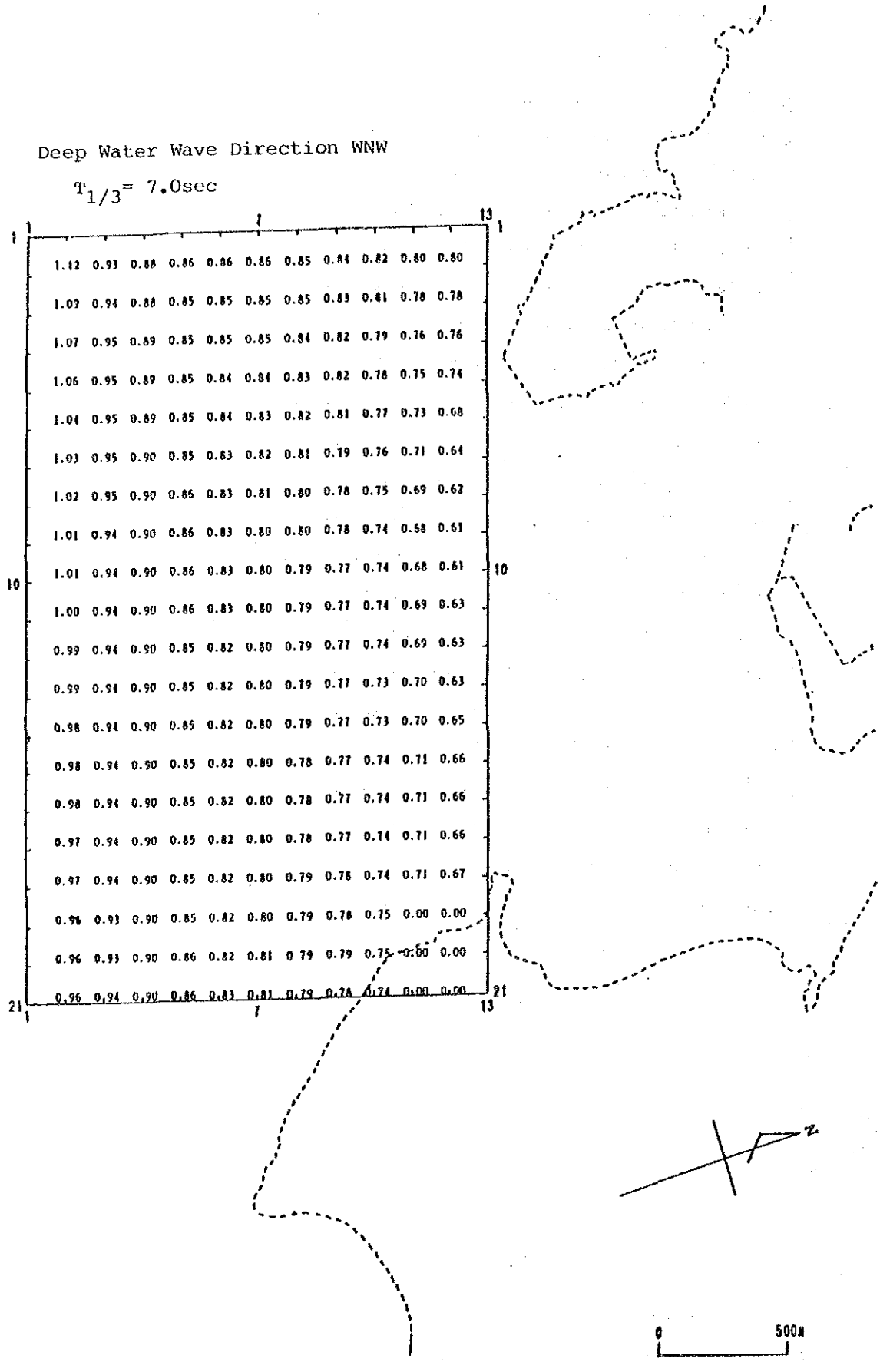
Appendix II-4-4(8) Coefficient of Refraction

Deep Water Wave Direction W

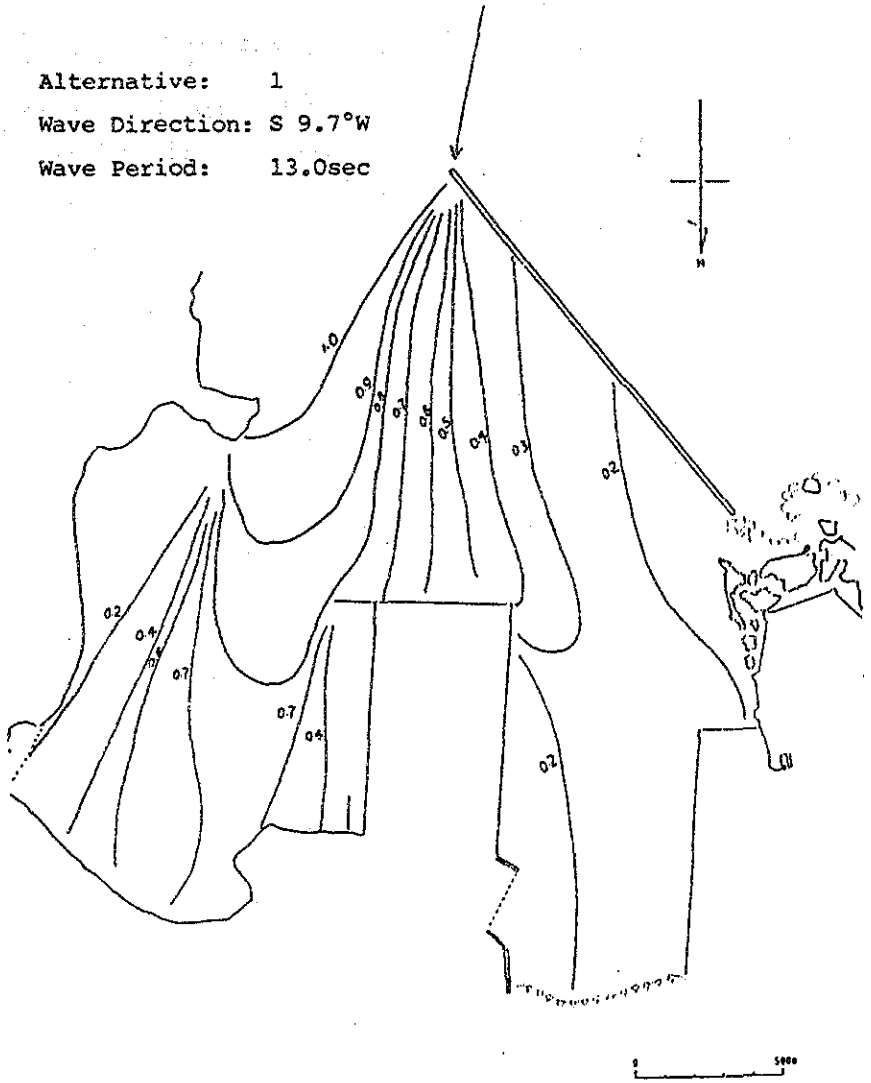
$T_{1/3}$= 7.0sec



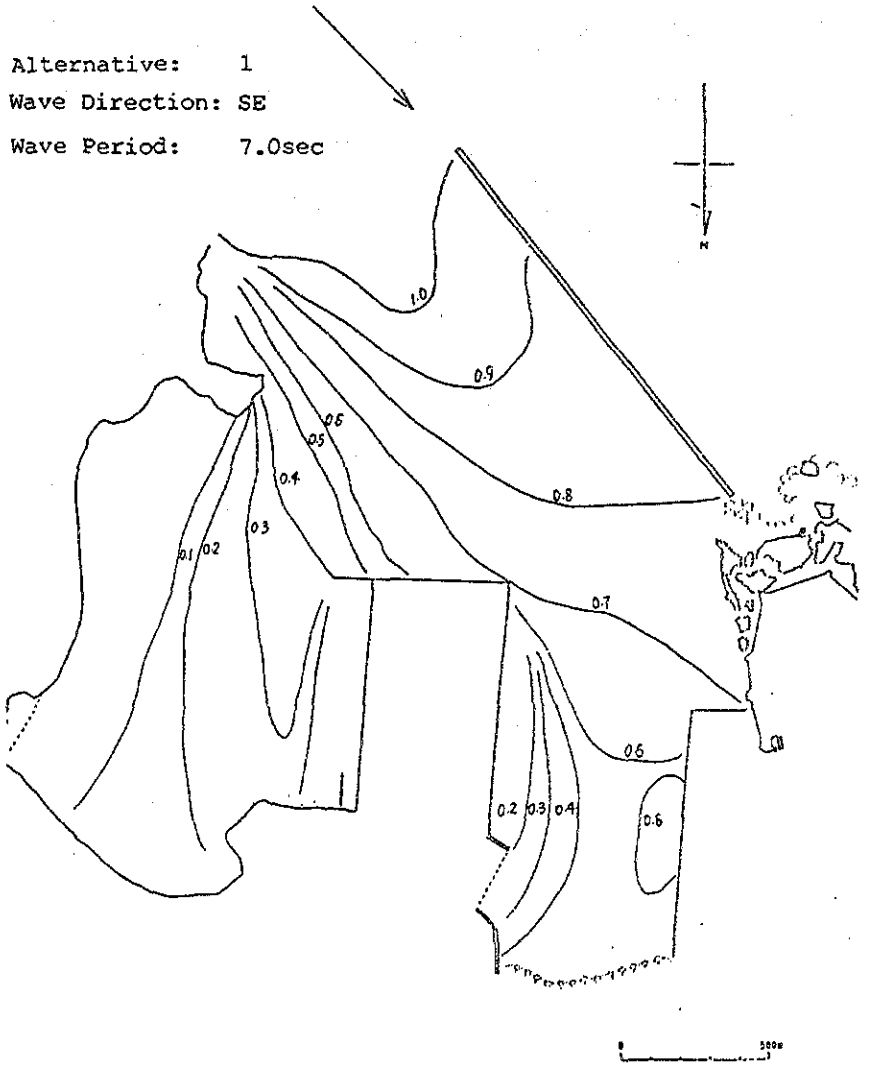
Appendix II-4-4(9) Coefficient of Refraction



Appendix II-4-4(10) Coefficient of Refraction



Appendix II-4-5(1) Wave Height Ratio



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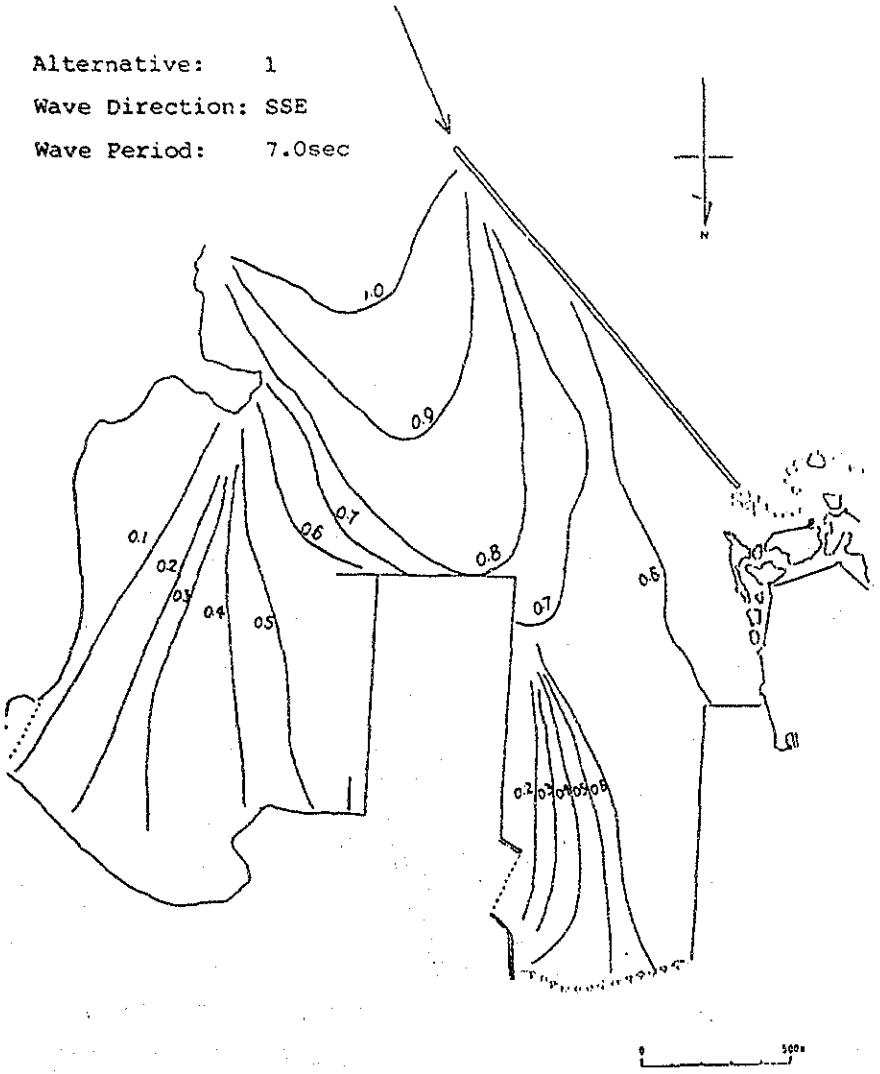

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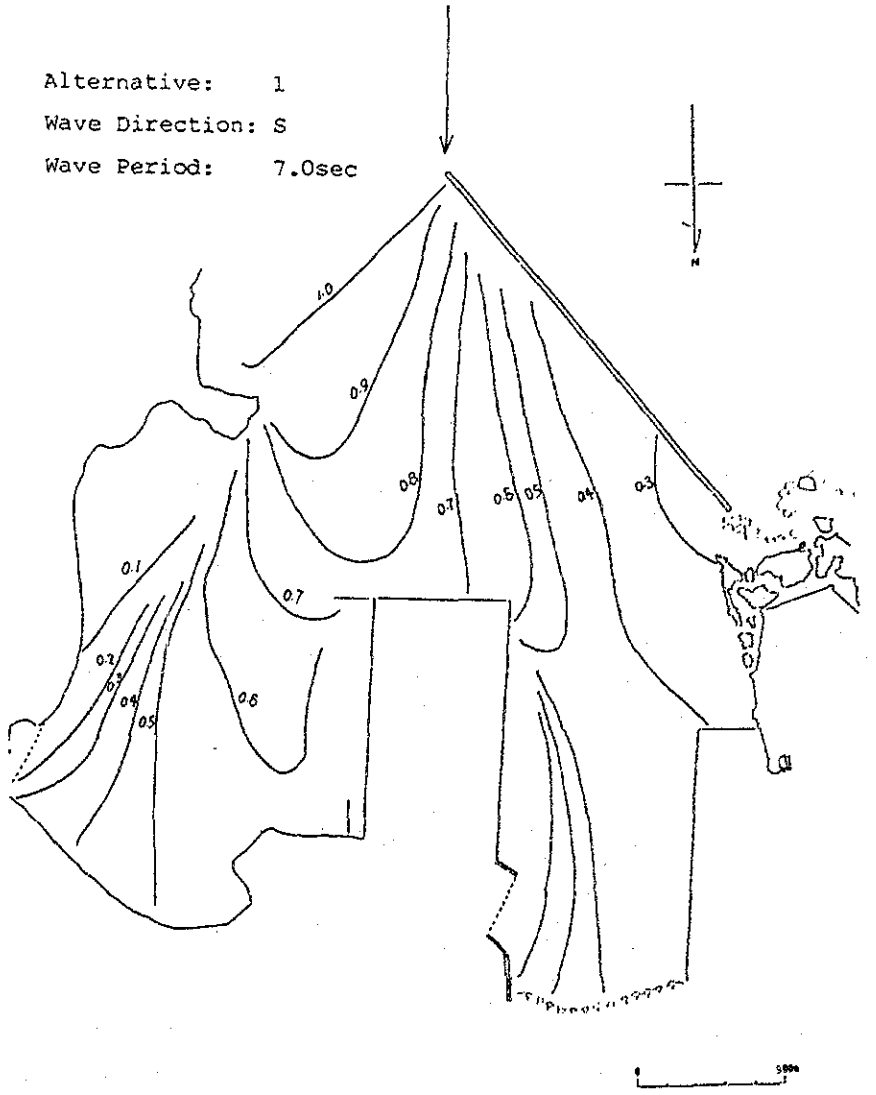

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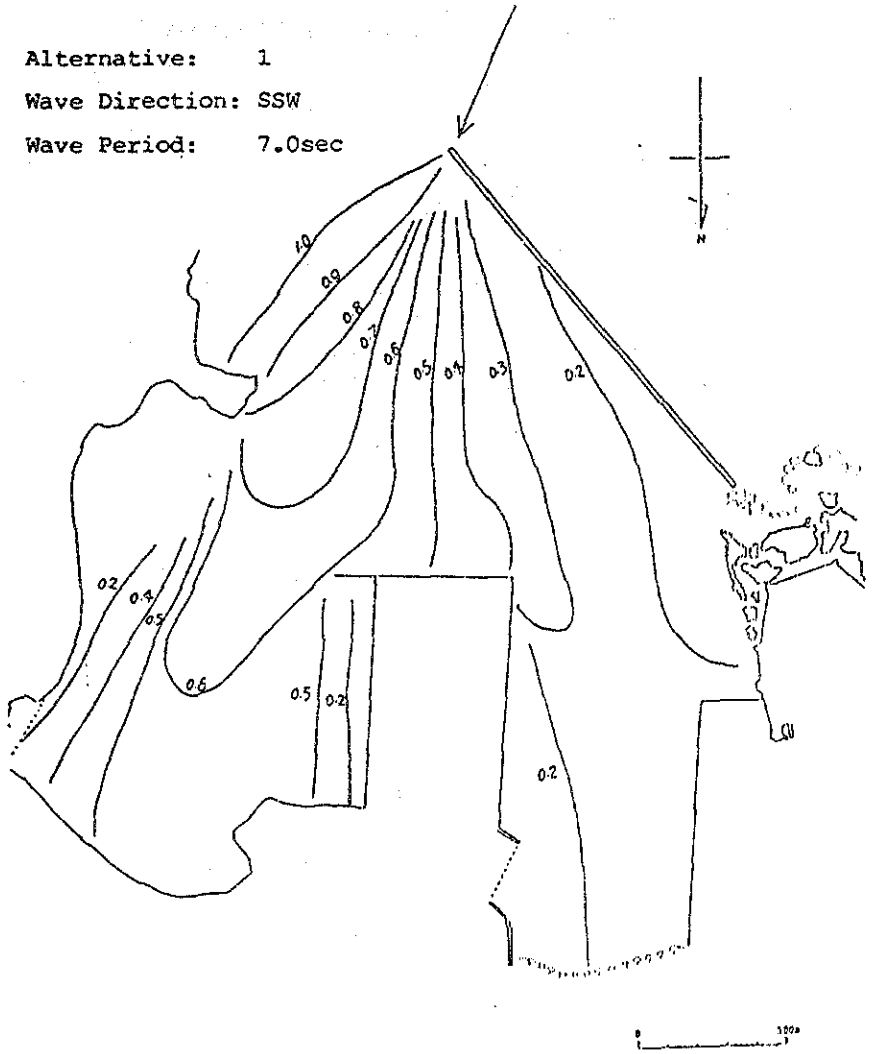

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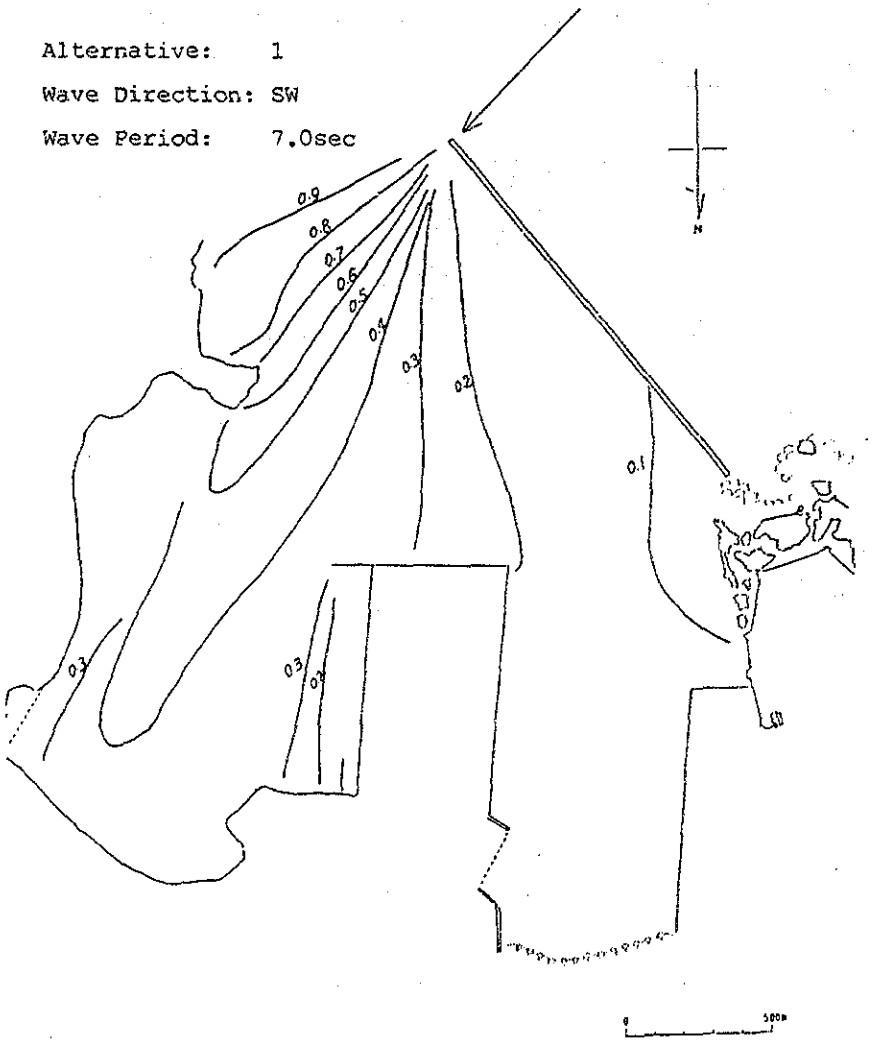

Appendix II-4-5(6) Wave Height Ratio

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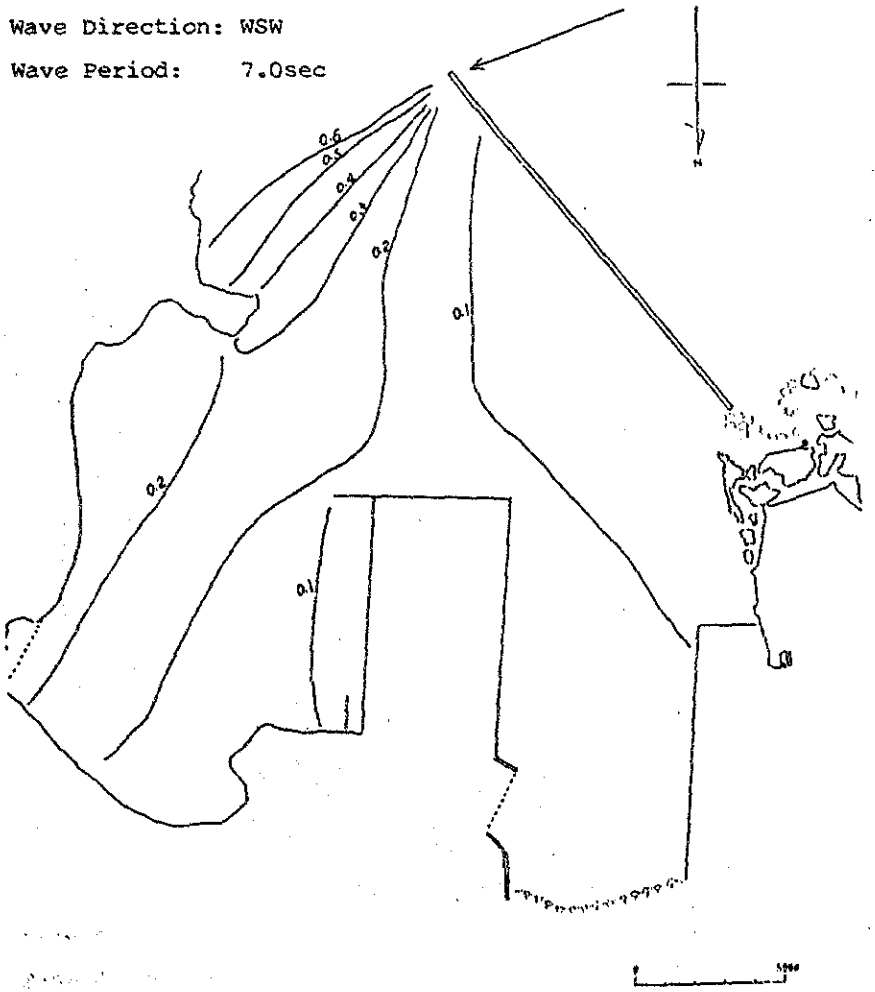
Wave Period: 7.0sec



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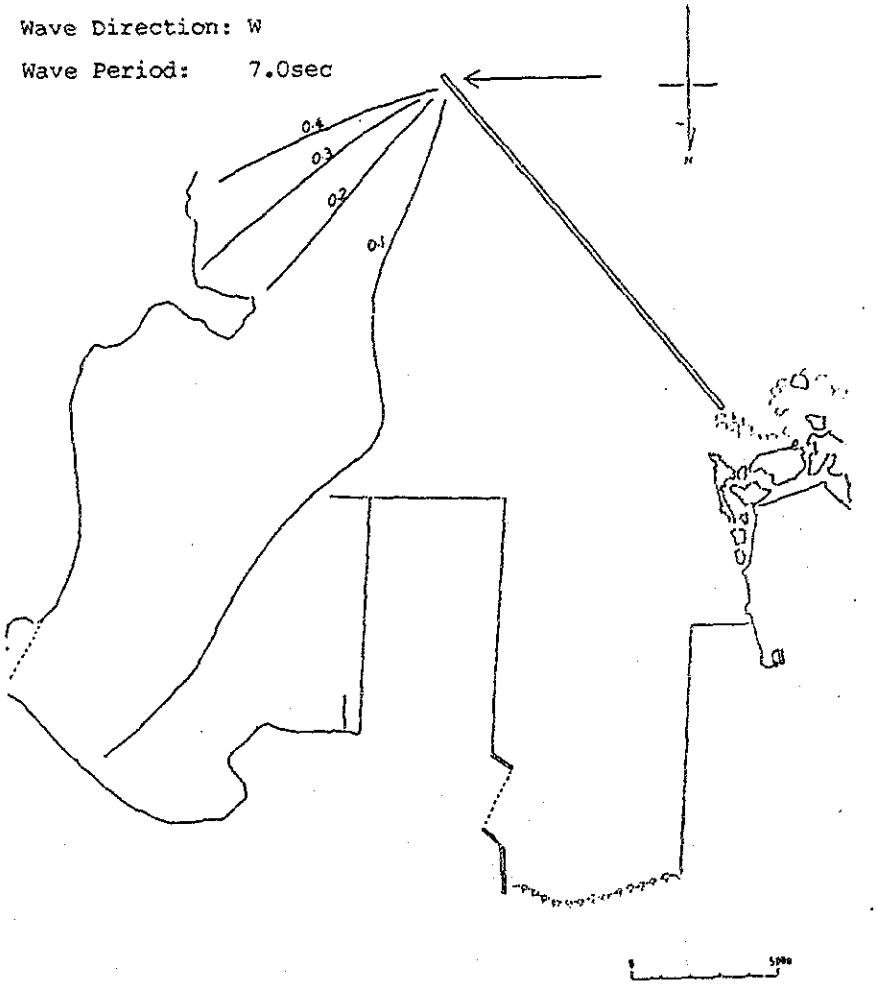
Wave Period: 7.0sec



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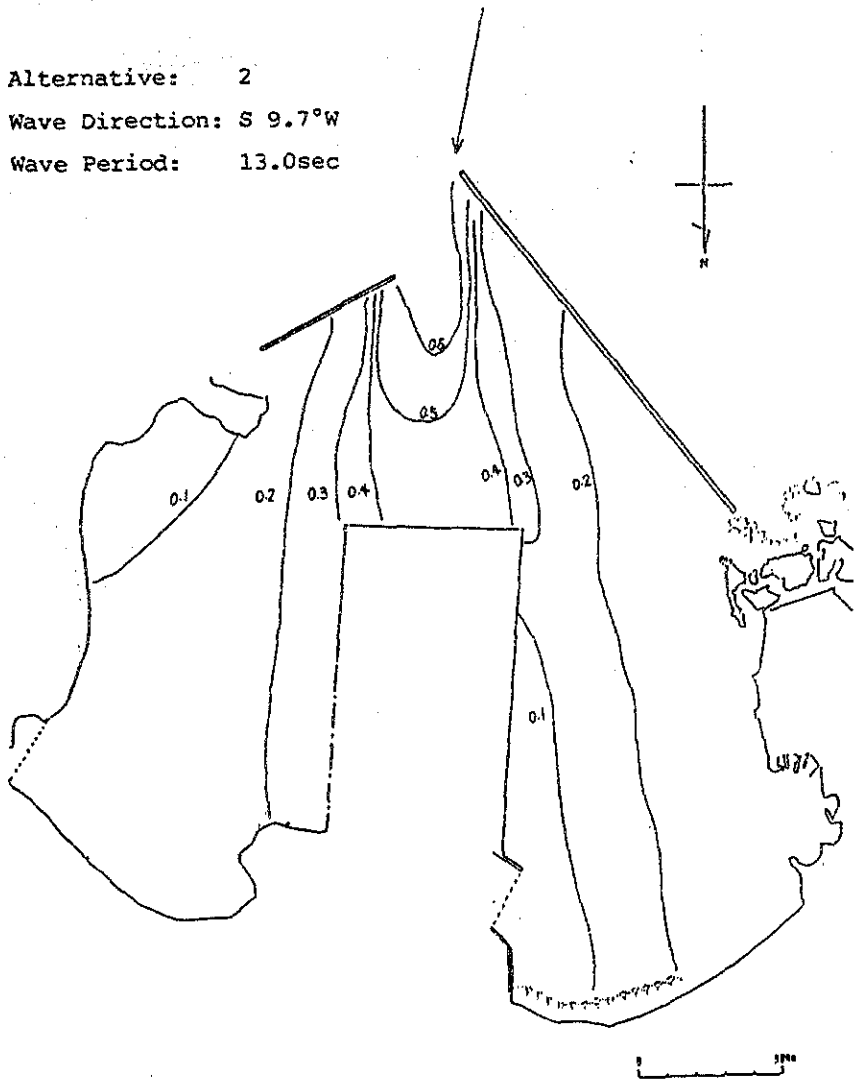

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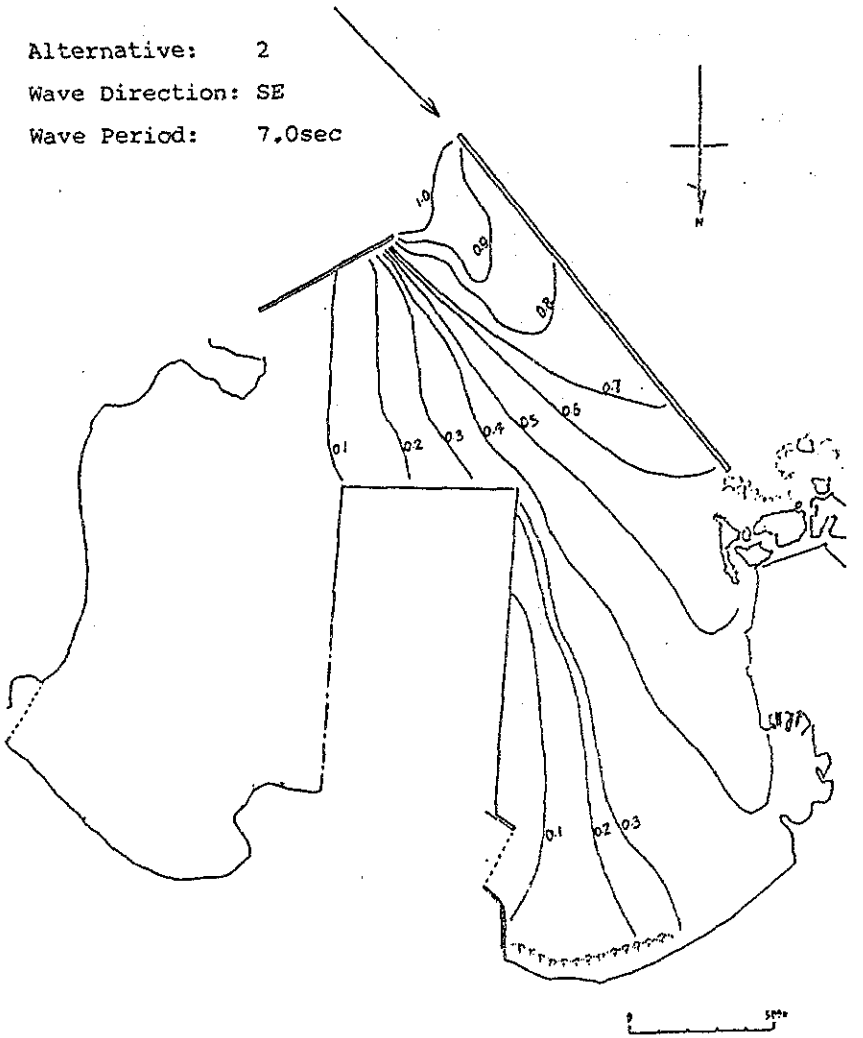

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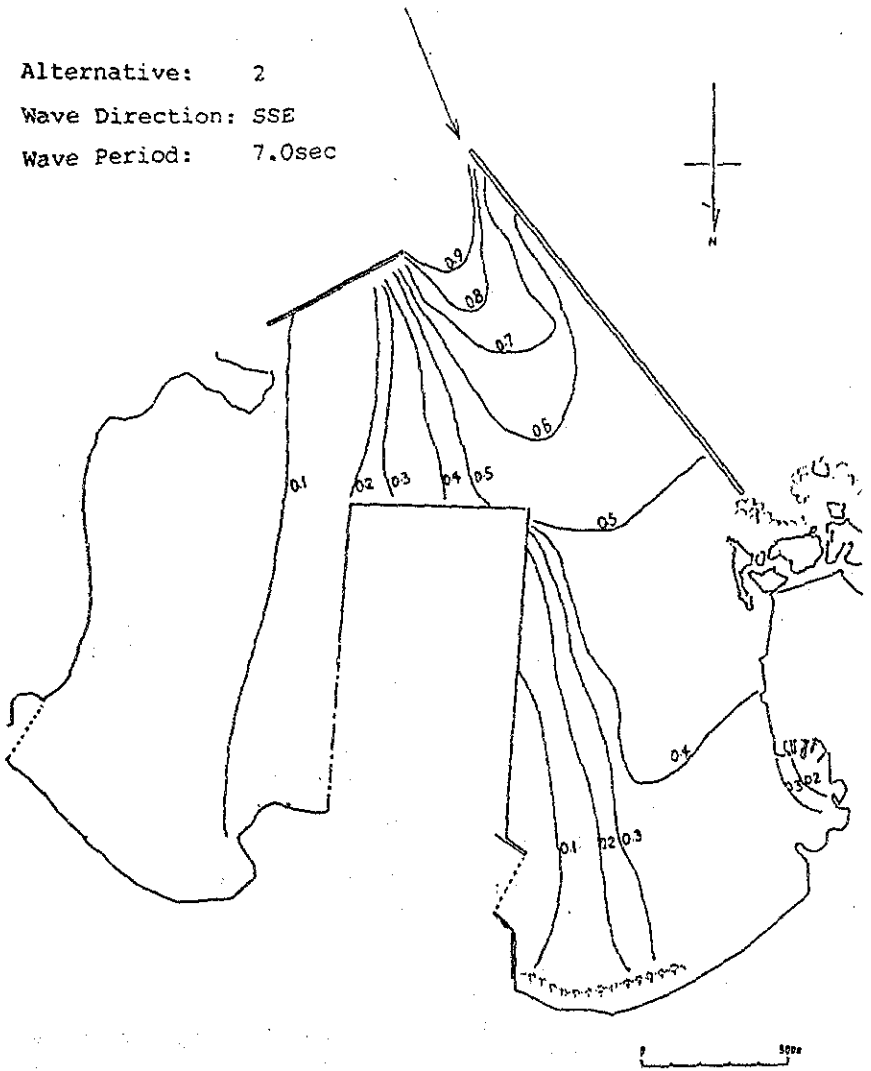

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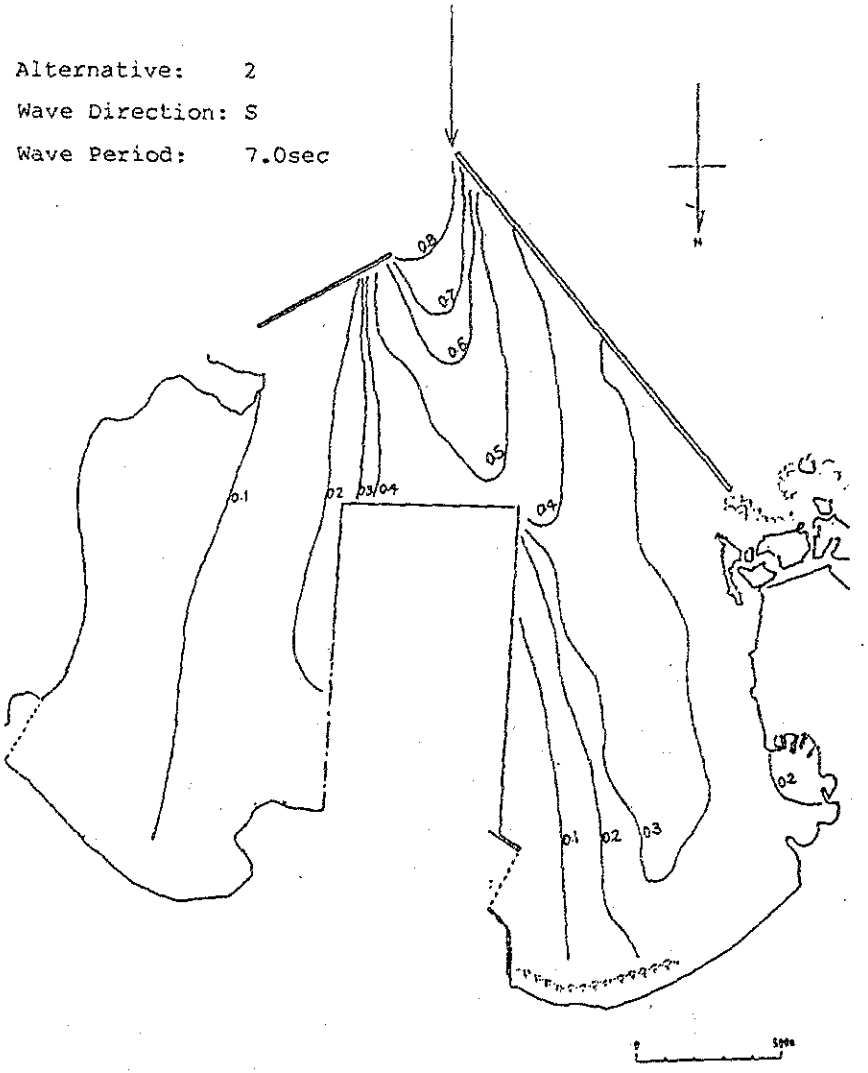

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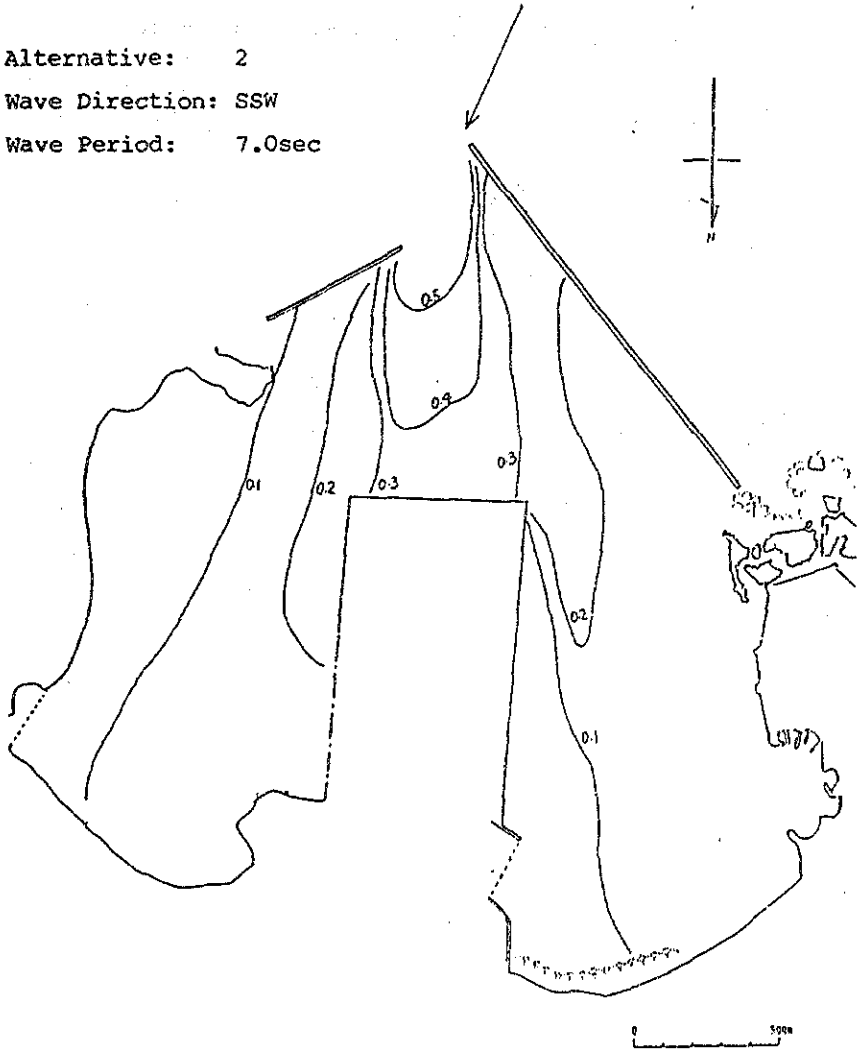

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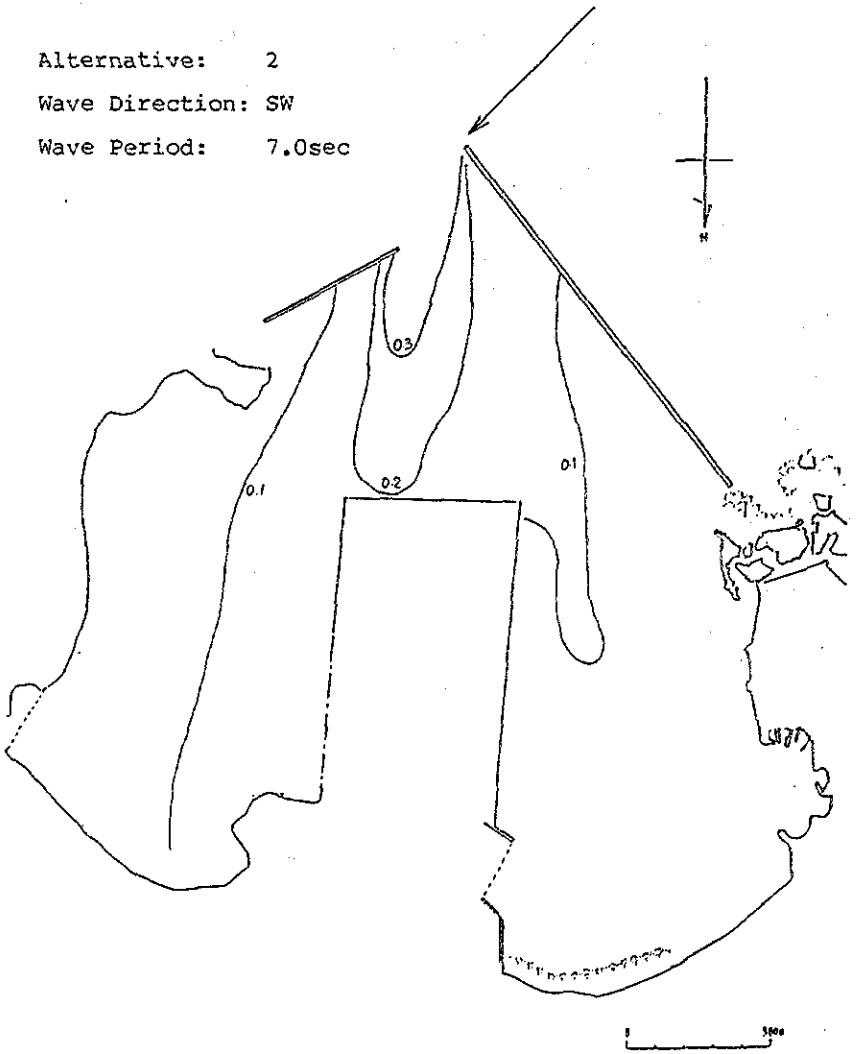

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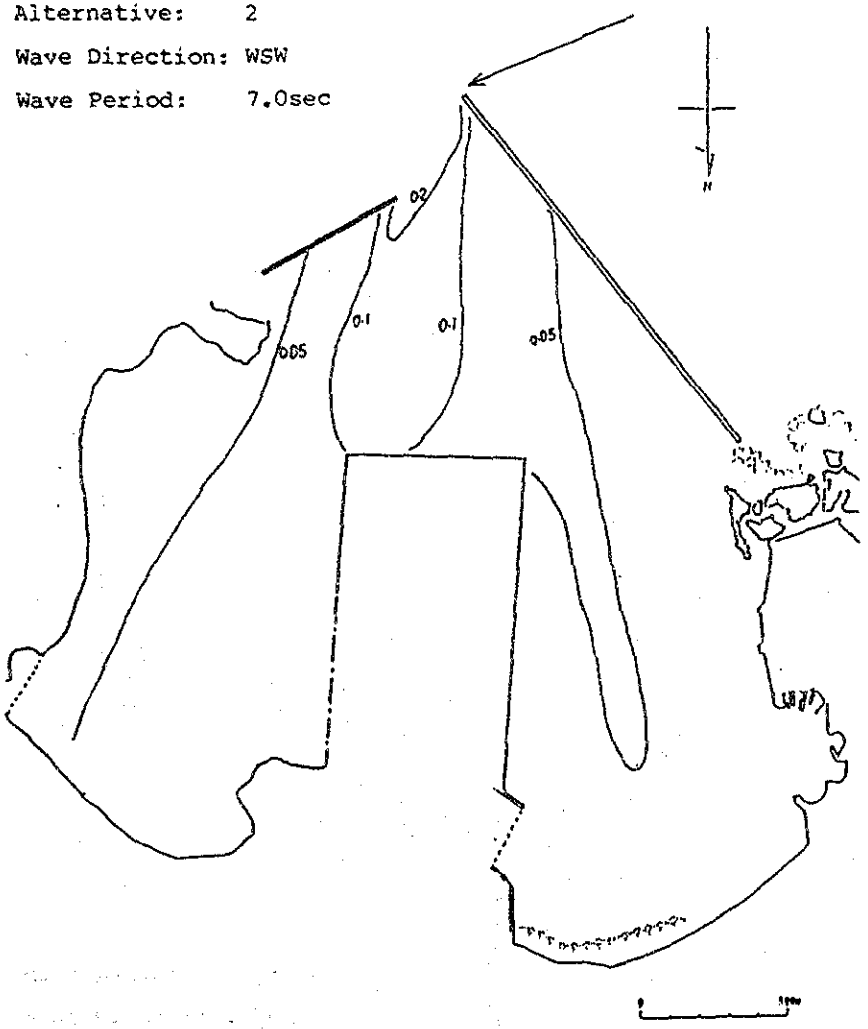

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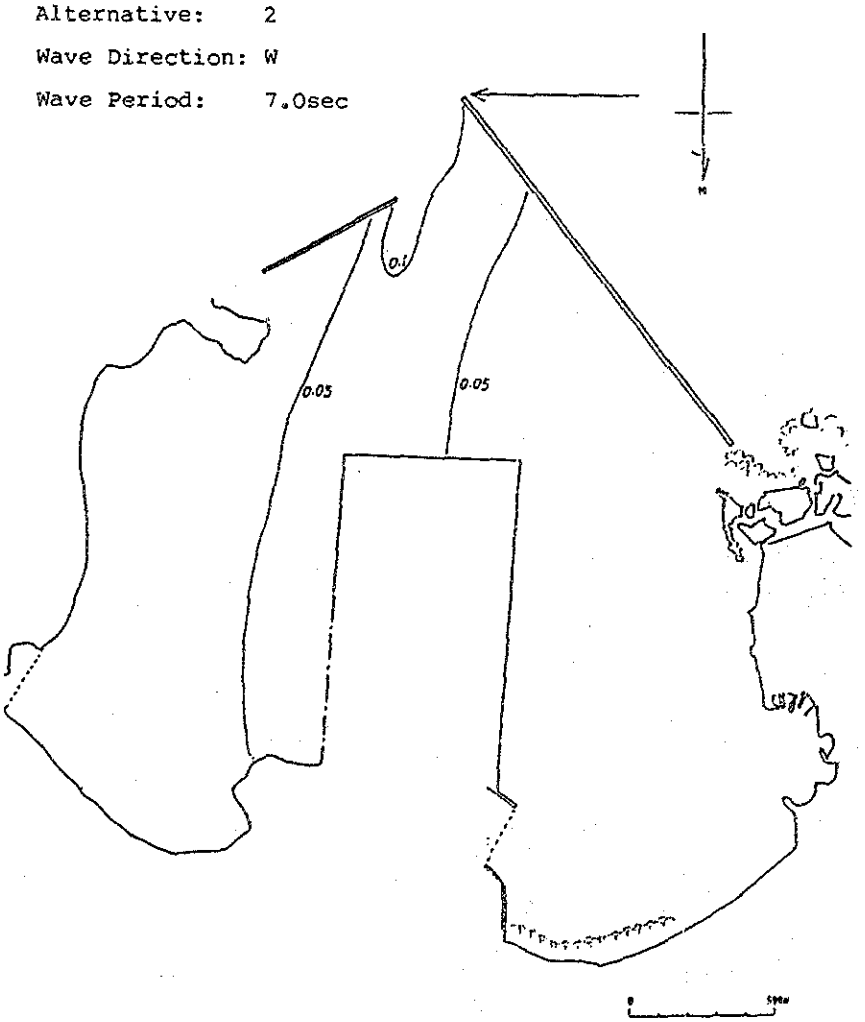

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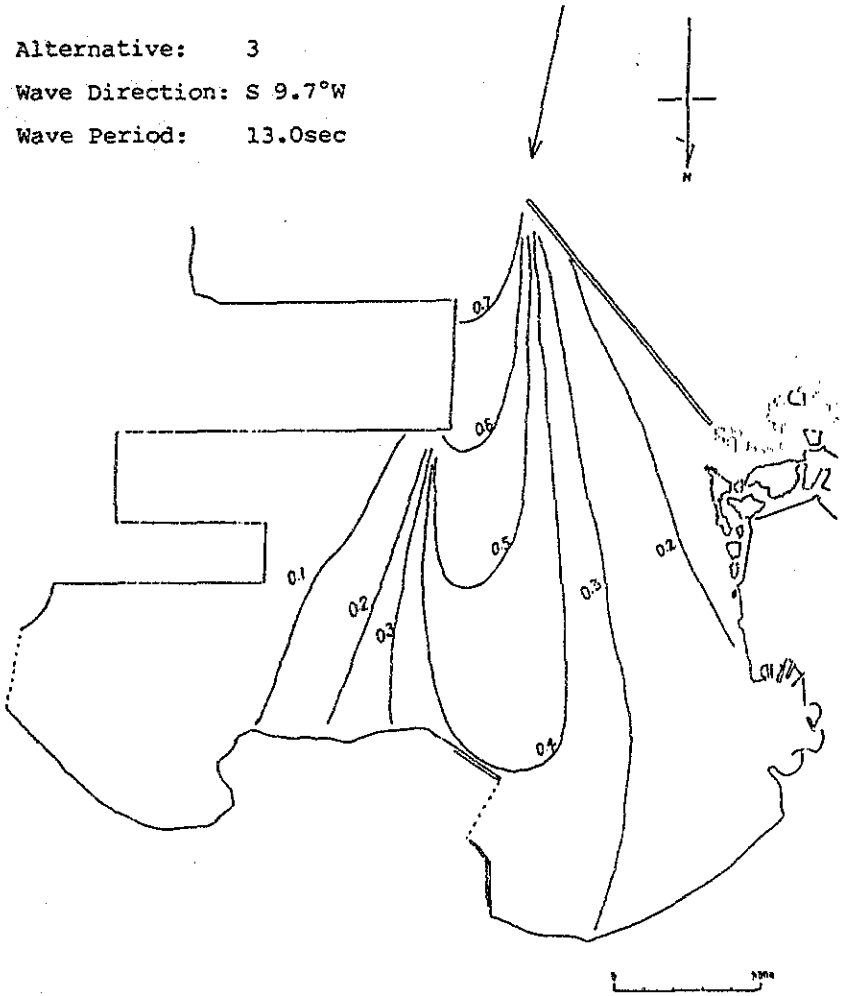

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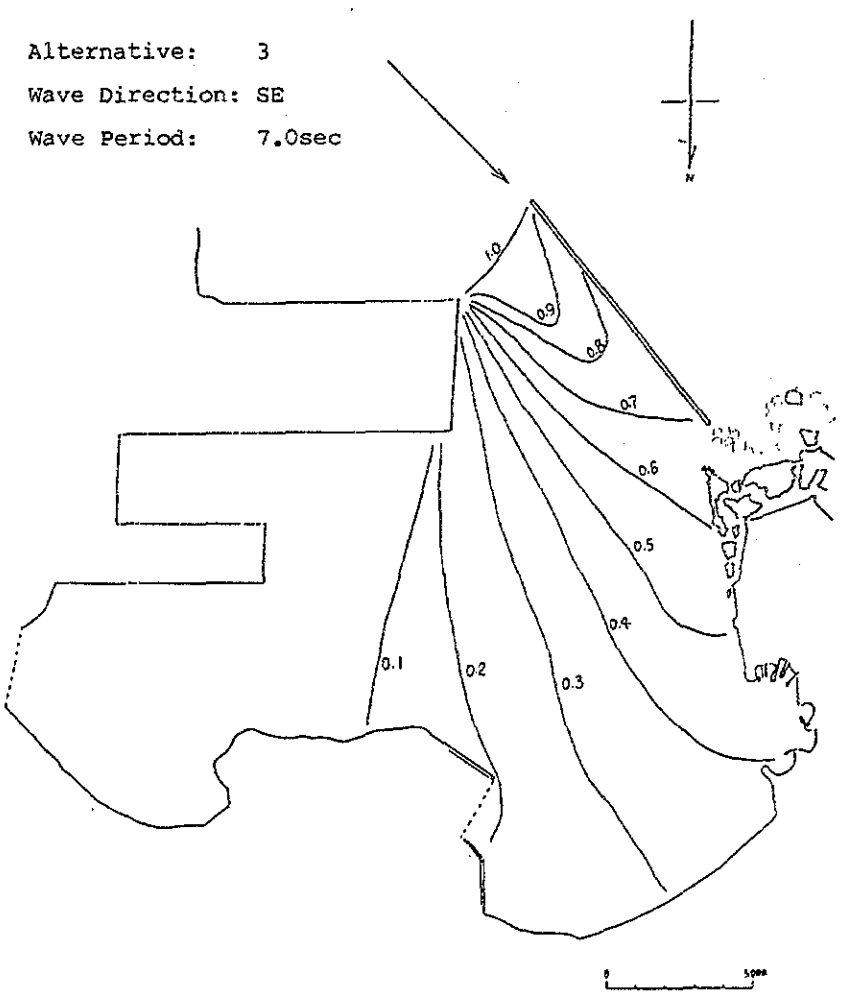

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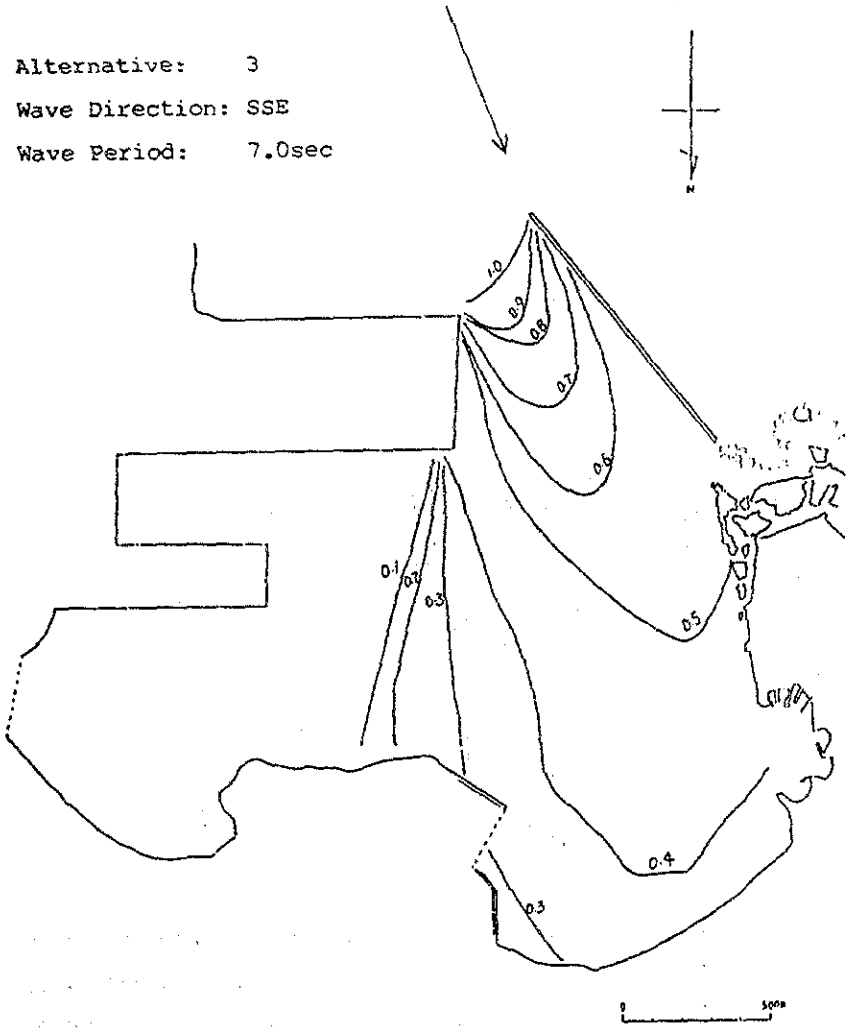

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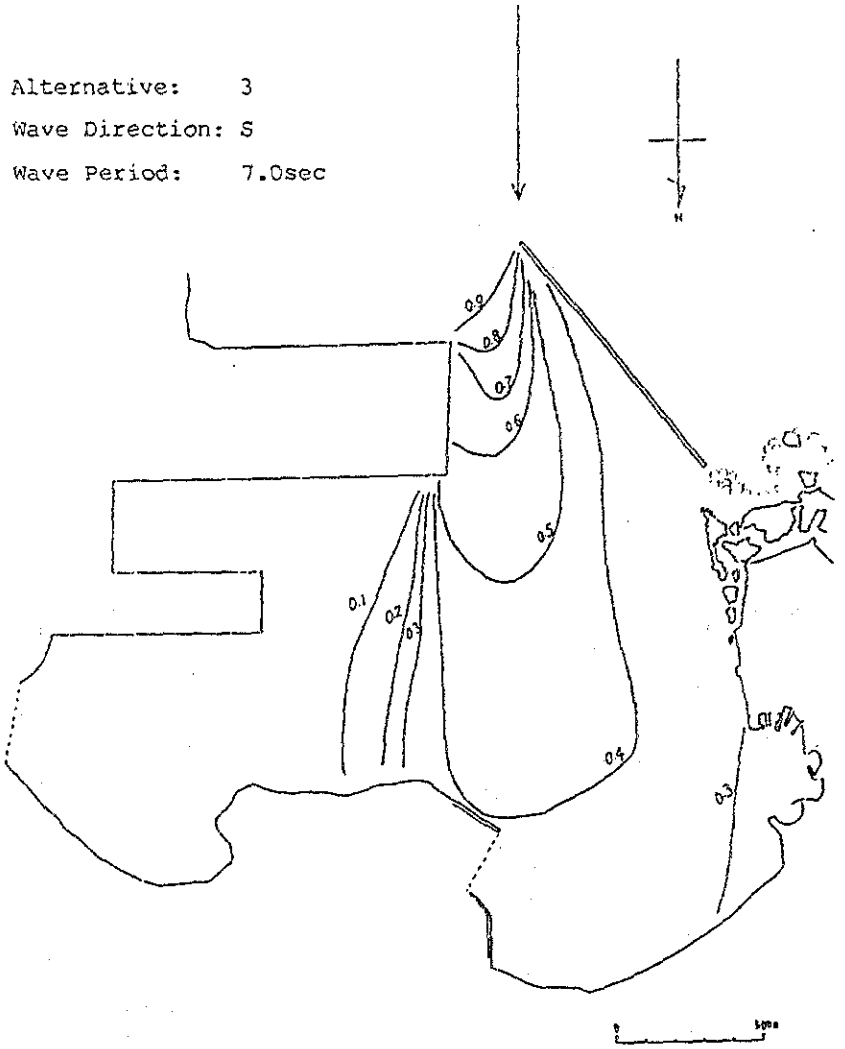

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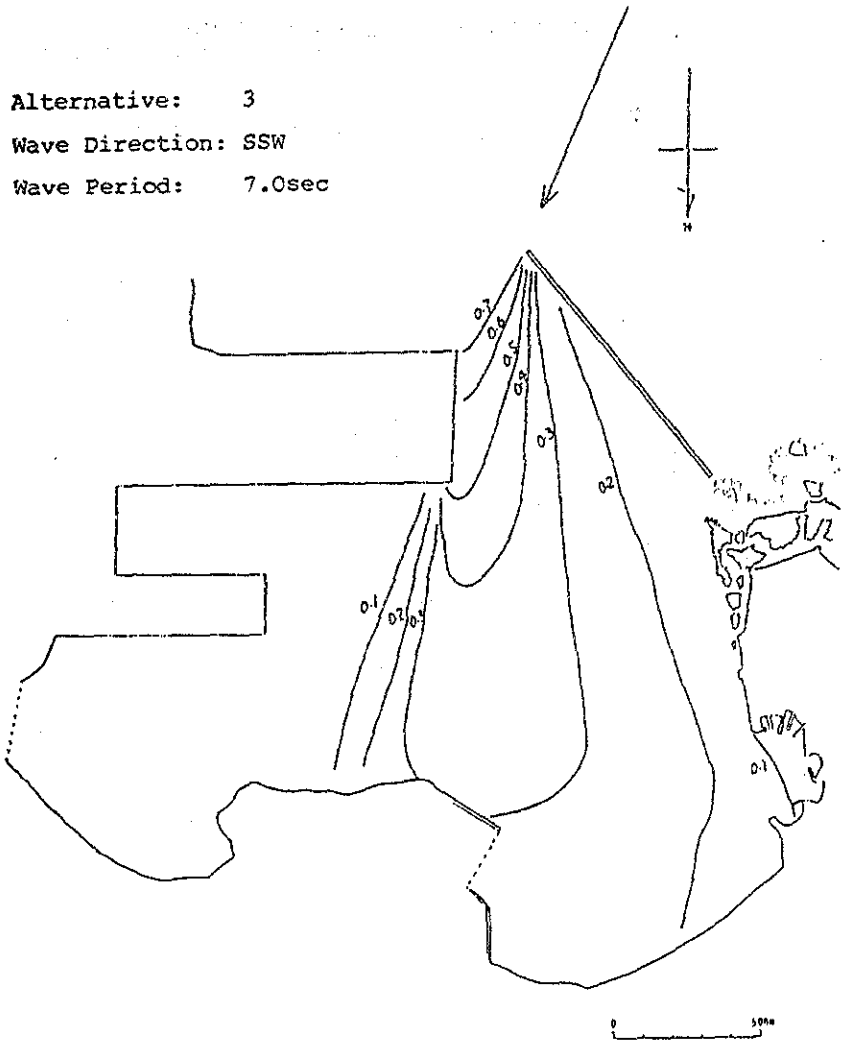

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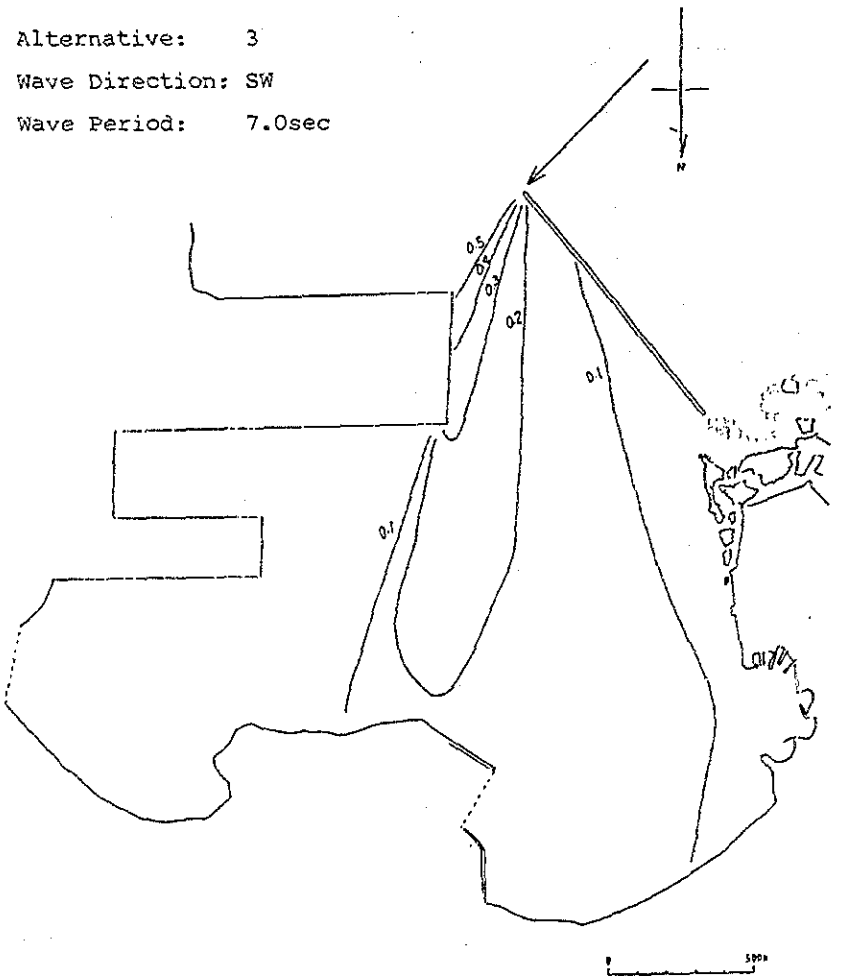

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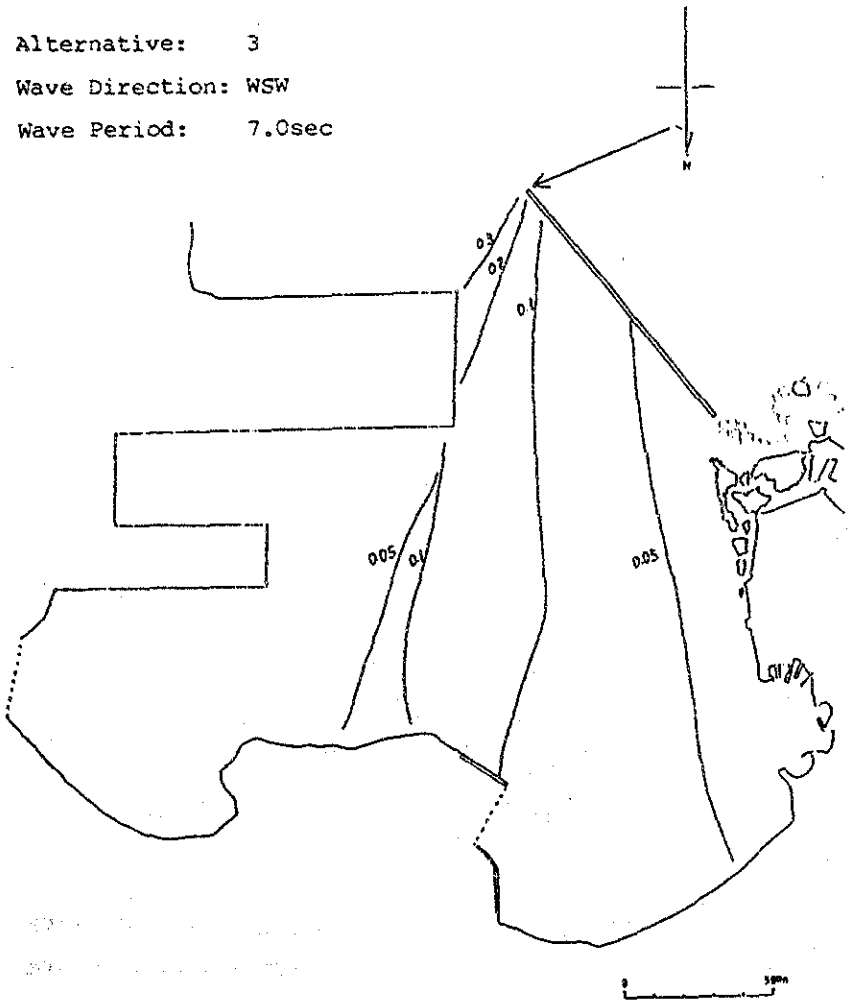

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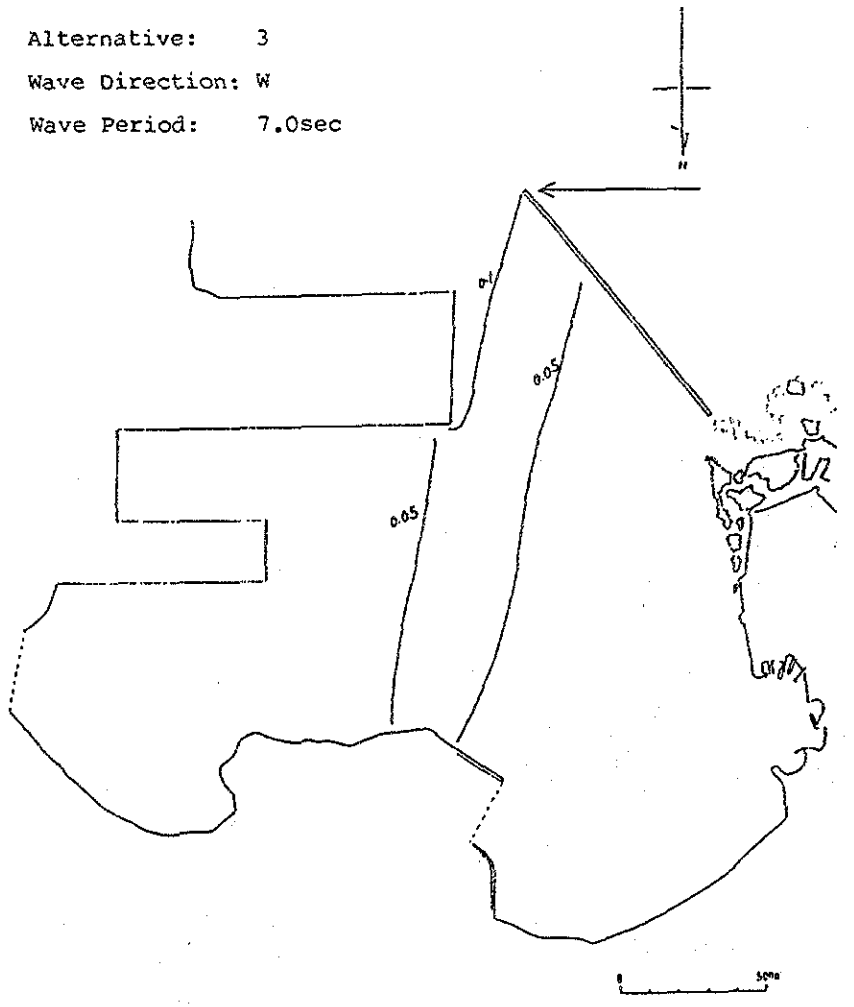

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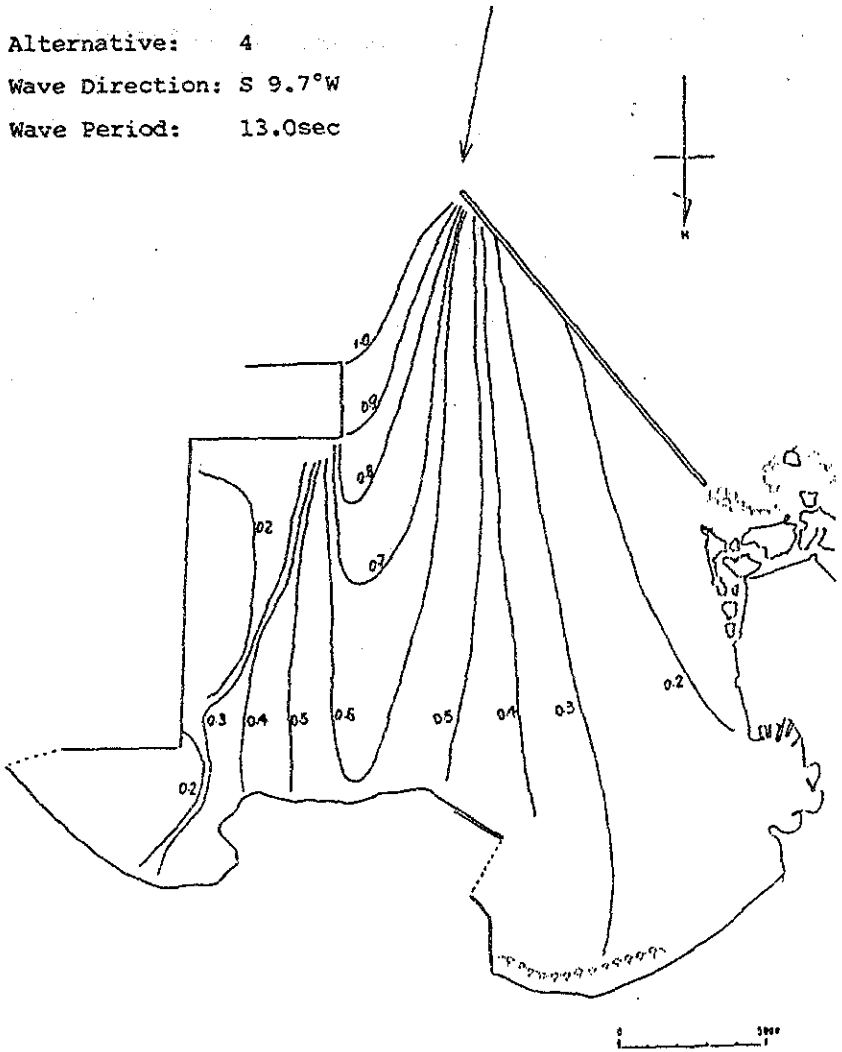

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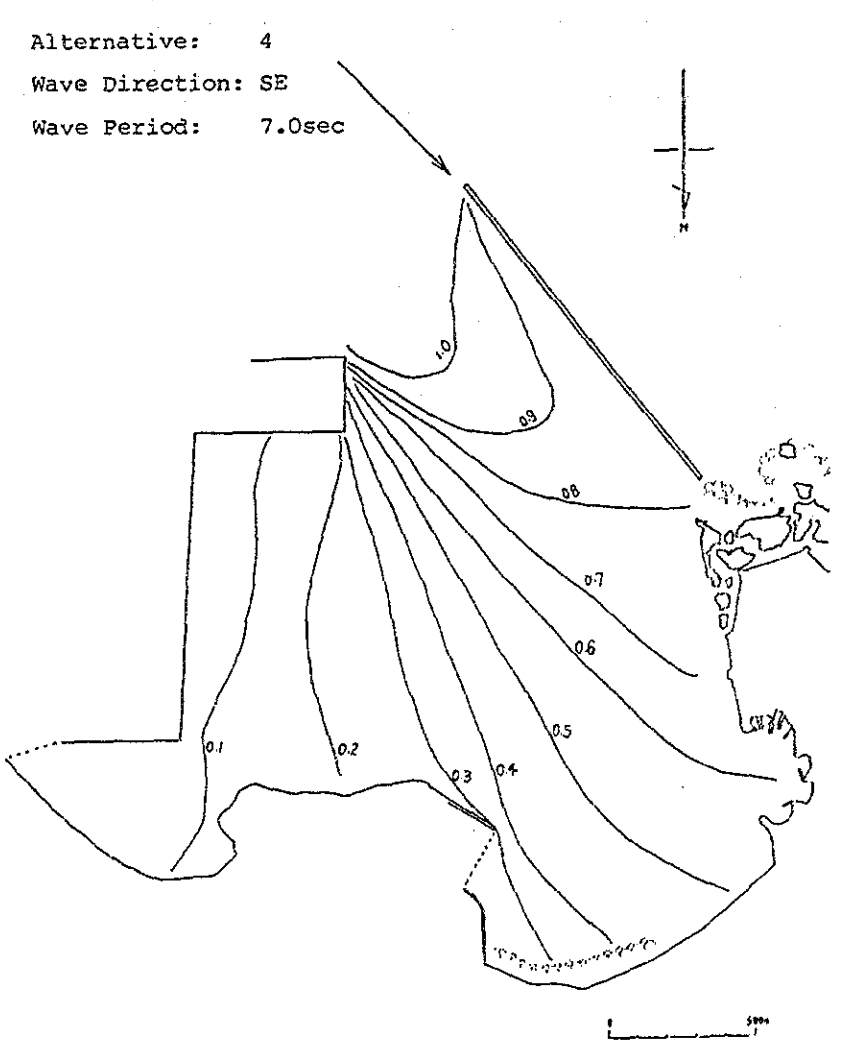

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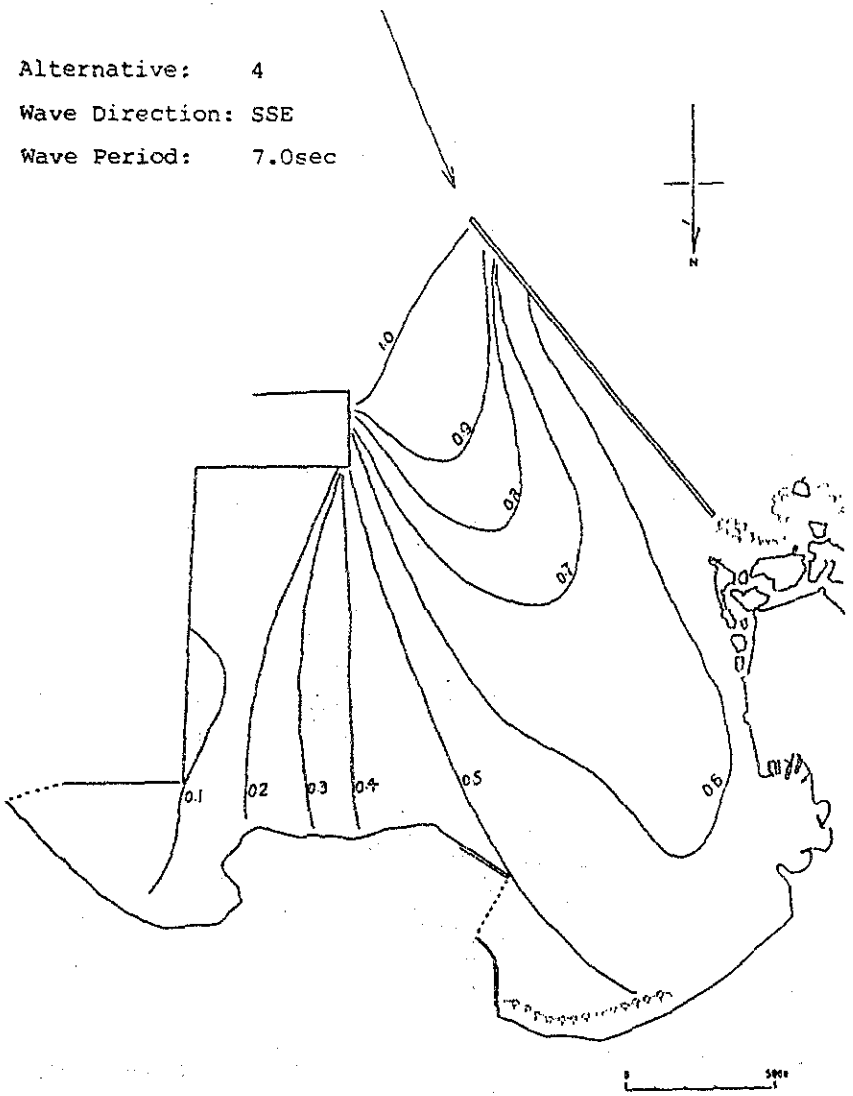

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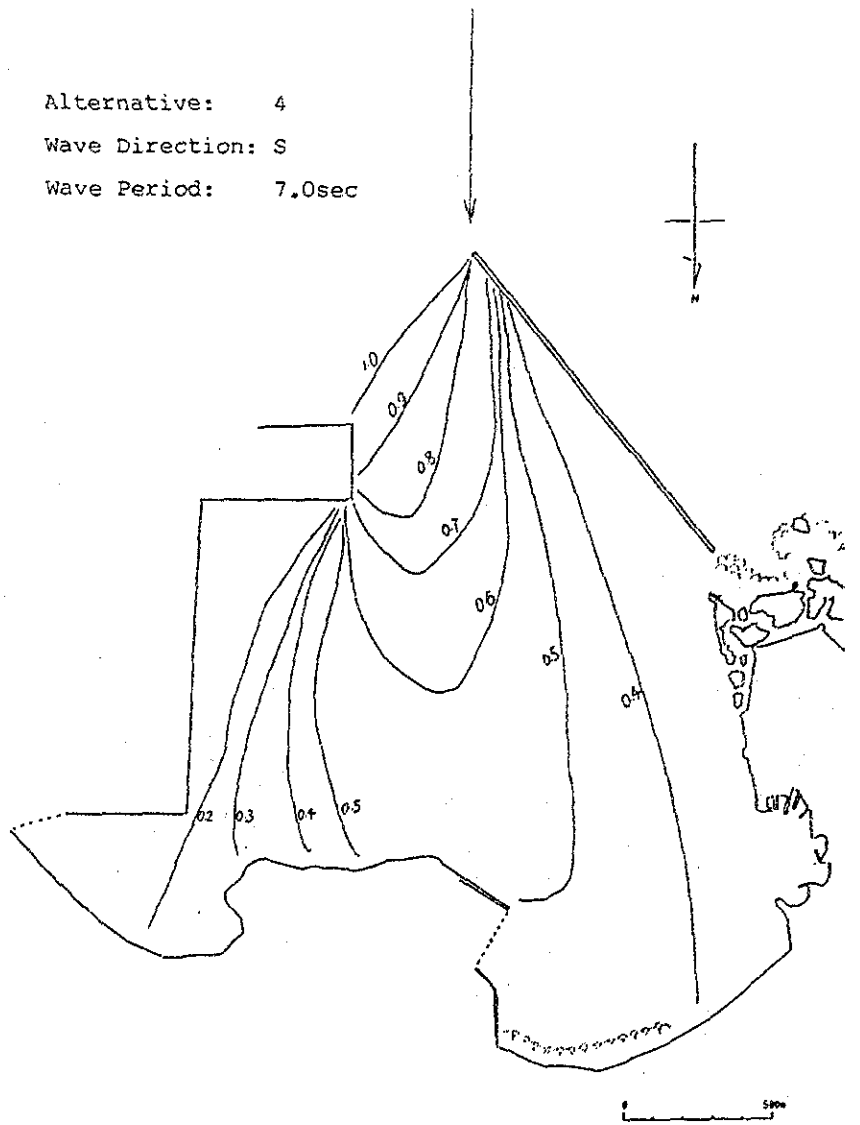
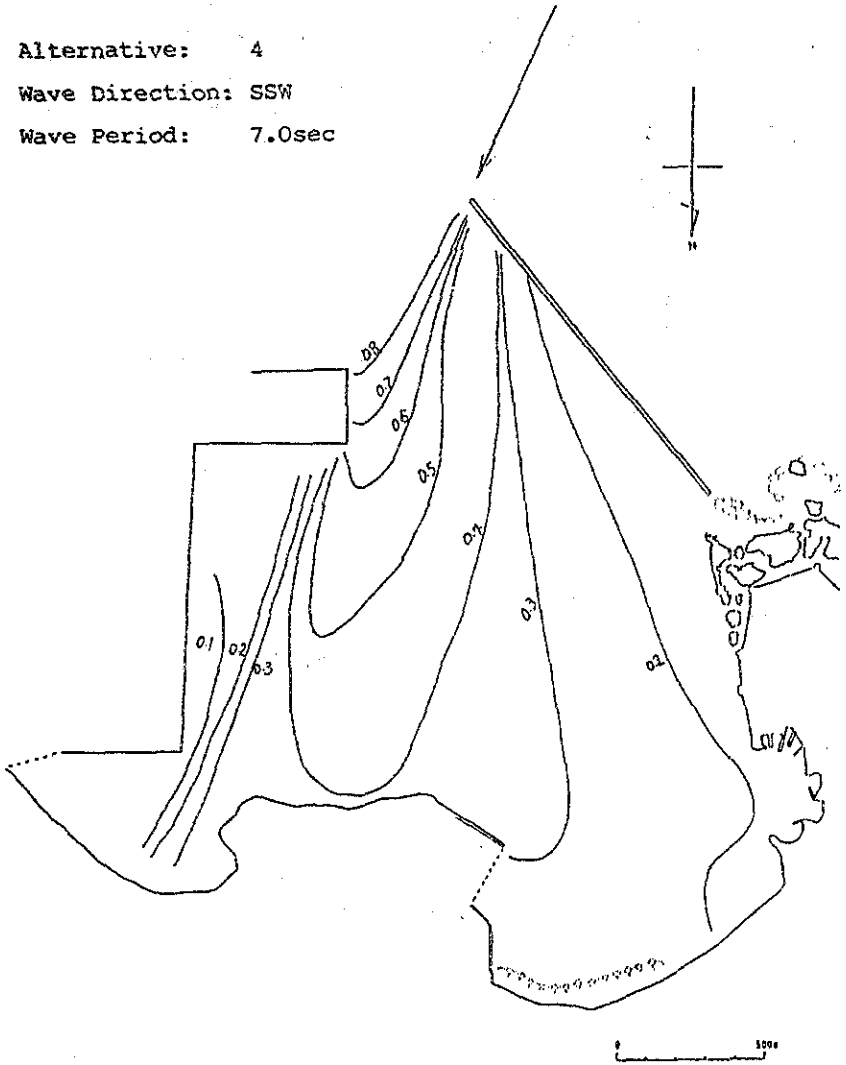


Appendix II-4-8(4) Wave Height Ratio



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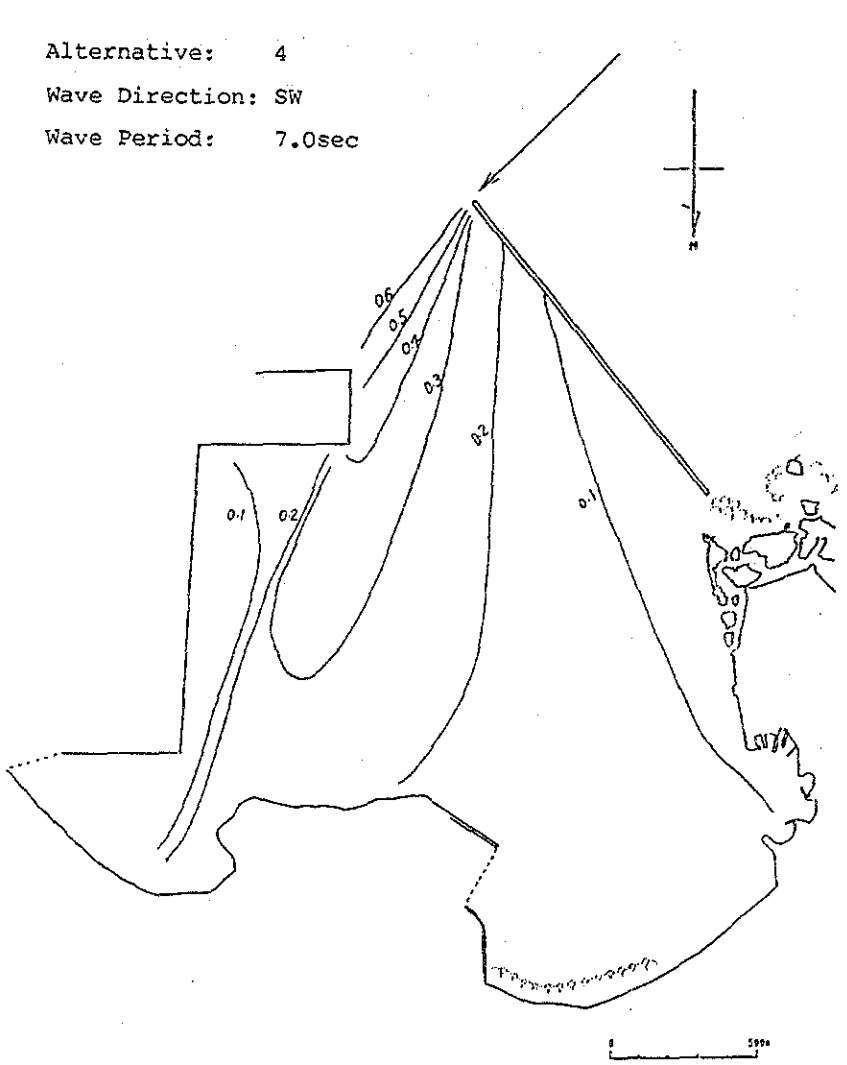

Appendix II-4-8(6) Wave Height Ratio

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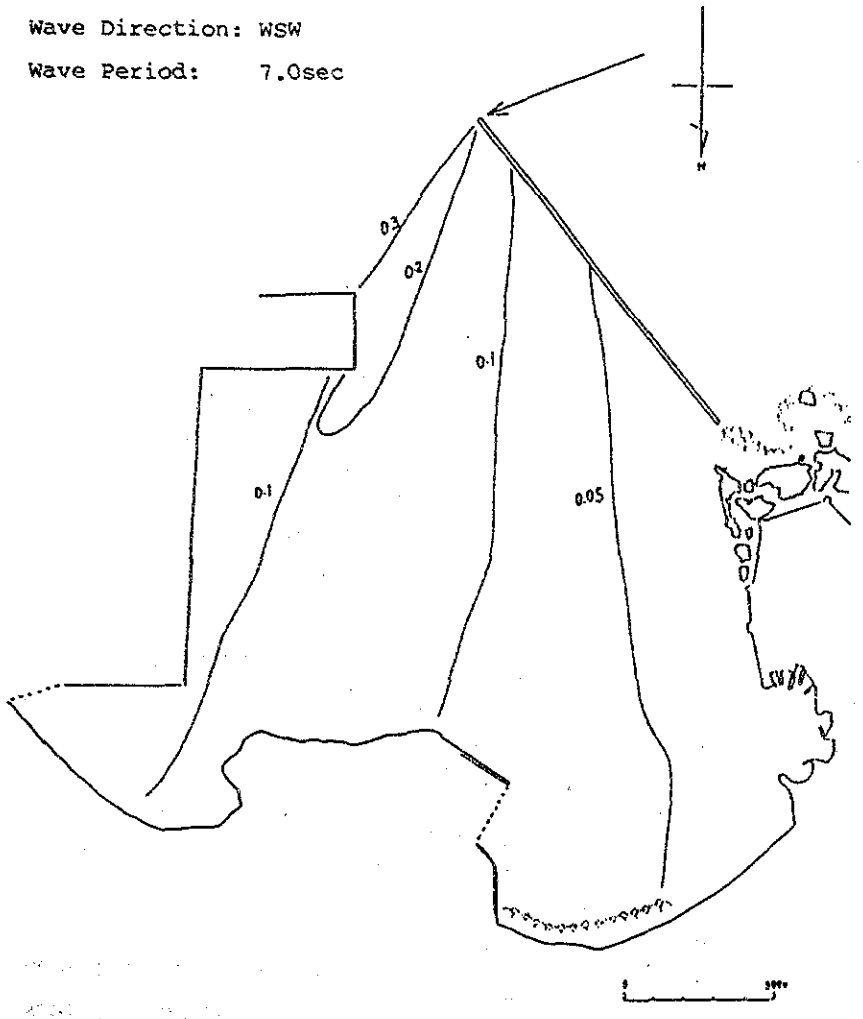
Wave Period: 7.0sec



Appendix II-4-8(7) Wave Height Ratio

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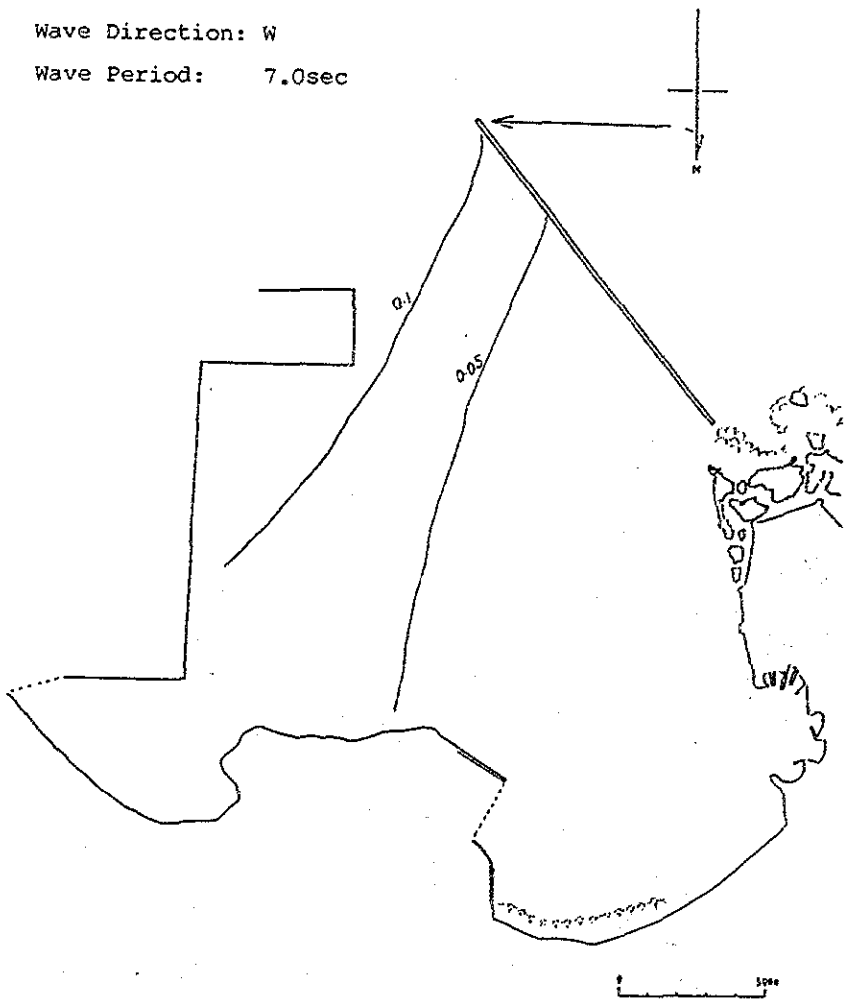
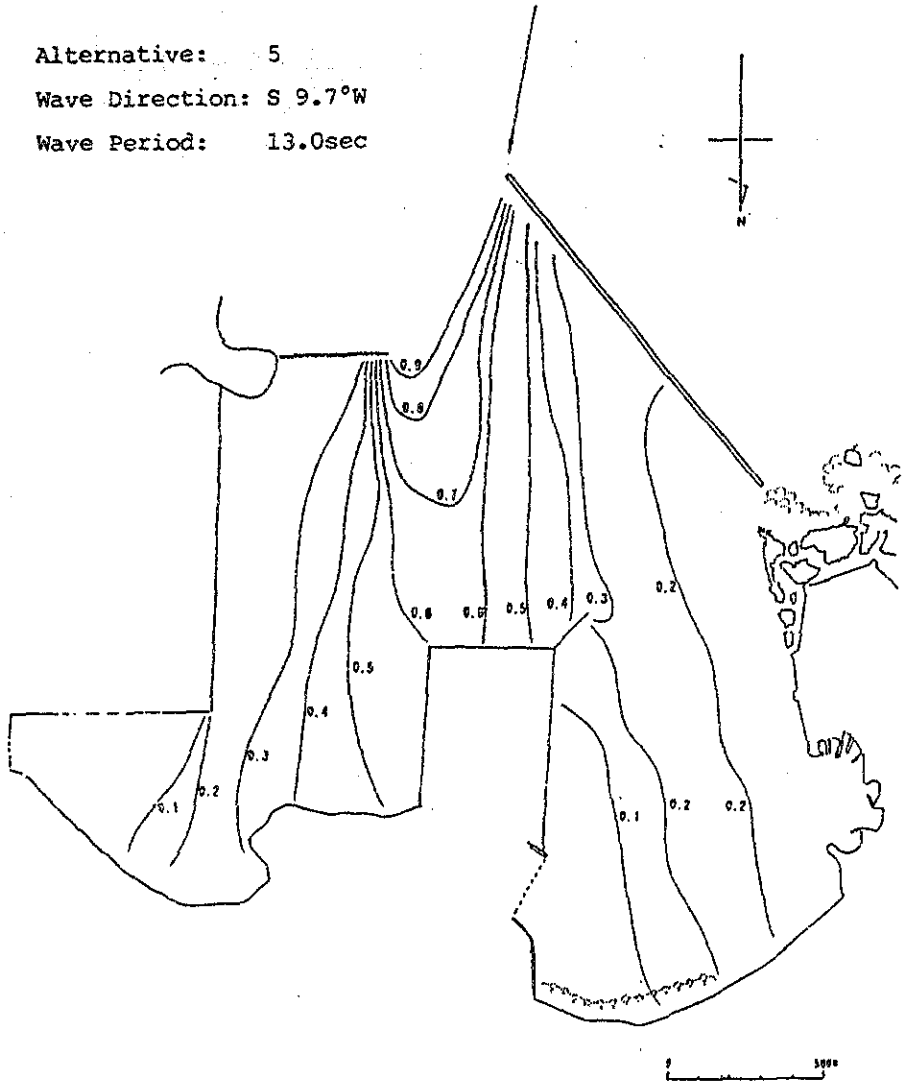
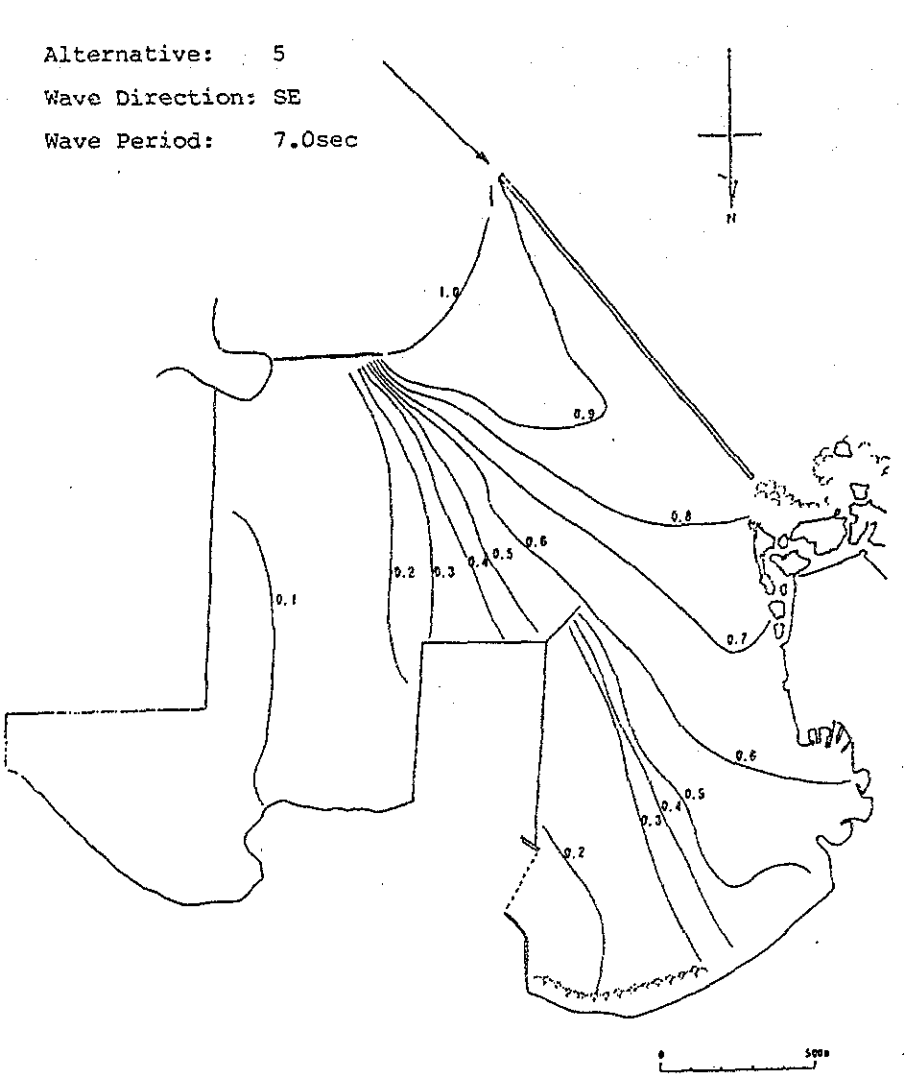
Wave Direction: W
Wave Period: 7.0sec



Appendix II-4-8(8) Wave Height Ratio



Appendix II-4-9(1) Wave Height Ratio



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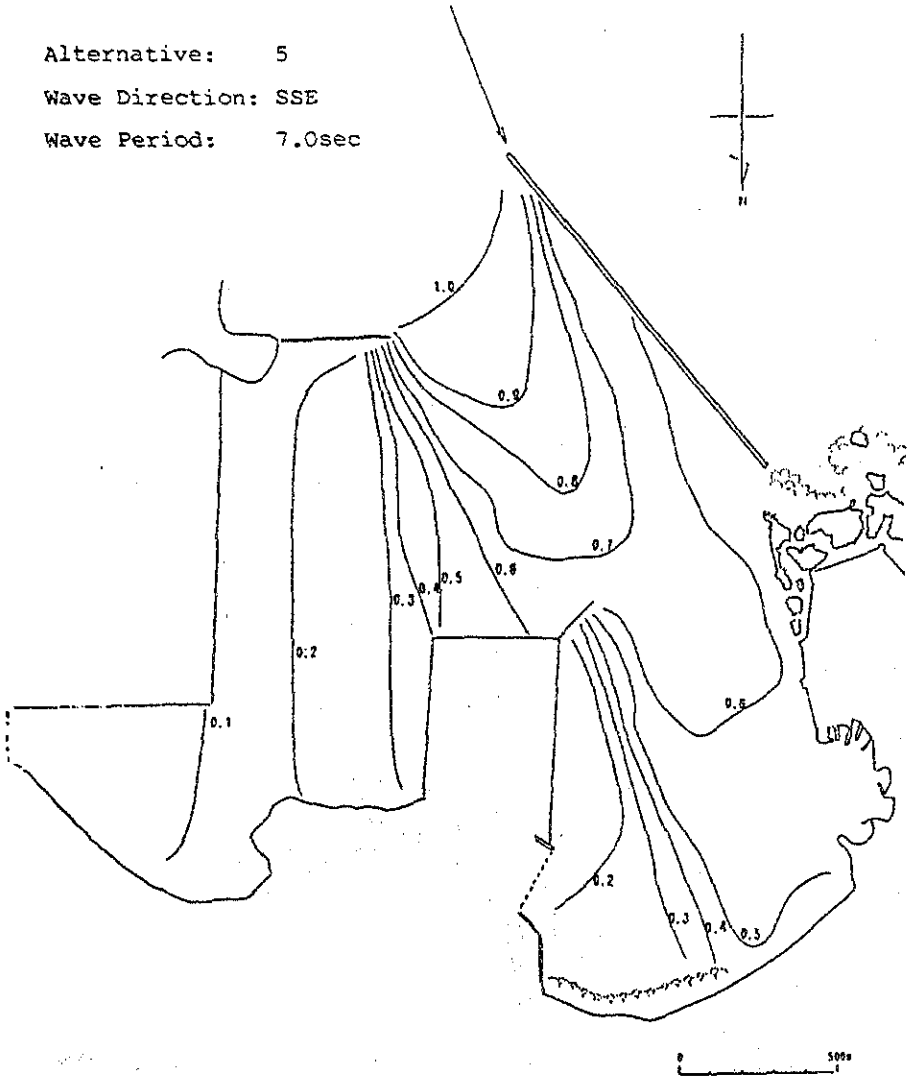

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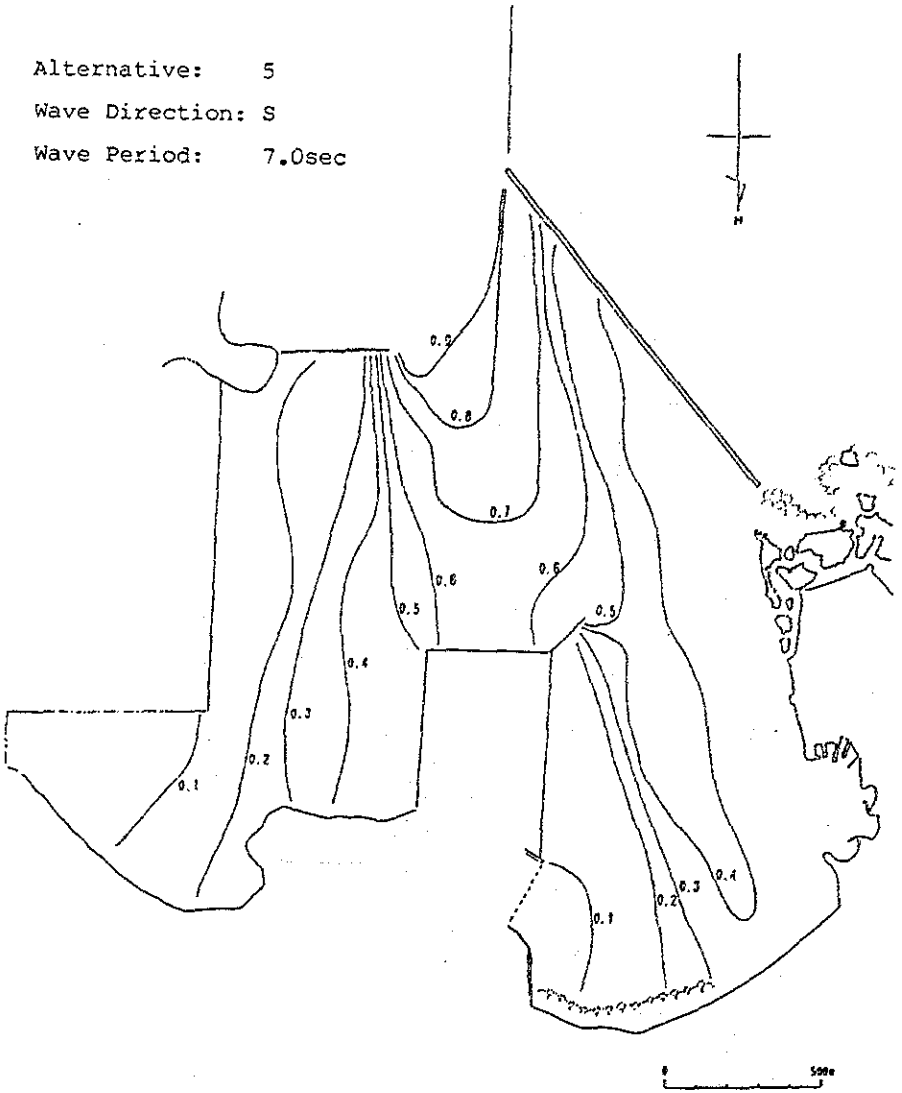

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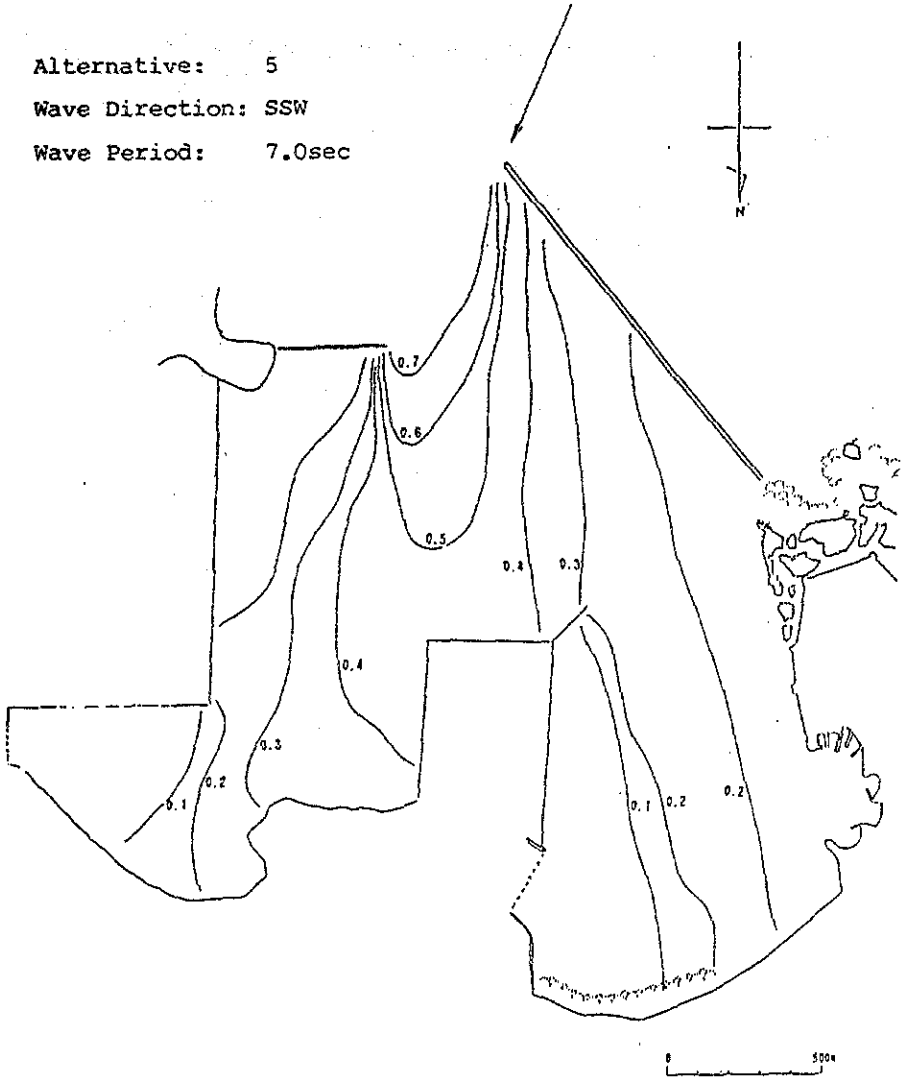

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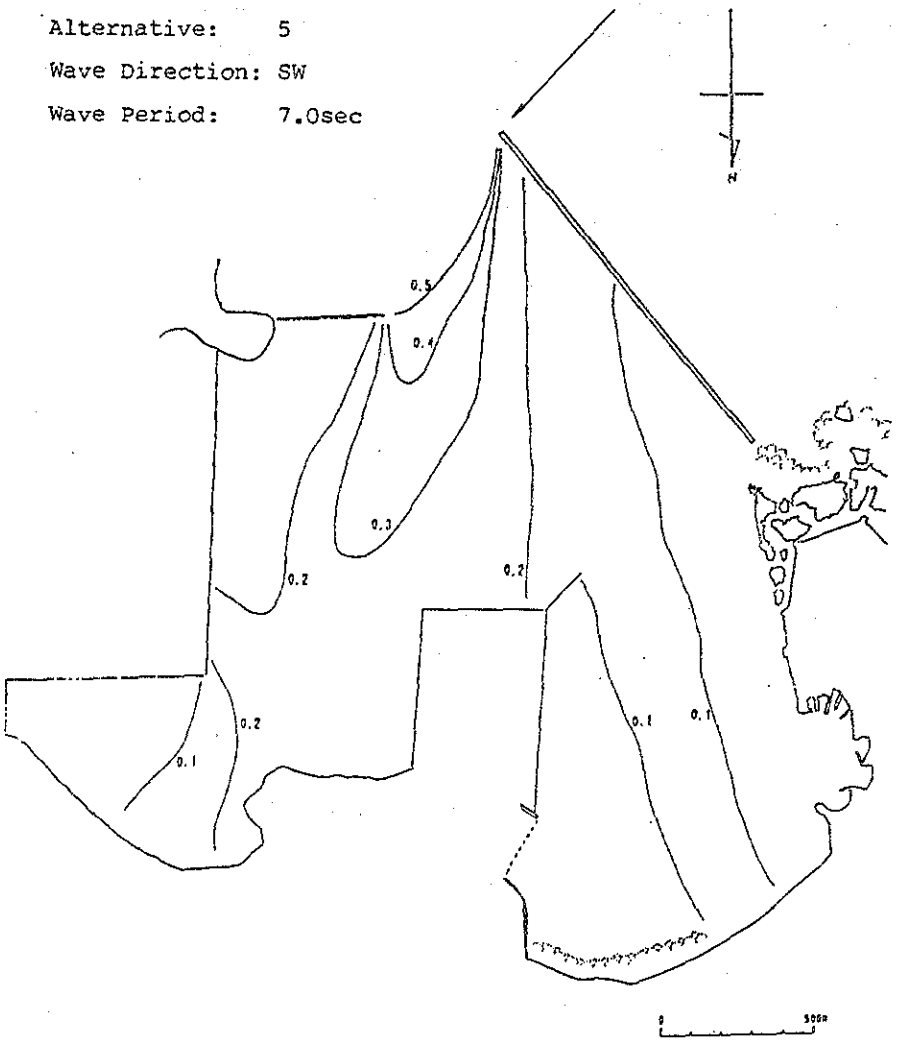

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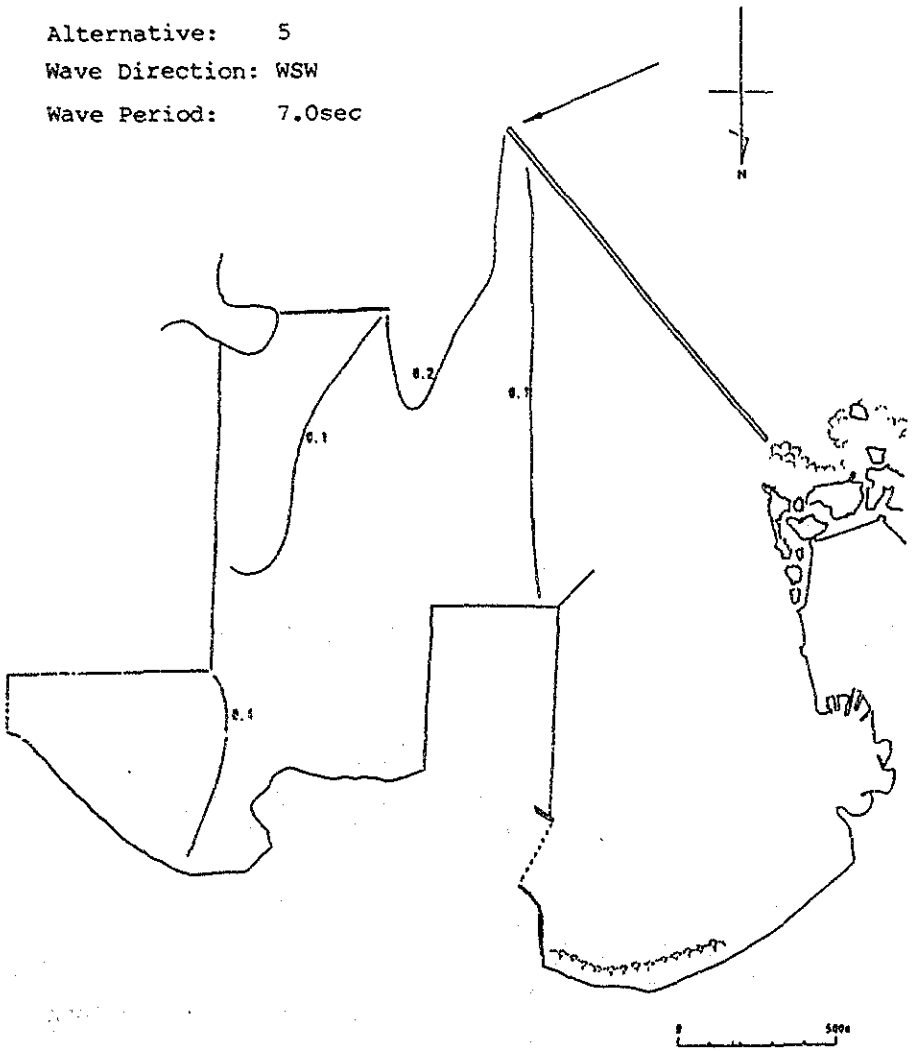
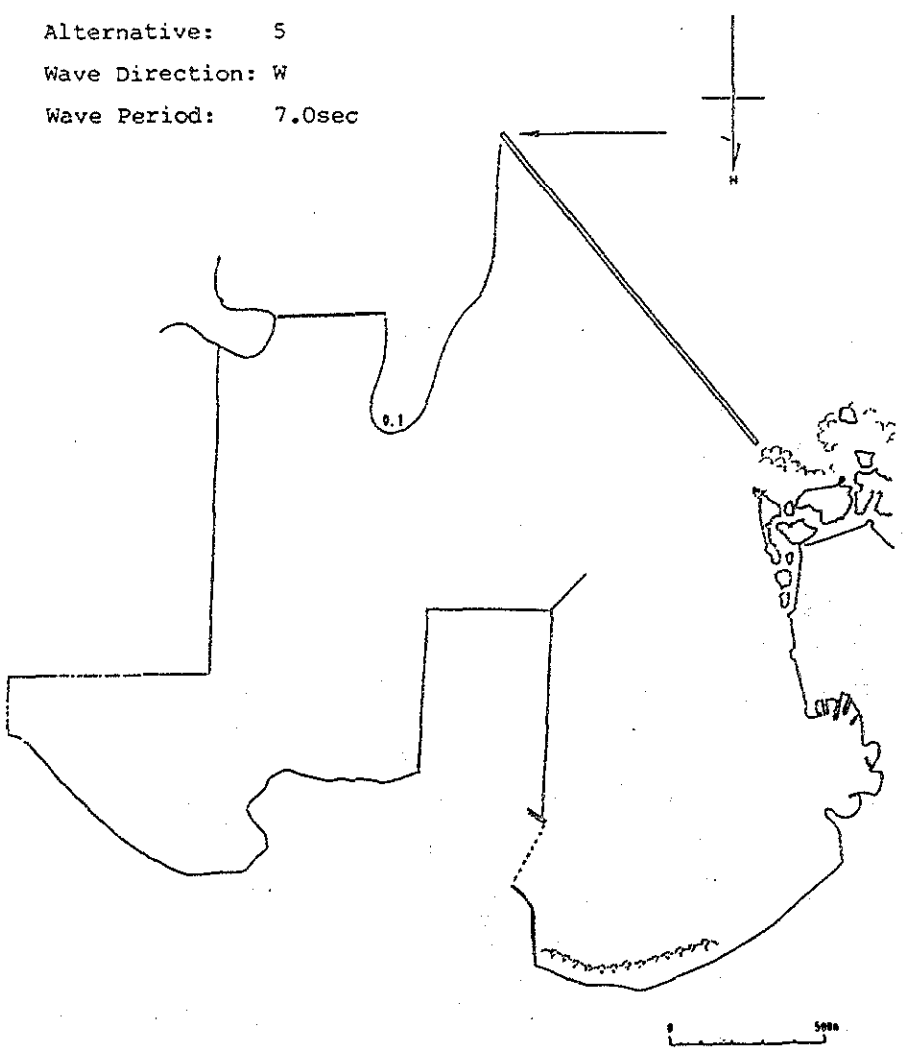


Appendix II-4-9(7) Wave Height Ratio



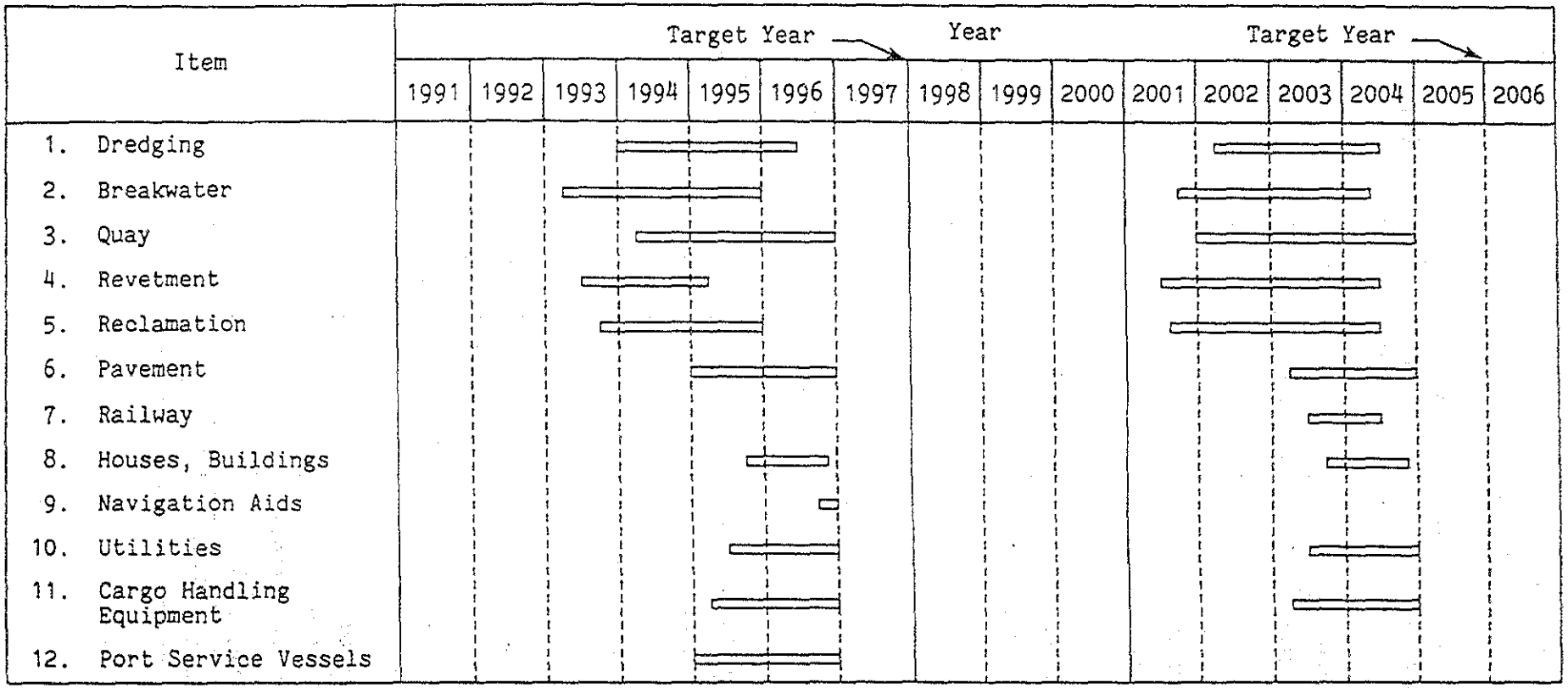
Appendix II-4-9(8) Wave Height Ratio

Appendix II-4-10 Rough Cost Estimates of Master Plan Project (2005)
(Alternative No.5)

Facility	Quantity		Cost (Million US$)
1. Dredging			
Rock Material	525,000	m^3	36.73
Other Material	2,920,000	m^3	16.57
2. Breakwater			
Southwest Breakwater	1,480	m	95.61
East Breakwater	350	m	29.96
3. Quays			
Container	1,150	m	74.76
Grain (Wheat)	270	m	24.77
General/Bulk Cargo	240	m	17.37
Bunker Oil	1	Sum	4.43
4. Revetment	1,520	m	39.86
5. Reclamation (Filling)	5,955,000	m^3	65.08
6. Pavement	631,000	m^2	48.10
7. Rail Way	1,000	m	1.08
8. Houses Buildings	1	Sum	11.76
9. Navigation Aids	1	Sum	0.70
10. Utilities (Water and Electric)	1	Sum	25.00
11. Cargo Handling Equipment			
Container	1	Sum	69.35
Grain	1	Sum	25.71
Fertilizer	1	Sum	7.56
Cement	1	Sum	1.50
Bunker Oil (Loading arm)	1	Sum	1.30
12. Port Service Vessels	2	Nos	6.48
13. Contingency (6%)			36.32
Grand Total (1~12)			640.00

Appendix II-4-11 Implementing Steps for The Master Plan

(Alternative No.5)



Appendix III-1. URGENT PLAN

1 Necessity of Urgent Plan

The Southern Province which consists of Galle, Matara and Hambantota districts has some basic problems as follows:

-Per capita GDP is rather low (78% of national value);
-The unemployment rate of 26% is rather high compared with the national level of 18%;
-Agricultural cultivation is behind in terms of mechanization compared with the rest of the country, even though it is the principal industry in the province;
-The level of manufacturing activity is low and its structure is relatively undiversified.

The above problems should be solved by degrees through further investment in the Southern Province. While the residents of the Southern Province have problems, as described in Chapter 3 of Part I, in their daily life, these difficulties appear based on regional socioeconomic differential, which is derived from above basic problems. Solving these problems should be considered a priority: they deal directly with basic human needs such as a stable society and a stable livelihood for the individual. An improvement in the transport sector would prove highly effective in opening distribution channels, thereby improving the economy as well as the quality of life in the province.

1-1 People's Daily Problems in the Southern Provinces

(1) Shortage of Commodities

According to the Ceylon Fertilizer Corporation, which has a fertilizer mixing plant in Weligama, there often has been a shortage of raw materials (component) of fertilizer because of transportation problem between Colombo and Galle.

Transportation by rail is generally delayed three or four days

(sometimes a week), because passenger transportation has priority over cargo transportation. Further, cargo is sometimes stolen on the way to Galle when shipped via road transportation. In the worst case, 65% of bagged fertilizer has been replaced with other materials on the way to Galle. Policing the road between Colombo and Galle, it appears, has been difficult.

Now, in April 1991, the supply of kieserite (a component of fertilizer) from Colombo has been cut off for two months, because of insufficient stock in Colombo. This shortage has interfered with mixing several kinds of fertilizer. As another example of the shortages, the supply of potash (a important component of fertilizer) from Colombo was cut off for two months during November-December 1990. At that time, it depressed the cultivation of paddy, tea, rubber and palm oil in the Southern Province because of poor supply of fertilizer to farmers. Not surprisingly, the average farmer was hit the hardest by the shortage. Although a few rich farmers could afford to go fertilizer hunting to Colombo, other common farmers couldn't.

The principal reasons the above situations occurred is that economic activities in the Southern Province are too dependent on the state of affairs in Colombo and that the transportation connecting these two areas is too weak to cope with these situations.

(2) Higher Retail Prices

Retail prices of some important foods such as flour and rice are controlled by the Government to some extent. However, retail prices of rice in the Southern Province are higher than those in Colombo as shown in Table 1-1.

This table shows retail prices of rice in Colombo and each district of the Southern Province from 1975 to 1989. Prices in the province are the weighted average value in consideration of each district's population. Consequently, it also shows that average retail price in the province for the period to 1989 was 5.1% higher than that in Colombo.

Meanwhile, according to "Price and Wage Statistics 1986" issued by Central Bank of Sri Lanka, average daily wage rates for key

agricultural production and building construction in the Southern Province was 6.9% lower than that in Colombo. Therefore, this means that substantial living expenses in the province was 12.9% higher than those in Colombo.

This is the very regional differential between Colombo and the Southern Province, and it is difficult to dissolve this differential without the development of the province, which is spearheaded by the improvement of infrastructures in the transport sector.

Table 1-1 Retail Prices of Rice

(Unit: Rs/Kg)

Year	① Colombo	Southern Province	② Galle	Matara	Hambantota	②/①-1 (%)
1975	4.12	4.34	4.10	4.19	4.95	5.39
1980	6.15	6.66	6.61	6.45	7.01	8.25
1983	8.49	8.96	8.97	8.72	9.26	5.54
1984	11.44	11.72	11.51	12.15	11.51	2.46
1985	10.84	11.15	11.04	10.81	11.77	2.83
1986	10.58	11.04	10.74	10.72	11.95	4.31
1987	11.73	12.54	12.29	11.64	14.16	6.93
1988	11.92	12.71	12.51	12.11	13.82	6.59
1989	14.66	15.16	15.00	15.13	15.46	3.40

Source: Bulletin of Selected Retail Prices, Department of Census & Statistics, Ministry of Policy Planning & Implementation

(3) At Emergency

Sri Lanka has been afflicted with ethnic problems for a long time and civil disturbances have occurred continually since 1983. During these civil disturbances, especially during April, August and September 1988 and November and December 1989, delivery shortage of many imported goods for the Southern Province occurred. These goods, which consist of consumer staples such as rice, flour, sugar, milk foods and so on, and intermediate goods such as fertilizer, petroleum and so on, have a strong relationship with people's livelihoods in the province.

A serious distribution shortage of essential food in the Southern Province was averted, because the province maintains a three month stock. However, even though the Provincial Council attempted to restrict against a rise in prices with the release of stock and the help of "price control law" by the Government, prices still rose dramatically, particularly in the Southern Province. Table 1-2 shows retail prices of rice in Colombo and each district of the Southern Province from January to December 1989. It can be found that the price in rise during November-December is remarkable.

Table 1-2 Retail Prices of Rice in 1989

(Unit: Rs/Kg)

Year	Month	① Colombo	Southern Province	② Galle	② Matara	② Hambantota	②/①-1 (%)
1989	JAN	16.17	13.71	12.50	13.50	16.00	-15.24
	FEB	13.79	13.83	13.00	14.00	15.00	0.29
	MAR	12.25	13.84	14.00	13.50	14.00	12.94
	APR	12.83	13.96	14.00	13.50	14.50	8.81
	MAY	12.83	14.13	14.00	14.00	14.50	10.09
	JUN	13.00	14.29	14.00	14.50	14.50	9.92
	JUL	13.08	14.29	14.00	14.50	14.50	9.25
	AUG	14.67	14.88	15.00	15.00	14.50	1.40
	SEP	14.88	15.25	15.50	15.50	14.50	2.49
	OCT	16.04	15.71	16.00	15.50	15.50	-2.06
	NOV	17.58	18.42	19.00	18.00	18.00	4.78
	DEC	18.83	19.58	19.00	20.00	20.00	3.98

Source: Bulletin of Selected Retail Prices, Department of Census & Statistics, Ministry of Policy Planning & Implementation

While as for fertilizer, the fertilizer mixing plant, as mentioned earlier, stopped operation for two or three months in each disturbance because of traffic suspension between Colombo and Galle.

These disturbances had a bad effect on not only socioeconomic activity in the Southern Province but also that in all island (of

course including Colombo). It is because almost all of marketing routes concentrate on Colombo. These situations would be easily avoided by providing a powerful channel for input of goods into the Southern Province.

1-2 Roles to be Played by the Port of Galle

The Port of Galle was constructed in 1971 and has quaywalls with a depth of nine meters and a length of 400 meters, where two 9,000 DWT class vessels are capable of being moored at the same time. Considerable volumes of commodities such as rice and sugar have been handled at the port. According to the development of the Port of Colombo, however, the quantity has gradually decreased for the past 10 years, except for clinker for cement production. To take some examples, the volume of rice handled at the Port of Galle was a scant 4,000 tons in 1989, compared with 30,000 tons in 1980. Sugar has not been handled at all for the past three years. The volume of loaded cargo was 1,400 tons in 1989, compared with 5,900 tons in 1980.

It is quite correct that the principal reason for the decrease in the handling of above cargoes results from the lack of a safe maneuvering area for vessels calling at the port.

Meanwhile, there is another problem at the coastal area of the city of Galle. The main shopping area is located at the east side of Galle Station, and some part exists along the "Marine Drive" which runs just behind the seashore. Although the "Marine Drive" is protected by a revetment made of rubble stones, it is always attacked by waves because there is no beach in front. Wave spray crashing on rubble stones has hindered the lives of people working on the sea side of the road.

According to interviews held with people living in this area, they have some trouble walking on the sea side of the road two to three months of the year. They also said that it was impossible to use the coastal side of the road as business parking spaces during those months.

To solve the problems that the people in the Southern Province have in their daily life, it is of urgent necessity to ease the situation of excessive concentration of the distribution function of goods on

Colombo by strengthening channels for input of goods into the province. From this viewpoint, it is considered to be most economical and effective to improve the Port of Galle by executing an urgent improvement plan described in the following section.

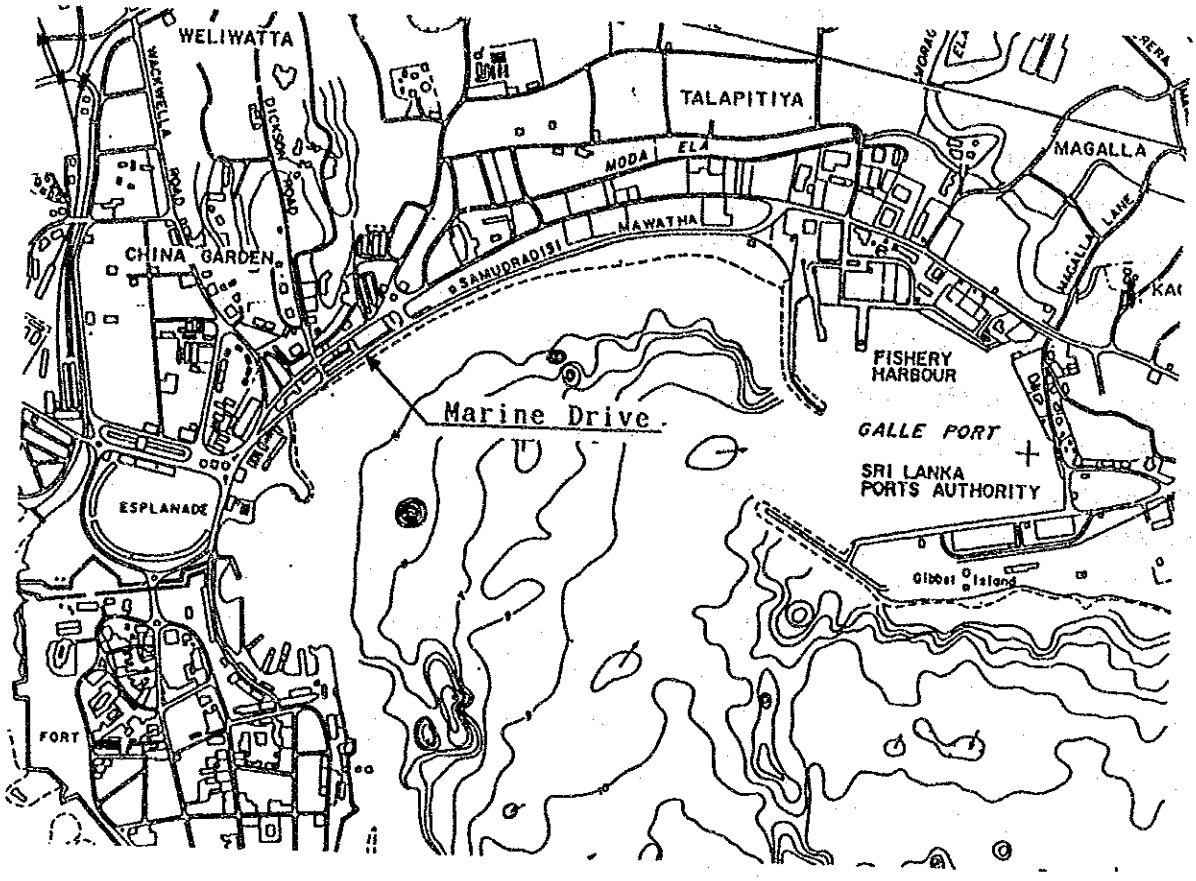


Figure 1-1 Coastal Area of Galle Bay

1-3 Problems of Existing Facilities

It is clarified in the former section that the Port of Galle, which is the gateway for the Southern Province as well as a fundamental base for providing transportation services to residents of the province, should implement its functions fully.

In fact, however, although the Port of Galle is located in a prime location on World Shipping Routes and is also the port to have been first developed in Sri Lanka, it is currently in a situation of stagnation. Therefore, even its small-scale handling facilities, composed only of berthing facilities 400m long and two warehouses, are not well utilized.

There are several reasons for this situation at Galle. Recently, dominant trends in world shipping have been towards the enlargement of vessel size, higher handling speed due to the introduction of containerization and so on. The Port of Galle, however, hasn't responded to these trends at all, an important point that needs to be indicated at the outset. It will take a long time to solve this problem, because it is necessary to undertake a full scale reconstruction of the wharves, basin and so on.

However, the most important issue for the time being will remain the problem of safety. In particular, the channel outside the port poses serious safety questions.

1-4 Present Condition of Safety in the Channel

(1) Maneuvering Condition

1) The Entrance of the Port

Fig.1-2, 1-3 show the maneuvering of vessels in arriving and departing respectively. According to these figures, some turning activities are carried out in the area just outside the port. In the case of arrivals, the vessel has to turn more than 90 degrees outside the existing port and stop in a very short space just

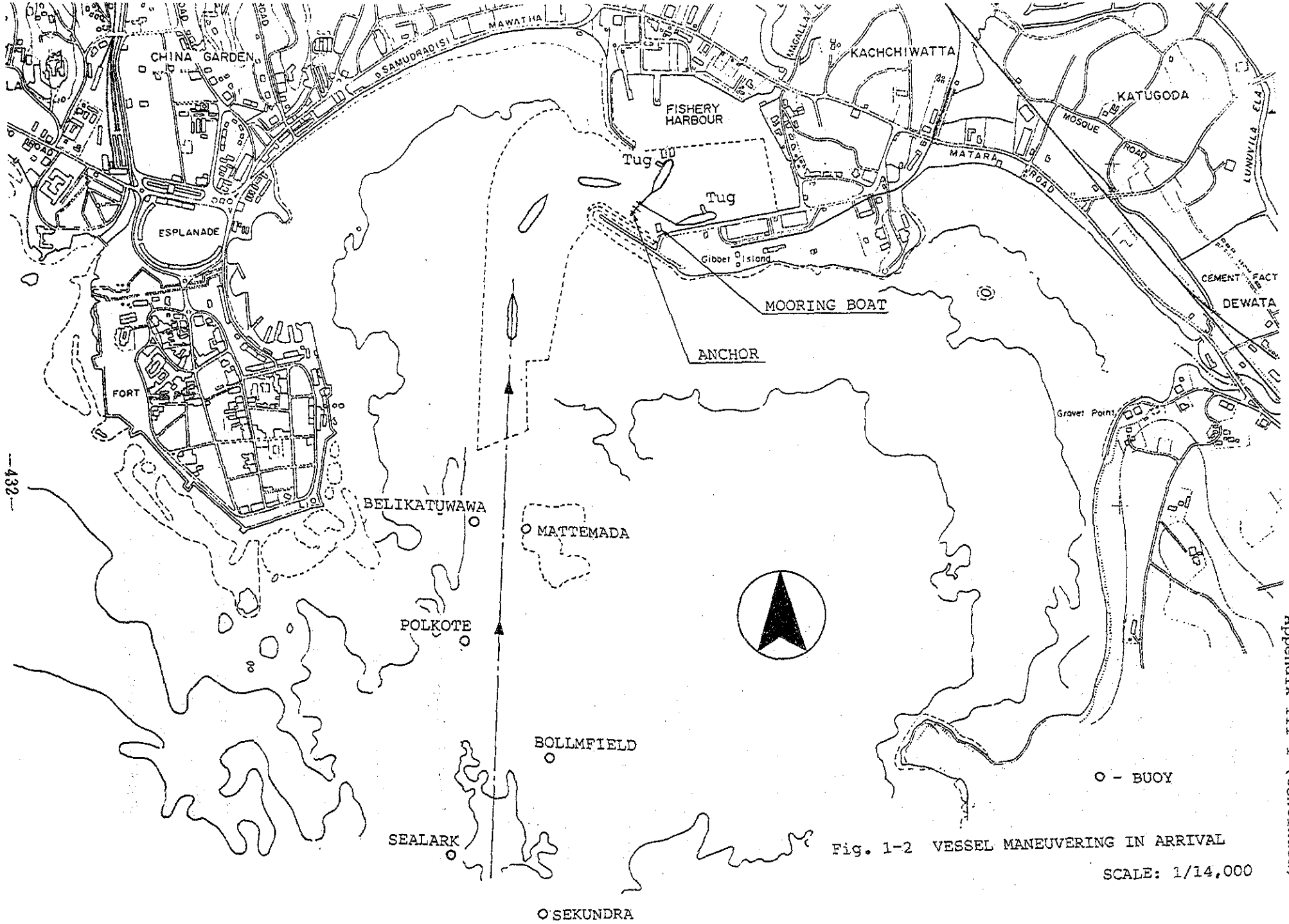


Fig. 1-2 VESSEL MANEUVERING IN ARRIVAL

SCALE: 1/14,000

Appendix III-1 (Continued)

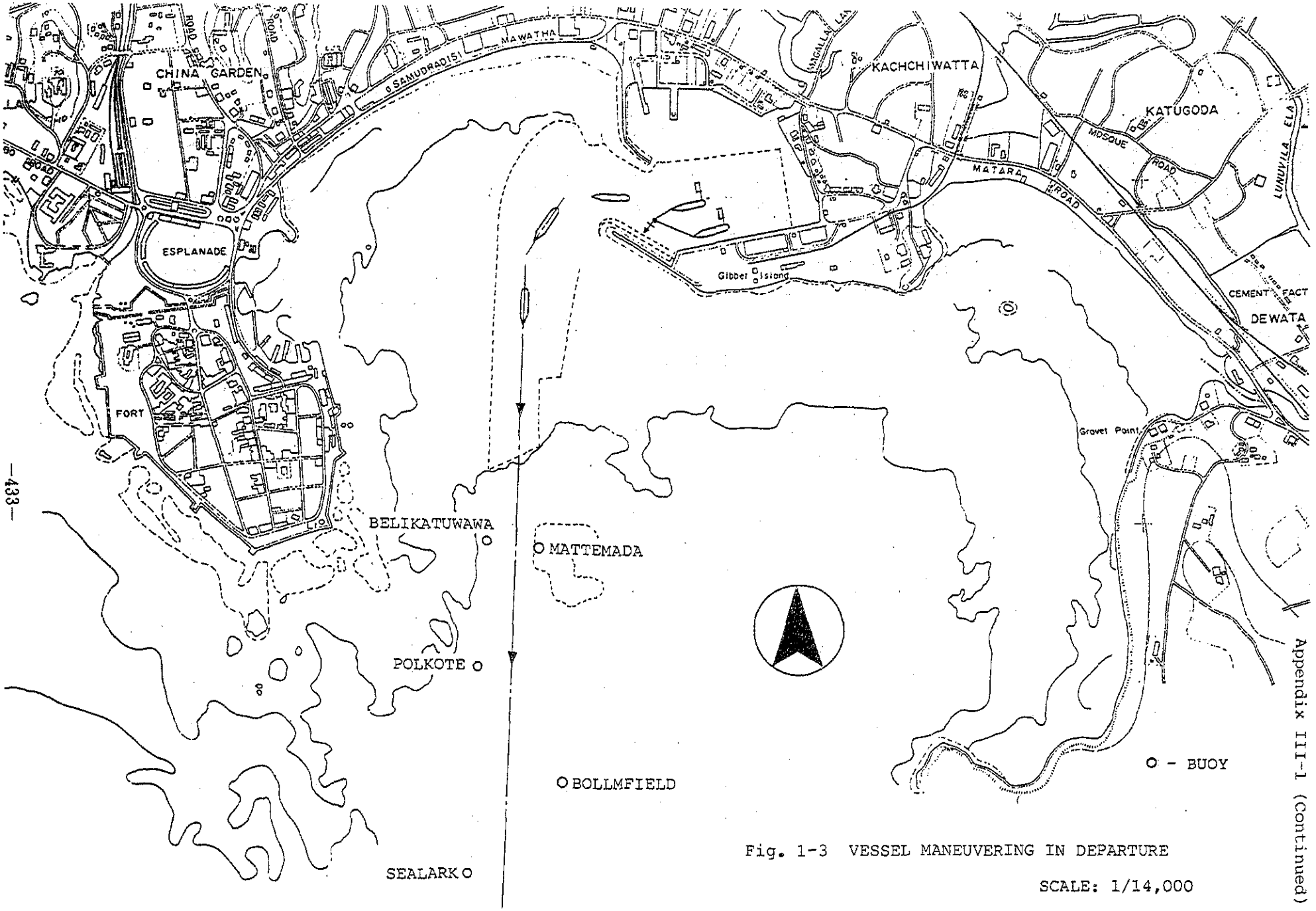


Fig. 1-3 VESSEL MANEUVERING IN DEPARTURE

SCALE: 1/14,000

after entering the basin. In these conditions, ships are easily affected by external forces such as waves and winds. Therefore, sharp technique by the maneuvering vessel is required, and it is difficult to conduct smooth entrance into the existing port even with the assistance of tug boats. Although the turning area is wide enough, it does not meet the criterion for calmness. This area sometimes suffers rough conditions mainly because of south swells.

2) Channel

This channel is located outside of the existing port and the depth is set at 9.8 meters, which is 0.9m deeper than that of the basin in the port. The narrowest width of the channel is about 150m, judging from the map. There are many parts which are shallower than 9.8m along the channel. According to the sounding results, there are shallow areas between the Fort and the channel in the western side of the channel. There are also some shallow areas corresponding immediately east of the channel. At the same time, there are some shallow points along the channel in the deep area. Although these shallow areas or points are marked with buoys, there are strong possibilities that vessels may inadvertently near these shallow areas because of high waves and strong winds. In fact, there have been accidents in this area, as is described later.

(2) Wave Conditions

Wave conditions of Galle Bay were already described in Chapter 4 of Part I. The main features are as follows:

Swells:

* Directions are substantially constant at SSE to SSW throughout the year.
* Waves with a height of over 0.5m attack the port throughout the year, percentage of 1.5m or over in height is 47% during the southwest monsoon season.

Wind waves:

* The influence of wind waves is most significant during the southwest monsoon season with waves of 1.5m or more in height generated with a frequency of nearly 50%.

The following table 1-3 shows the degree of calmness at three points in the central channel shown in Figure 1-4. In this table, the number shows the frequency of occurrence of the wave height that exceeds each critical wave height Hc.

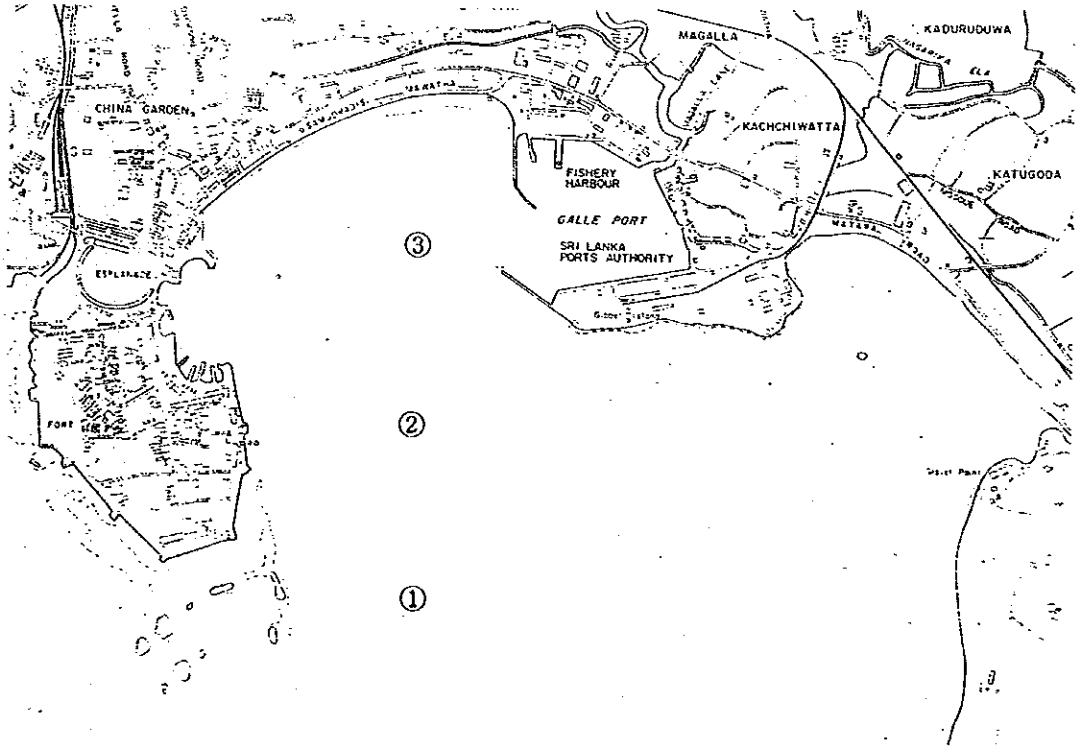


Fig. 1-4 Points of Calmness Estimation

Table 1-3 Degree of Calmness in the Channel

Unit: %

Hc / Point	0.7m	1.0m	1.5m	2.0m
1	>90	67.4	42.7	18.7
2	>90	62.7	27.0	5.9
3	>90	56.6	21.8	2.2

From this table, it is understood as follows:

* The entrance of the bay (point 1), for 42.7% of the year, namely 165 days, is attacked by the waves of 1.5m or more in height.
* Even the entrance of the existing port (point 3), which exists at the inner most part of the bay, is attacked by the wave of 1.5m or more in height for more than 20% of the year.

(3) Some Accident Examples Caused by Waves

1) Parting of Buoys

Because of these wave conditions in this water area, buoys lose their sinkers every year. The location of parting is shown in Fig.1-5. In the last two years, four buoys were parted from their sinkers, i.e.,breakage occurred twice a year. According to the harbour master, the reason for this is assumed to be waves. This problem is not a frequent occurrence in bays other than Galle.

Parting of Buoys in the Galle Bay

YEAR	DATE	NAME OF PARTED BUOY
89	7/4	SEKUNDRA
89	8/20	MATTEMADA
90	5/17	MATTEMADA
90	6/24	BELIKATUWAWA

2) Marine Accidents

Fatal marine accidents have also happened in this area. In the

last 10 years, two marine accidents, namely ships sinking, took place. The table describes the content of accidents and the figure 1-5 shows the location of the accidents. This shows that the accident places are just alongside the channel. Although there are three ports in Sri Lanka, there have been no cases of ships sinking except for these two cases in these 20 years.

Incidents of Sinking Ships

	Incident one	Incident two
Name of Vessel	TONJOO	Extraco 1
Nature of Incident	Grounding	Grounding
Date	1978.9.18	1988.10.28
Position		
GRT	4,690	-
NRT	3,110	-
Port of Registry	Singapore	-
Length of Vessel	420 feet	-
Draft	26 feet	-
Piloted or Selftaker	Piloted	-
Number of Tugs used	250 HP tug	-
Cargo carried	Rice	-

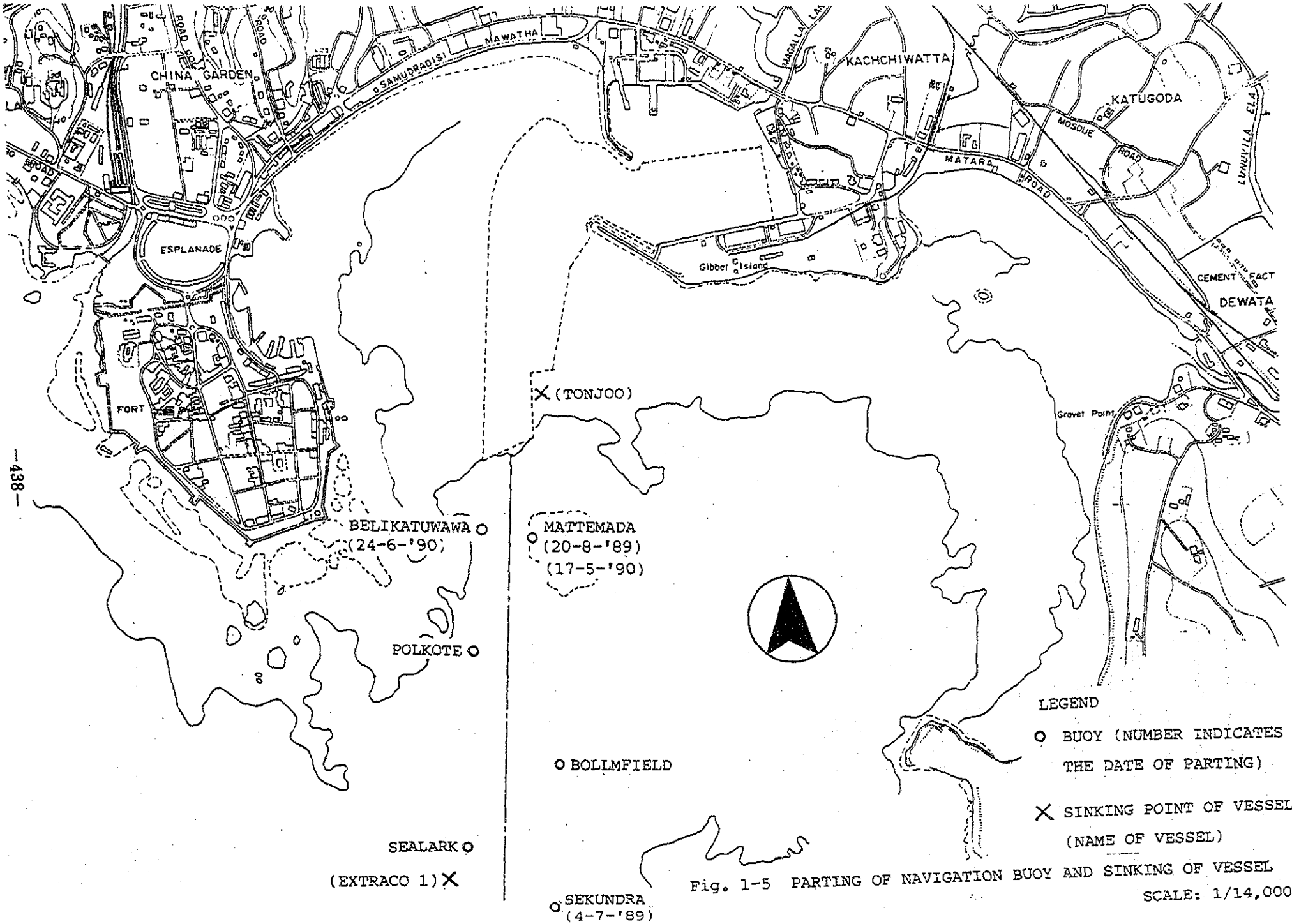


Fig. 1-5 PARTING OF NAVIGATION BUOY AND SINKING OF VESSEL

SCALE: 1/14,000

Appendix III-1 (Continued)

2 Basic Design

2-1 Site and Layout Plan

(1) Objectives of the Plan and Necessary Measures

The objective of the Urgent Plan is to provide a safe gateway to the Southern Province as the Port of Galle. To attain it, it is necessary mainly to secure safety for maneuvering of vessels. This is divided into two parts:

1) To increase the safety of maneuvering at the entrance of the existing port where vessels have to turn more than 90 degrees.

2) To increase the safety of maneuvering at the approaching channel where the vessel tends to be pushed towards shallower areas along it by waves and winds.

For these objectives, the following measures are considered:

1) To construct a breakwater as protection from high waves

2) To dredge the shallow area along the channel to widen the deep area

It is ideal to take both measures simultaneously, but it is considered difficult because of the high expense and long construction period.

If dredging of the shallow area is conducted after the completion of the breakwater, it then can be done easily and cheaply because water conditions will be calmer. Therefore, it is better to construct the breakwater first. Even only the construction of the breakwater will be very effective for improving condition of safety. At the same time, the construction of the breakwater will also reduce the influence of wave spray mentioned previously.

Accordingly, construction of the breakwater should be selected as a content of the Urgent Plan. So, a minimum required length of breakwater against the southwest monsoon is planned.

(2) Construction Site

As described above, it is necessary to attain the two objectives simultaneously by constructing a breakwater. The construction site of the breakwater should be the entrance of the bay to increase the calmness at the shallow points along the channel where the marine accidents have occurred. Therefore, it is most appropriate to construct the breakwater from the foot of the Fort. Considering the existing of rocks in front of the Fort, it would be suitable to select the site between rocks and the edge of the channel.

(3) Layout Plan

1) Alignment

The alignment of the breakwater shall be planned taking into consideration the wave direction, the ample width of the existing channel and the influence of reflected waves from the breakwater on vessels running along the channel.

2) Required Calmness

The maneuvering condition of vessels in the channel of Galle Bay is assumed to be similar to that of entering the port. Presented below are the results of interviews held with pilots in Japan on the maneuvering conditions of vessels entering the port. From the interviews, it was observed that tolerant limits of wave height at the entrance of the port for maneuvering vessels are as follows:

Direction of wave to vessel	90 deg.	45 deg.	0 deg.
Wave height	1.8m	1.9m	2.1m

From these results, it can be understood that 1.8m is the maximum wave height and when waves are smaller than that, it is possible to maneuver a vessel when attacked by waves from the side. 2.1m is observed to be the maximum wave height for waves from the front.

These are averages of all the figures based on answers by pilots,

excluding the impact of other forces such as winds and tides.

However, in the real situation during the southwest monsoon season in Sri Lanka, the wind blows hard simultaneously when high waves attack the bay. Therefore, in consideration of other forces, lower figures should be taken into account as the limit wave height for maneuvering ships.

As described in 4-3-1 of Part I and 4-6-3 of Part II, swells mainly come from the south. In the case of wind waves, they mainly come from between the south and west-southwest around the central channel because most of the waves are fairly refracted there. Accordingly, it is possible to assume that vessels plying along the channel will be attacked mainly from the rear by waves while they are attacked from the side at the entrance of the existing port. In consideration of these elements, the criteria for required calmness are assumed to be as follows:

The entrance of the port	1.5m
Channel	2.0m

The criterion of frequency is set at 95% considering a usual port planning criteria for calmness.

3) Study of Calmness

There are many exposed rocks in front of the Fort and these rocks work as a breakwater. Therefore, it is appropriate to start construction of the breakwater from the Southeast tip of these rocks.

On the other hand, the head of the breakwater to be constructed shall be set with a necessary allowance from the edge of the existing channel, if that channel is maintained to be used as is. On the assumption that 200m is secured as the width of the channel, the length of the breakwater would be 350m. As such, the maximum length of the breakwater would be 350m.

Figure 2-2 to Figure 2-17 show wave height ratio in the inner harbor by wave direction.

The table below shows the result of computer-aided simulation analysis of the effect of both a 300m and a 350m breakwater on calmness.

Table 2-1 Degree of Calmness (Critical Wave Height 0.5m)

Unit: %

Critical wave height	1.5m			2.0m		
Length of breakwater	0m	300m	350m	0m	300m	350m
Point 1	57.3	71.4	76.0	81.3	93.1	95.1
Point 2	73.0	77.9	84.0	94.1	96.4	97.6
Point 3	78.2	93.3	95.3	97.8	99.5	99.7

The following is observed from these results:

-With a 300m breakwater, the frequency of waves less than 1.5m is 93.3% at the point of 3 and that of waves less than 2.0m is 93.1% at the point of 1.

-On the other hand, if the breakwater is 350m, the frequency of waves less than 1.5m at the point of 3 and that of waves less than 2.0m at the point of 1 are more than 95%.

4) Layout Plan

Through the examinations described above, the breakwater with a length of 350m as shown in Figure 2-1 is being planned on an urgent basis.

On the completion of the construction of this breakwater, the Port of Galle will become a fully utilized port due to the enhancing of safety for maneuvering vessels in the central channel.

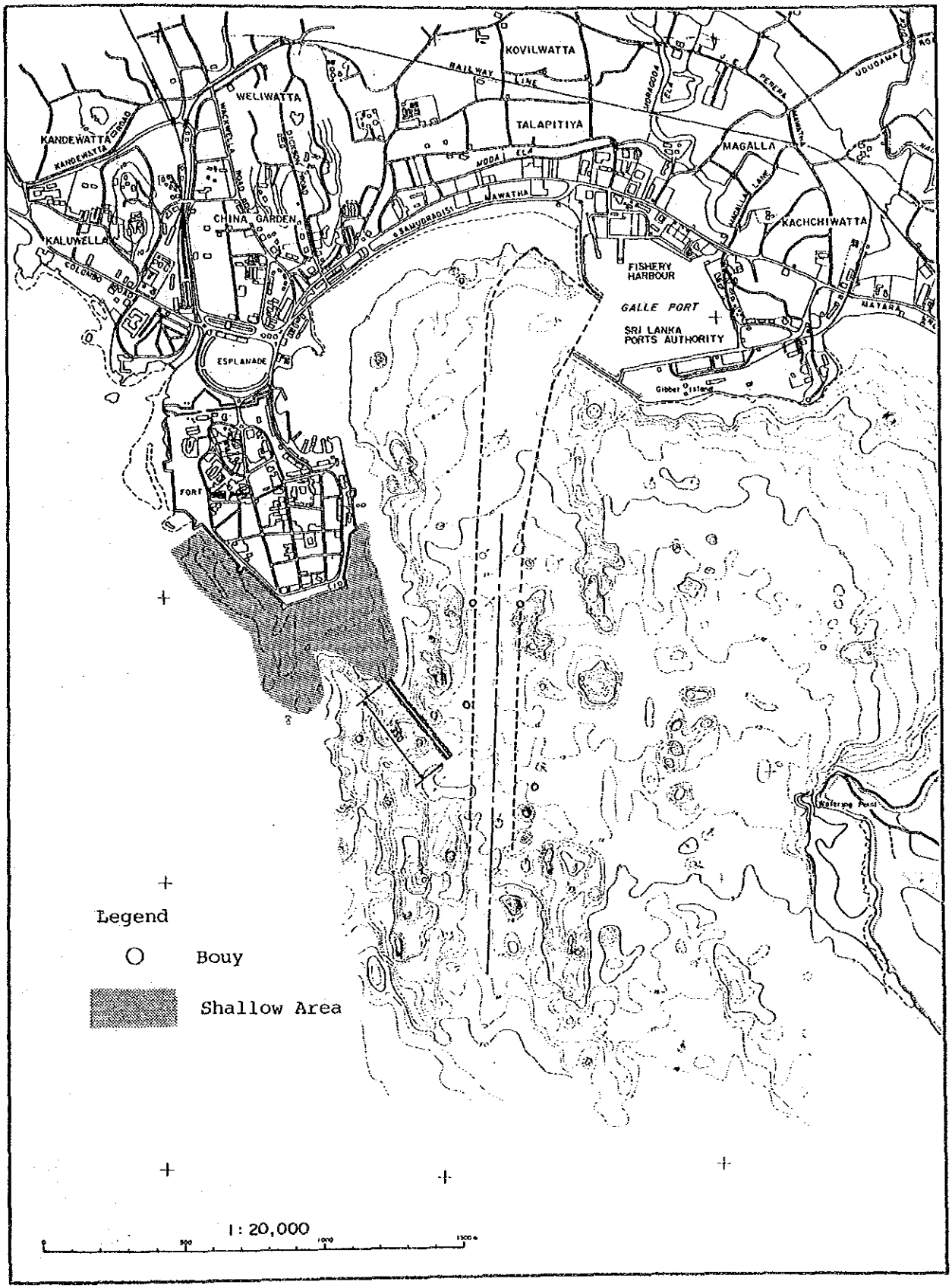


Fig. 2-1 Layout of Urgent Plan

Present
Wave Direction : S 7.9° W
Wave Period : 13.0 sec

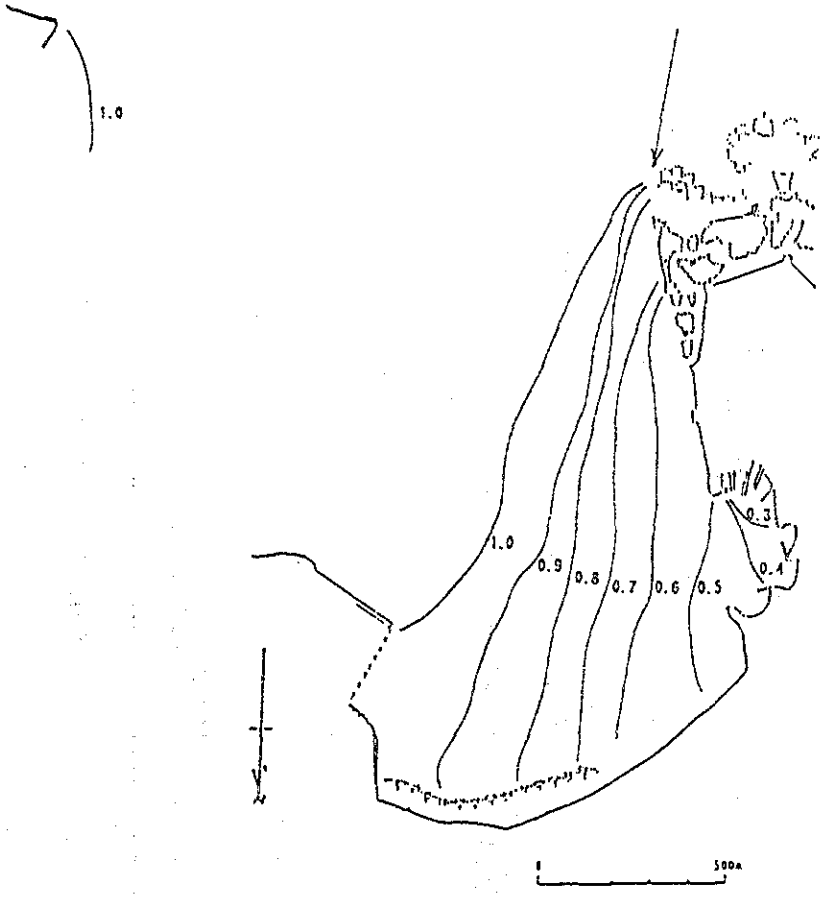


Fig. 2-2 Wave Height Ratio

Present
Wave Direction : SE
Wave Period : 7.0 sec

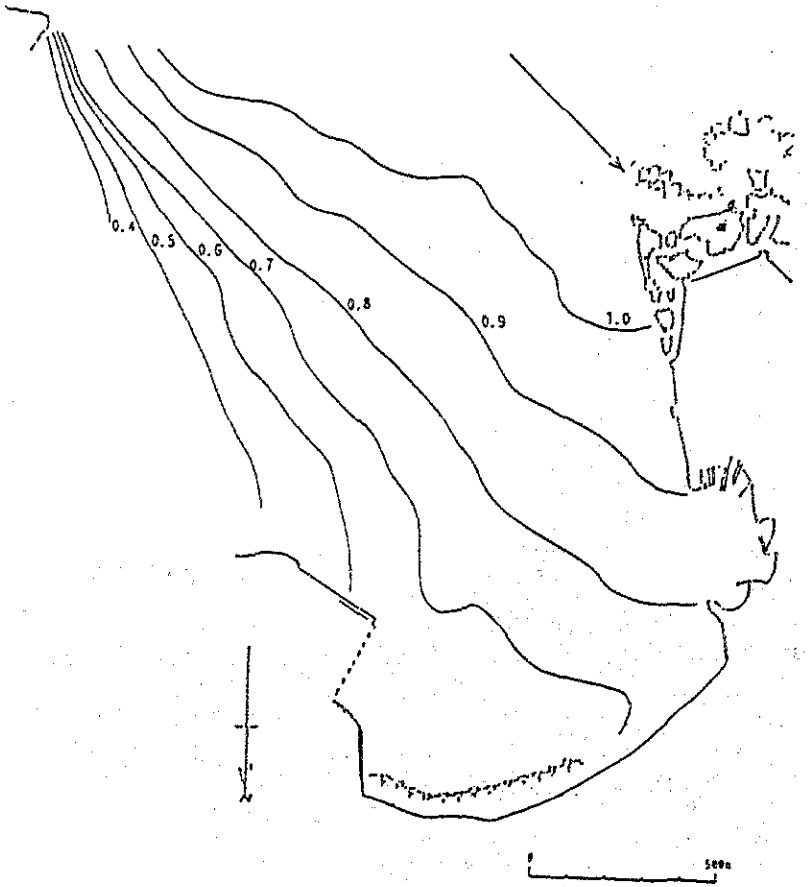


Fig. 2-3 Wave Height Ratio

Present
Wave Direction : SSE
Wave Period : 7.0 sec

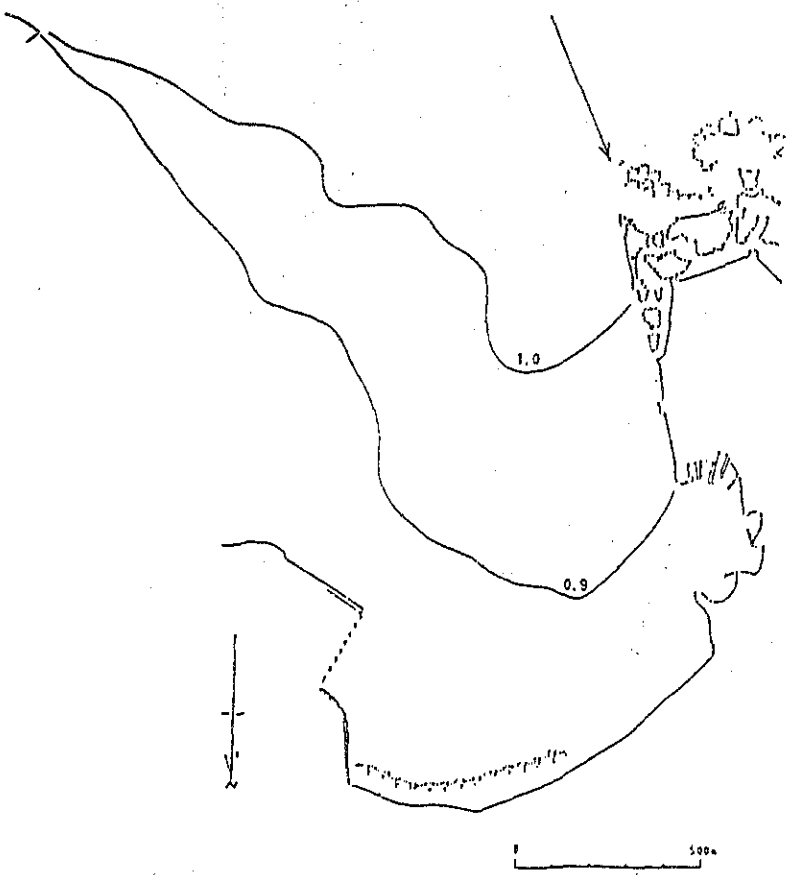


Fig. 2-4 Wave Height Ratio

Present
Wave Direction : S
Wave Period : 7.0 sec

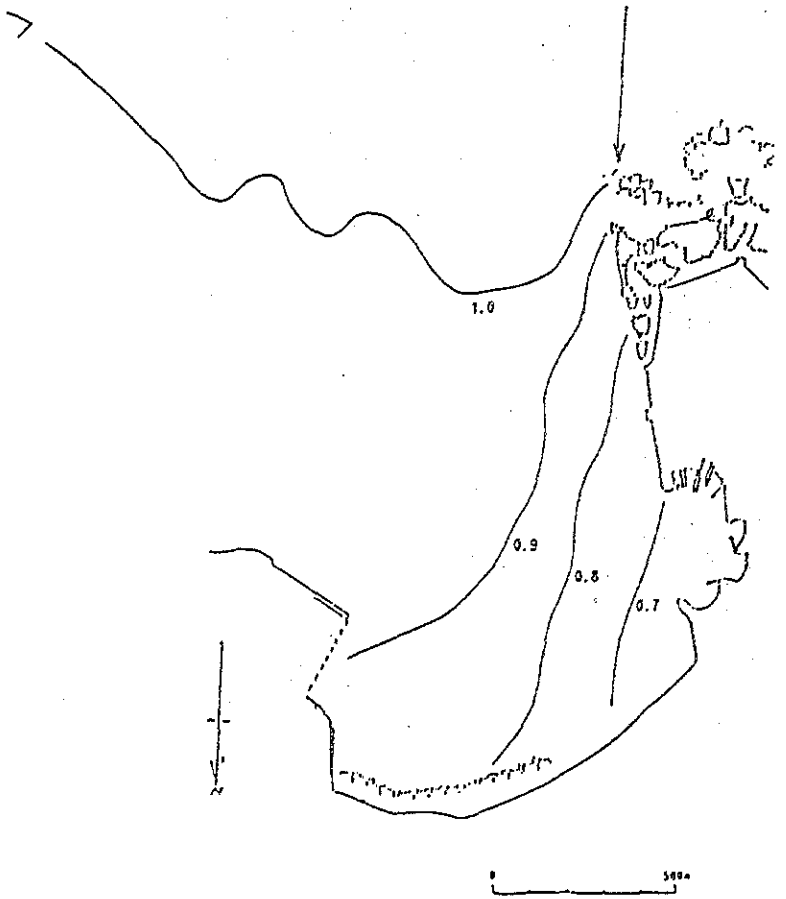


Fig. 2-5 Wave Height Ratio

Present
Wave Direction : SSW
Wave Period : 7.0 sec

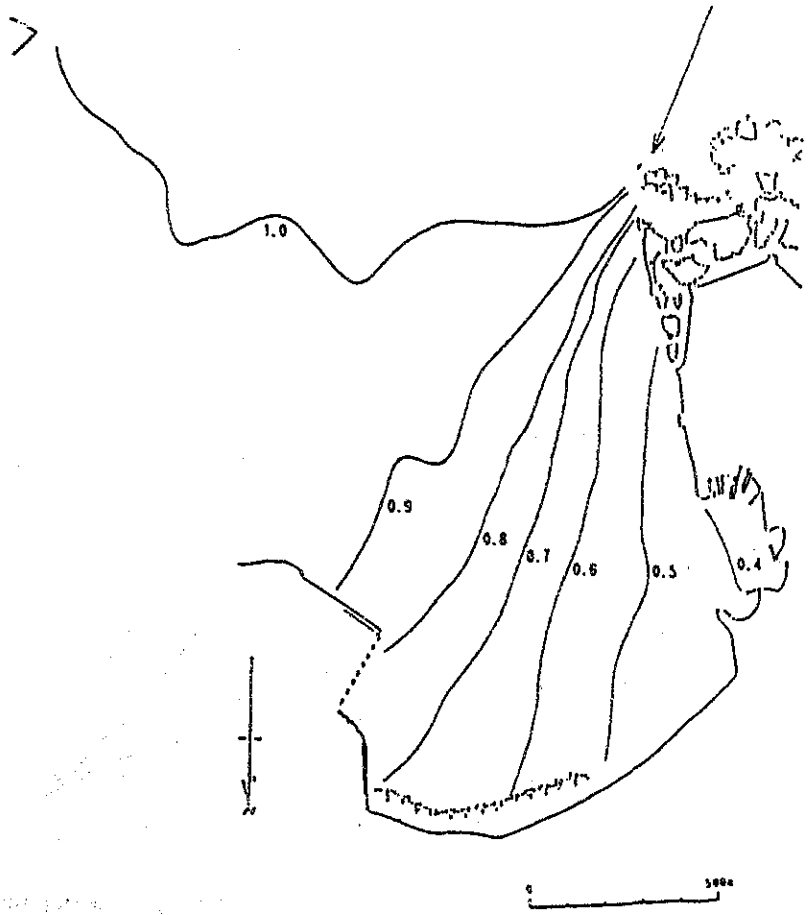


Fig. 2-6 Wave Height Ratio

Present
Wave Direction : SW
Wave Period : 7.0 sec

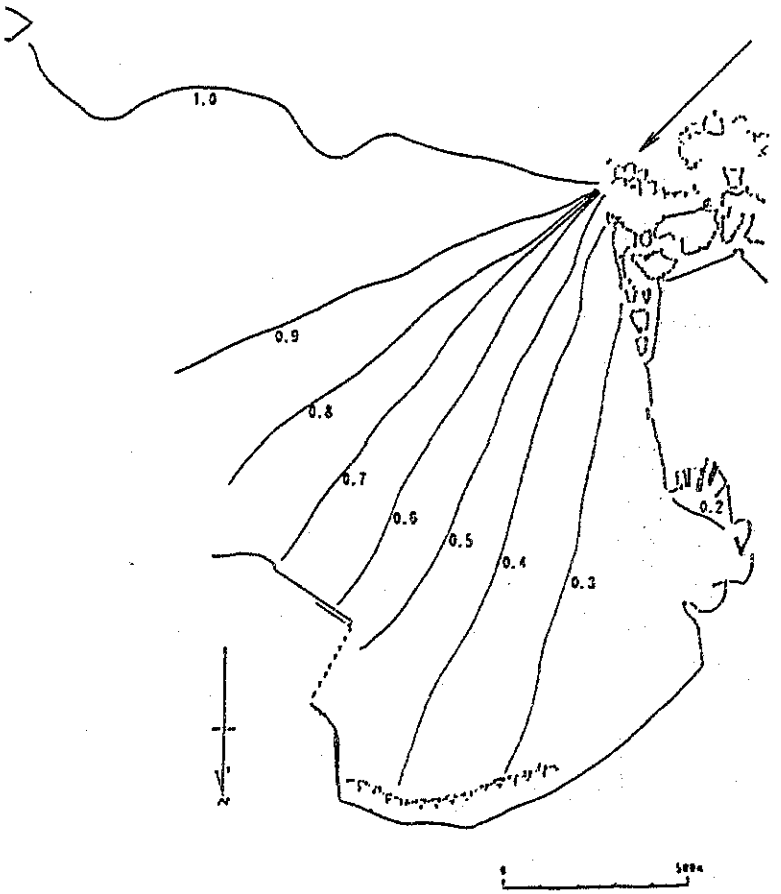


Fig. 2-7 Wave Height Ratio

Present
Wave Direction : WSW
Wave Period : 7.0 sec

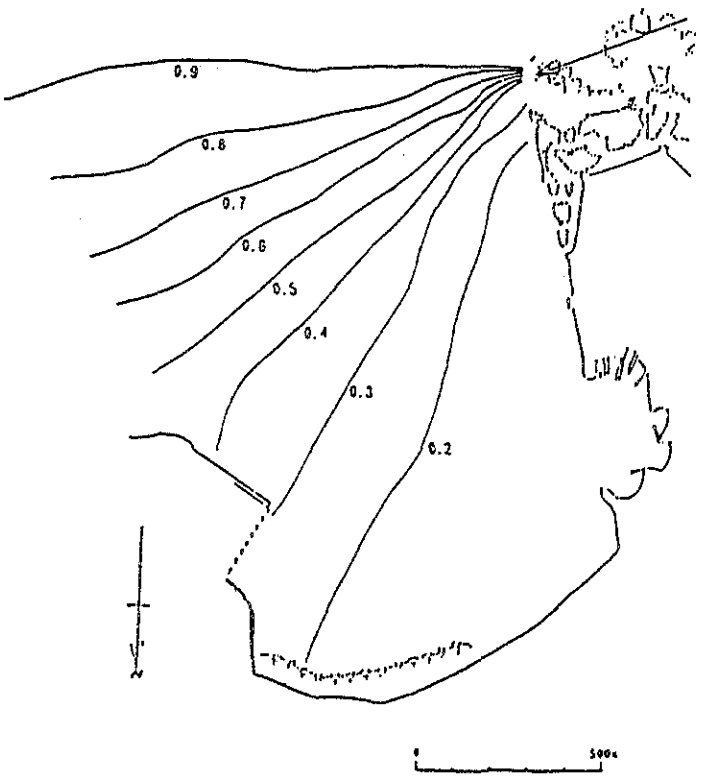


Fig. 2-8 Wave Height Ratio

Present
Wave Direction : W
Wave Period : 7.0 sec

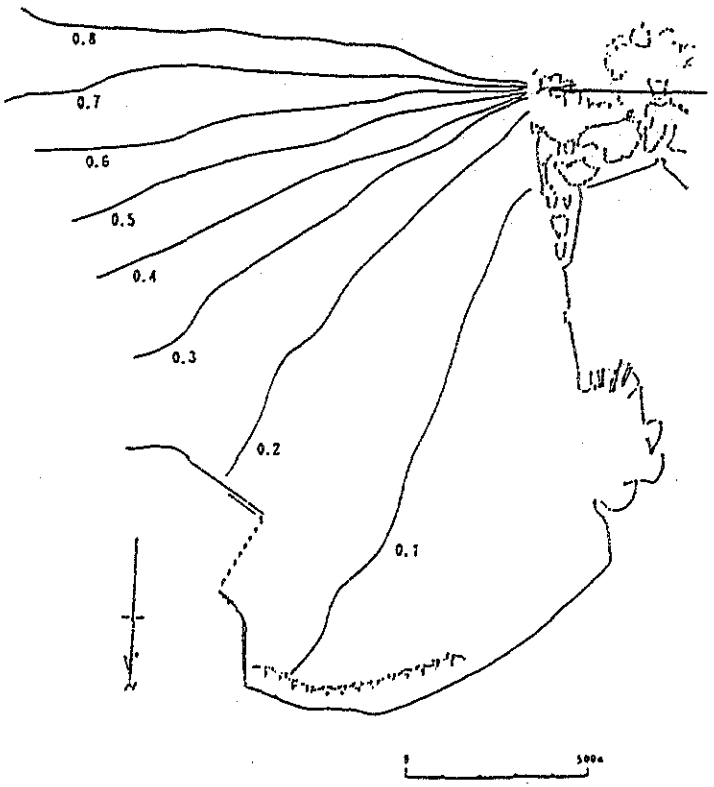


Fig. 2-9 Wave Height Ratio

Urgent Plan
Wave Direction : S 7.9°W
Wave Period : 15.0sec

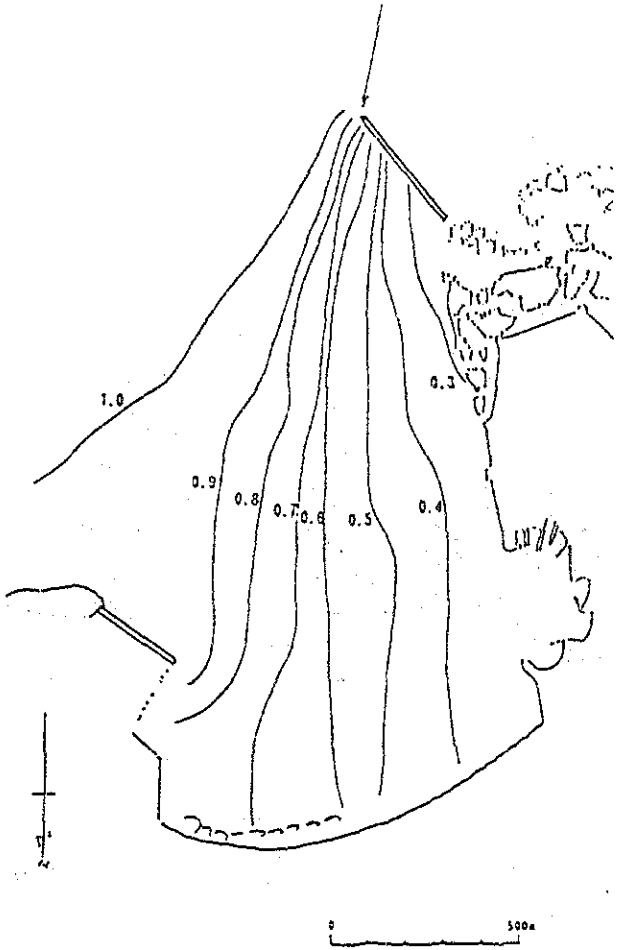


Fig. 2-10 Wave Height Ratio

Urgent Plan
Wave Direction : SE
Wave Period : 7.0 sec

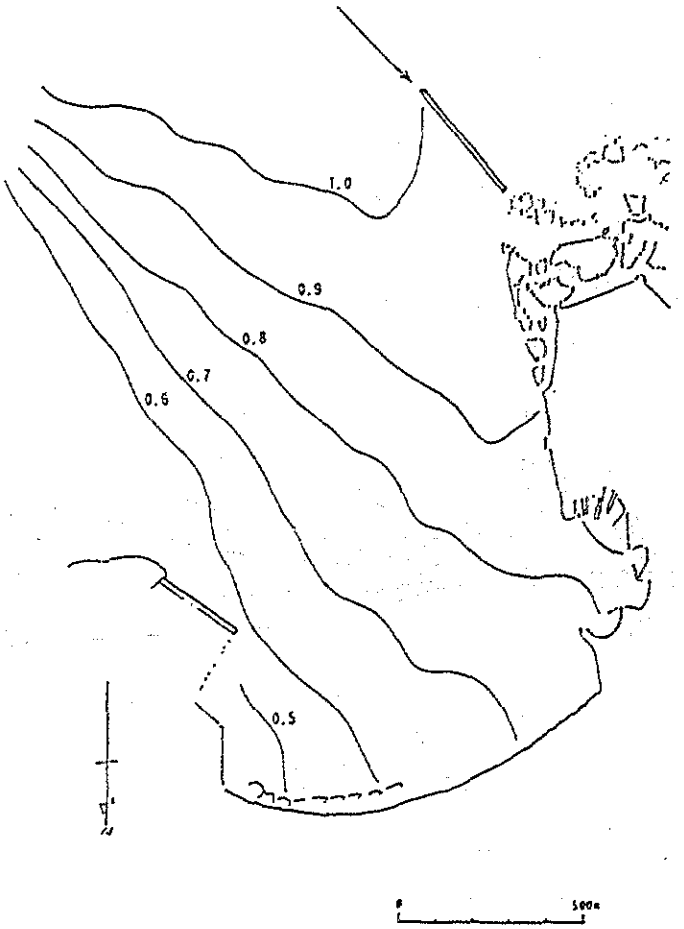


Fig. 2-11 Wave Height Ratio

Urgent Plan
Wave Direction : SSE
Wave Period : 7.0 sec

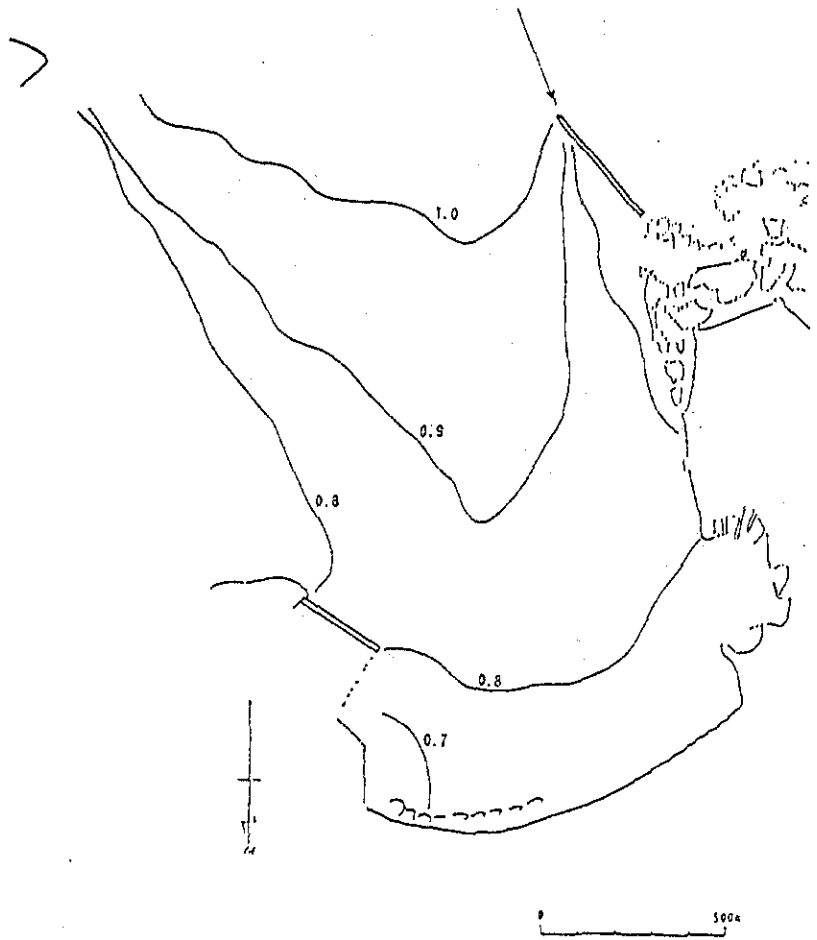


Fig. 2-12 Wave Height Ratio

Urgent Plan
Wave Direction : S
Wave Period : 7.0 sec

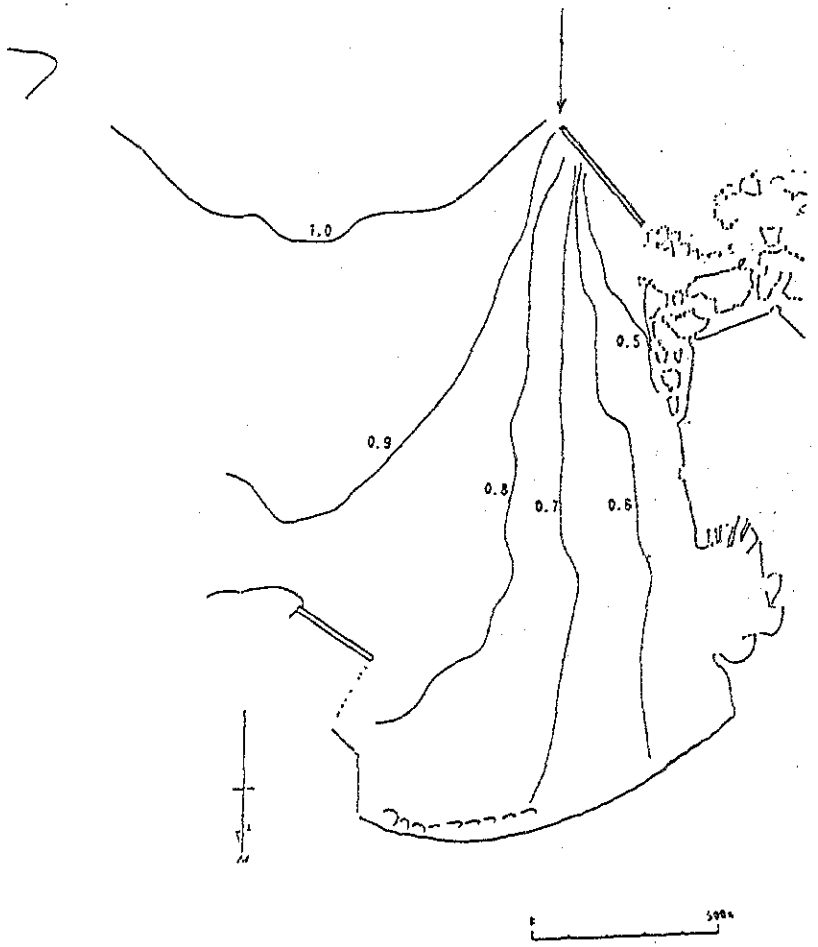


Fig. 2-13 Wave Height Ratio

Urgent Plan
Wave Direction : SSW
Wave Period : 7.0 sec

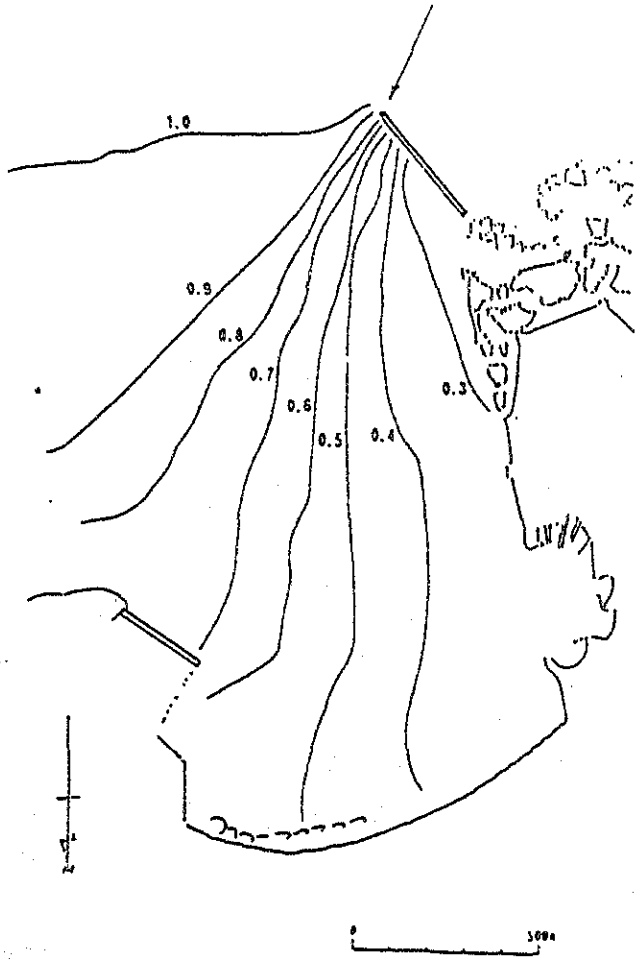


Fig. 2-14 Wave Height Ratio

Urgent Plan
Wave Direction : SW
Wave Period : 7.0 sec

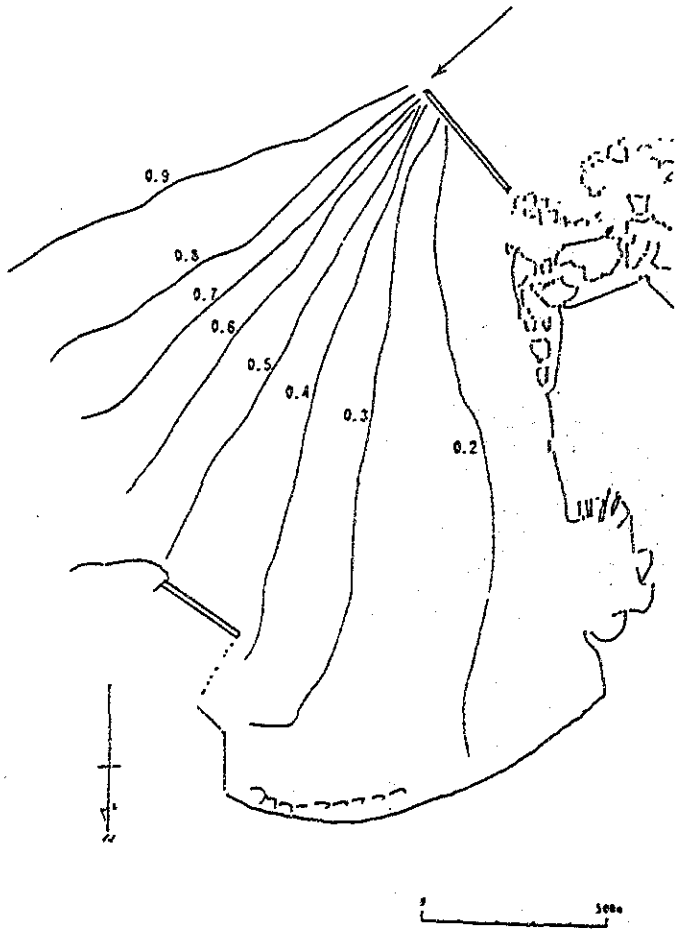


Fig. 2-15 Wave Height Ratio

Urgent Plan
Wave Direction : WSW
Wave Period : 7.0 sec

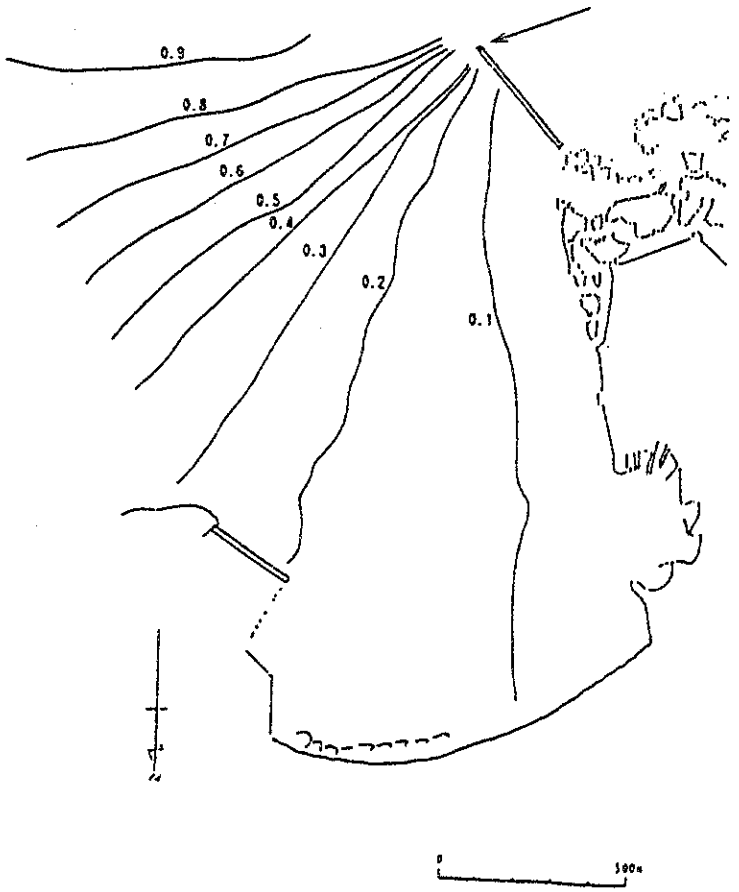


Fig. 2-16 Wave Height Ratio

Urgent Plan
Wave Direction : W
Wave Period : 7.0 sec

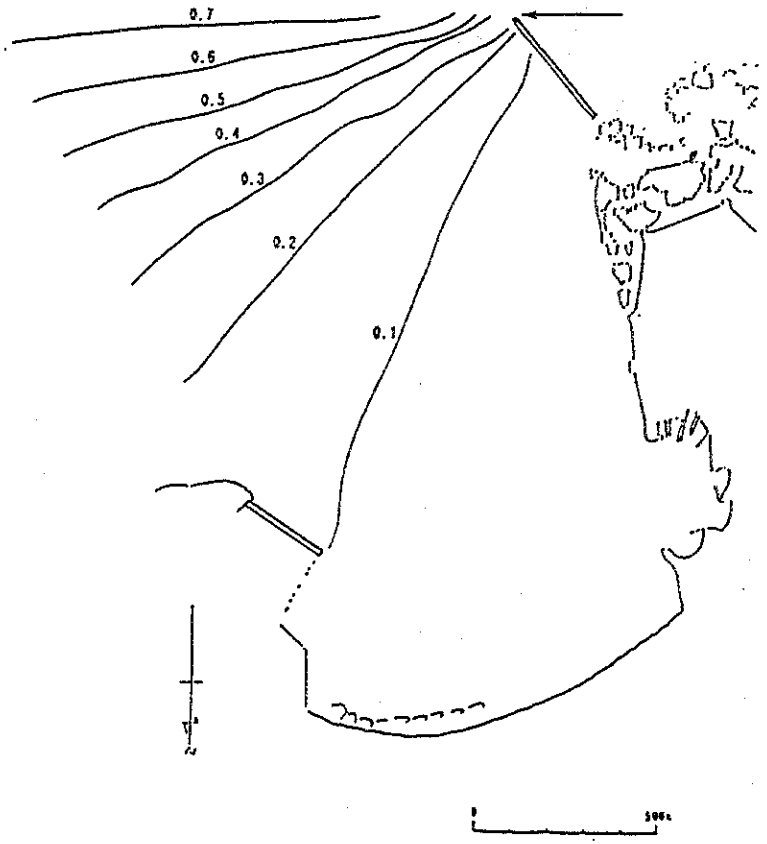


Fig. 2-17 Wave Height Ratio

2-2 Structural Design

(1) Design Conditions

As stated in Subsection 2-1, the Urgent Plan consists of the construction of a 350-m extension of the Southwest Breakwater offshore of the Fort Walls.

The design included analyses of the following factors:

1) Layout of breakwater
2) Impacts on surrounding topography and marine ecology
3) Design Criteria
4) Structural Type of Breakwater
5) Design and construction method and cost

Evaluation of the breakwater layout included the following fators:

1) Environmental conditions
2) Calmness in the harbour basin and ship maneuverability
3) Construction and maintenance costs

The following design conditions and paramenters have been established on the basis of the analyses and evaluation noted above as well as the results of field surveys and investigations.

1) Tide level

Mean High Water Level	: + 0.6 m
Mean Sea Level	: + 0.34 m
Mean Low Water Level	: + 0.10 m
Datum Level	: ± 0.00 m

2) Waves

The design wave characteristics with a 50-year return period have been established as follows.

Direction	Height(Ho')	Height(H1/3)	Period
W - S	5.5 m	5.1 m	9.5 sec

3) Water depth and sea bottom condition

The design water depths range from -4.0 m to -14.0 m. The site of the first 270-m-long section of the proposed breakwater is scattered with outcrops of the bedrock and the remaining 80-m section will rest on a suitable foundation formed by a sand layer of 2 m in thickness.

(2) Design

1) Selection of Structural Type of Breakwater

In the selection of the various structural types listed below, they were weighed against one another with regard to the following factors:

- Layout
- Environmental and service conditions
- Construction problems and construction time and cost
- Availability of construction materials from local sources
- Relative ease of maintenance

List of evaluated Structural Types of Breakwater

- Breakwaters
  - Sloping Breakwaters
    - Rubble Mound Breakwater
    - Concrete Block Type Sloping Breakwater
  - Upright Breakwaters
    - Caisson Type Upright Breakwater
    - Concrete Block Type Upright Breakwater
    - Cellular Concrete Block Type Upright Breakwater
    - Mass Concrete Type Upright Breakwater
  - Composite Breakwaters
    - Caisson Type Composite Breakwater
    - Concrete Block Type Composite Breakwater
    - Cellular Concrete Block Type Composite Breakwater
    - Mass Concrete Type Composite Breakwater
  - Breakwater Armoured with Wave Dissipating Concrete Blocks
  - Special Breakwater

After an indepth analysis of the factors noted above, the sloping breakwater was selected for detailed analysis.

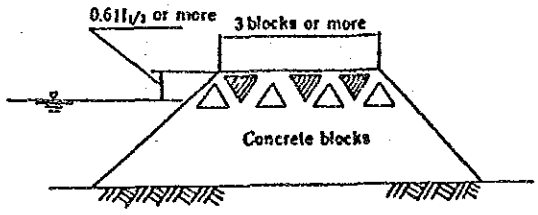
2) Design of Mound Breakwater

(a) Crown Height

The crown height of breakwaters should be equal to not less than about 0.6 times the design significant wave height above the mean spring high water level and should have an extra height to prevent considerable wave overtopping. With due regard for this point, the crown height of +5.0 m above the Datum Level has been taken for design purposes.

(b) Crown Width

The crown width should be equal to the width of three or more irregular concrete blocks installed in a row as shown below.



Crown Width of Sloping Breakwater

(c) Weight of Armor Concrete Block

The weight of concrete blocks covering the seaward faces of the rubble mound exposed to wave force was obtained by Hudson's formula.

$$W = \frac{\gamma_r H^3}{K_D (Sr - 1)^3 \cot \alpha} = 13.45\,t < 14.19\,t$$

where W : Minimum weight of rubbles or concrete blocks (ft)

γ_r : Unit weight of rubble or block in air (tf/m^3)

Sr : Specific gravity of rubble or block in sea water

α : Angle of the slope to horizontal plane (degrees)

H : Wave height (m)

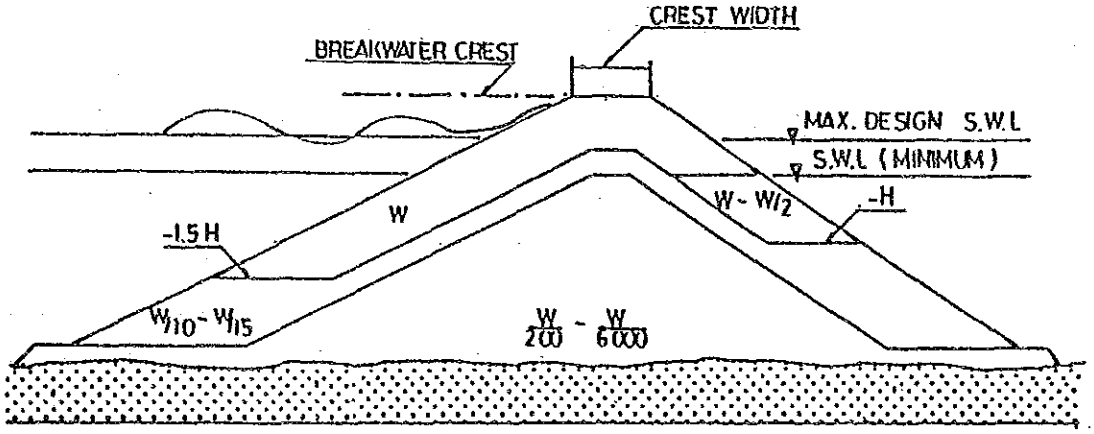
K_D : Constant determined by the armoring material and damage rate.

As a result of the calculations, the weight of 16 tons was taken for the concrete armor blocks to protect the seaward faces of the rubble mound. For the breakwater tip, provision is made for placing 25-ton concrete block armor stones.

On the other hand, armor stones of 4 to 6 tons each will be placed on the landward section of the breakwater for concrete blocks in the central part of the structure and an extra height provided for the crown level.

The weight of armor below the sea water level

The weight of armor unit below the sea water level is determined from the values recommended by the Coastal Engineering Research Center, Department of Army Corps of Engineers, USA as shown below.



The Plan view and typical cross section of the breakwater are shown in Figs. 3-2-1 and 3-2-2, respectively.

3 Implementation Schedule

Looking toward the Indian Ocean, Galle Bay is exposed to southerly swells more than 0.5 meter high all the year round. Moreover, wind waves of 1.5 m or more in height reach the bay from S to SW directions during the five southwest monsoon months (April to September).

Wind speeds of 10 m/sec or more and significant wave heights of 0.3 to 0.5 m or more are generally considered critical physical conditions which render harbour works and other marine construction activities impractical. By this standard, the proposed breakwater works in Galle Port will be affected to a greater or lesser degree throughout the year.

The numbers of days available for construction operations as determined on the basis of wave heights in and around the port are as indicated in Table 3-1. In this table, the wave heights of less than 1.5 m are considered to permit construction activities to be carried out, though with reduced efficiency, without interruptions.

Table 3-1 Days Available for Construction Operations

Season		Wave Height				Days Available for Construction Operations
Month	Total days	~0.49 m	0.5 m ~0.99 m	1.0 m ~1.49 m	1.5 m~	
		Ⓐ	Ⓑ	Ⓒ	Ⓓ	Total days of Ⓐ~Ⓒ
March April	61	-	17 days (27.5%)	33 days (54.0%)	11 days (18.5%)	50 days
May ~ September	153	-	-	8 days (5.0%)	145 days (95.0%)	8 days
October November	61	-	9 days (15.0%)	28 days (45.0%)	24 days (40.0%)	37 days
December February	90	-	45 days (51.25%)	44 days (48.75%)	-	90 days
Total	365	-	72 days (19.7%)	113 days (31.0%)	183 days (49.3%)	185 days

The available days in the tabulation are for offshore or coastal construction operations. For shore works the number of available days is assumed to be increased by nearly 80 days, which may vary depending on the type of work.

With due consideration given to the severe marine conditions. the implementation schedule has been established as shown in Table 3-3-2 on the following assumptions:

1) The first monsoon season will be devoted to activities, such as site preparation, opening of quarries, stockpiling of armor stones, and construction of a temporary yard and jetty for unloading armor stones. These operations are estimated to take five months, during which time all floating equipment will be mobilized.
2) During October to April construction crews will work on two shifts 12 hours a day and seven days a week.
3) Maximum use of the existing port area will be made for the production and storage of concrete blocks.

Table 3-2 Implementation Schedule

Description	Months														
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
I. Construction Works															
1. Mobilization and Preparation															
2. Manufacturing of Concrete Blocks															
3. Transportation of Stones															
4. Offshore Works															
5. Demobilization															
II. Engineering Services															

4 Cost Estimate

4-1 Basic Principles of Cost Estimation

The cost estimates of the project have been prepared by applying the basic prices and rates obtained during the Feasibility Study period from October 1990 to November 1990 to the plants, equipment, materials and labor required for the Project construction.

(1) The estimated construction cost consists of foreign and local currency components. The exchange rates used in the cost estimation are:

US$1.00 = Rs.40.37 = ¥130.60 (Quotation as of Nov. 1990)

(2) All prices and rates inputted into the cost estimates are as of November 1990.

(3) No allowance is made for the import duties applicable to the materials, equipment and construction plants to be imported into Sri Lanka from other countries.

(4) No allowance is made for the transaction tax (BTT) assessable on materials and fuels obtained from local sources.

(5) The contract tax applicable to construction contracts is not included in the cost estimates.

4-2 Estimation of Cost

(1) Basic Prices and Local Supply Capacity for Materials and Labor

In addition to a survey conducted on the prices and rates for locally available labor, fuels and construction materials, an investigation was undertaken to determine the supply capacities of these items with particular reference to major recent development projects in Galle and Colombo.

Table 4-1 Daily Wage Rates of Local Workers and Fuel Price

	Item	Daily Wage Rate & Fuel Price (Rs.)
Local Woker	Unskilled	90
	Skilled	120
	Foreman	225
	Crane Operator	160
	Driver	120
	Concrete Worker	120
	Small boat Skipper	140
	Crew	120
Fuel (Per l)	Gasoline	25
	Light Oil	11
	Heavy Oil	10.6

Table 4-2 Unit Prices of Construction Materials

Item	Unit	Unit Price (Rs.)
Graded rock (100kg - 6.0t)	Cu.m	390
Crushed Stone (50 - 100 mm)	"	600
Fine Aggregate	"	200
Cement (Bag)	ton	4000

4-3 Construction Cost

The construction cost of the Southwest Breakwater comprising the Urgent Plan project is broken down in Table 4-3.

The total cost of the Urgent Plan of the project is estimated at US$22,933,000.

The cost estimates are based on the following preconditions:

(1) A concrete block casting yard and a materials storage area shall be provided within the existing port area.

(2) The 100-m-long west end of the existing wharf structure shall be made available for free use of the contractor for unloading construction materials.

(3) Floating plants shall be allowed free anchorage within the harbour basin during the monsoon seasons.

Table 4-3 Construction Cost for Urgent Plan

Description	Quantity	Unit	Construction Cost (US$)
Southwest Breakwater	350 m	m	24,417,000
Engineering Services		Sum	1,516,000
Grand Total			22,933,000

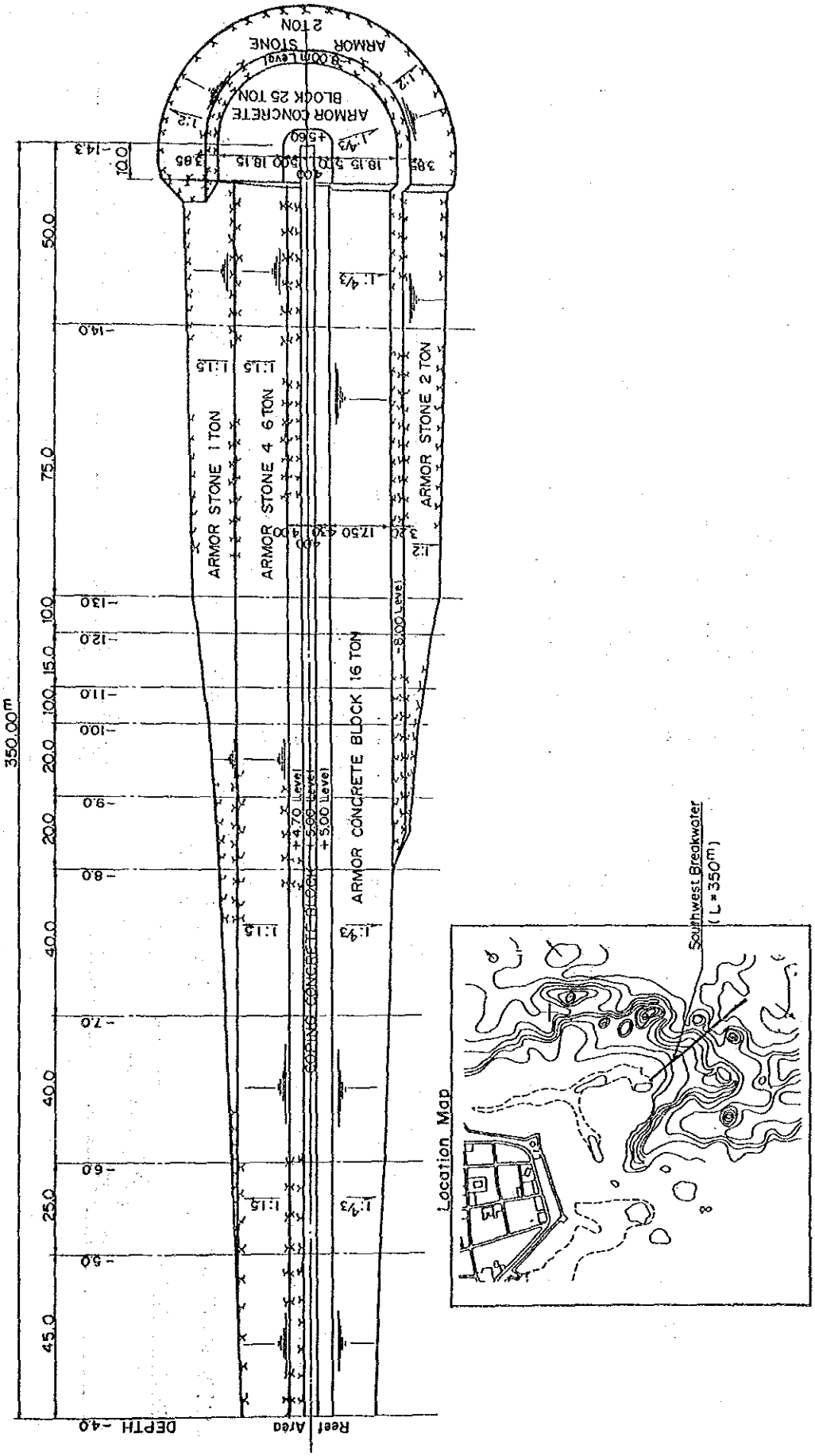


Fig. 4-1 Plan of Southwest Breakwater

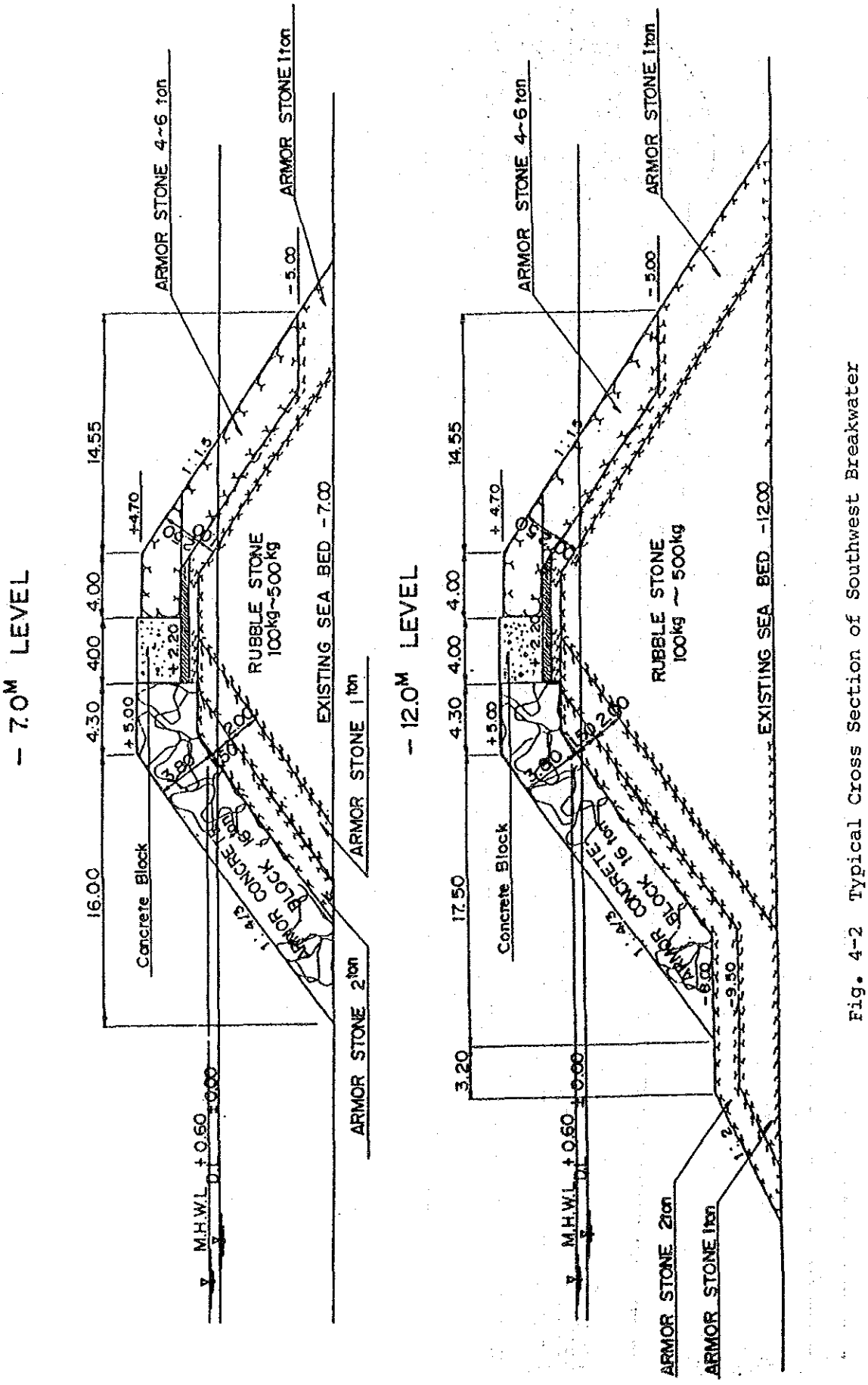


Fig. 4-2 Typical Cross Section of Southwest Breakwater

5 Project Evaluation and Conclusion

The port of Galle, which is managed and operated by the Sri Lanka Ports Authority (SLPA), is one and only port as an entrance of seaborne traffic to the province. As the regional development of the Southern Province is one of the most important projects in Sri Lanka, the improvement of the safety and the maneuverability of the Port of Galle is of urgent necessity from the viewpoint of alleviating the regional differential of livelihood between Colombo and the Province and answers the policy of the Government of Sri Lanka.

Effects of this project is evaluated basically as follows:

-Elimination of the shortage of subsistence commodities for the Southern Province;
-Stabilization of prices of subsistence commodities in the province;
-Improvement of the level of living for the residents in the province;
-Stabilization of the people's livelihood of the province.

As mentioned above, there are substantial benefits to the residents in the Southern Province resulting from this project. Some of which can be evaluated quantitatively to some extent, as is examined below;

Firstly, the capacity of facilities for handling cargoes at the Port of Galle at present is about 150,000 tons except clinker and the potential cargo volume, which is calculated based on current demand and supply data of the hinterland of the Port of Galle, is also more than 150,000 tons. On the other hand, the actual cargo volume handled at the port in 1988 and 1989 were less than 50,000 tons. Therefore, it can be expected that the cargo volume will increase by at least 100,000 tons. According to the increase of cargo volume handled at the port, the employment opportunity of port labors will also increase.

Secondly, the benefit in terms of improving the level of living due to the easement of the regional differential of retail prices of rice can be calculated based on the following assumption:

-Higher living expenses of residents in the Southern Province due to the price differential between Colombo and the province will be

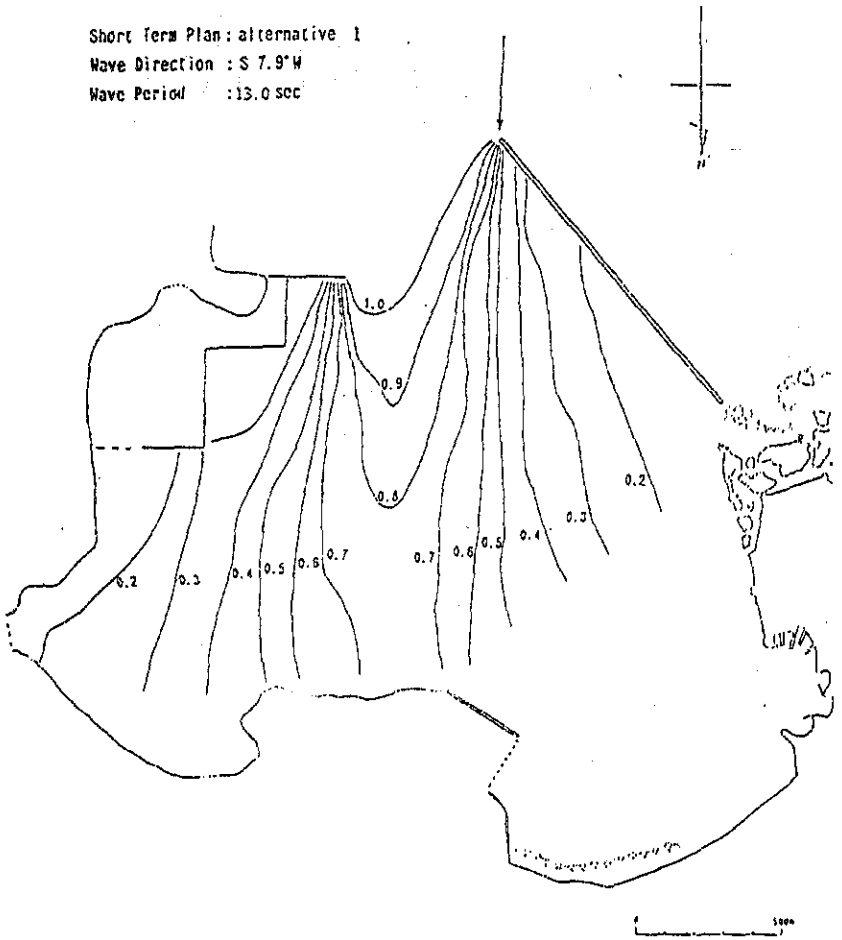
dissolved;

-The population of the Southern Province is about 2.1 million, 12.5% of Sri Lanka's population, at present;

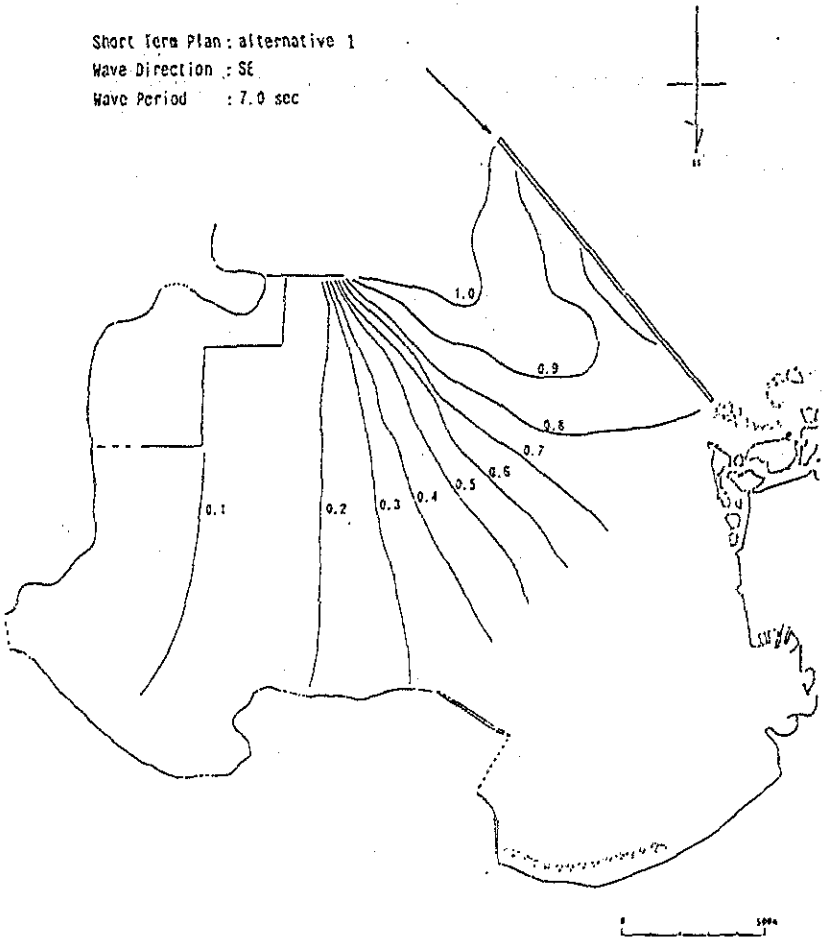
-Per capita consumption of rice in the Southern Province is about 100 kg per annum.

Above benefit will be about Rs. 150 million per annum.

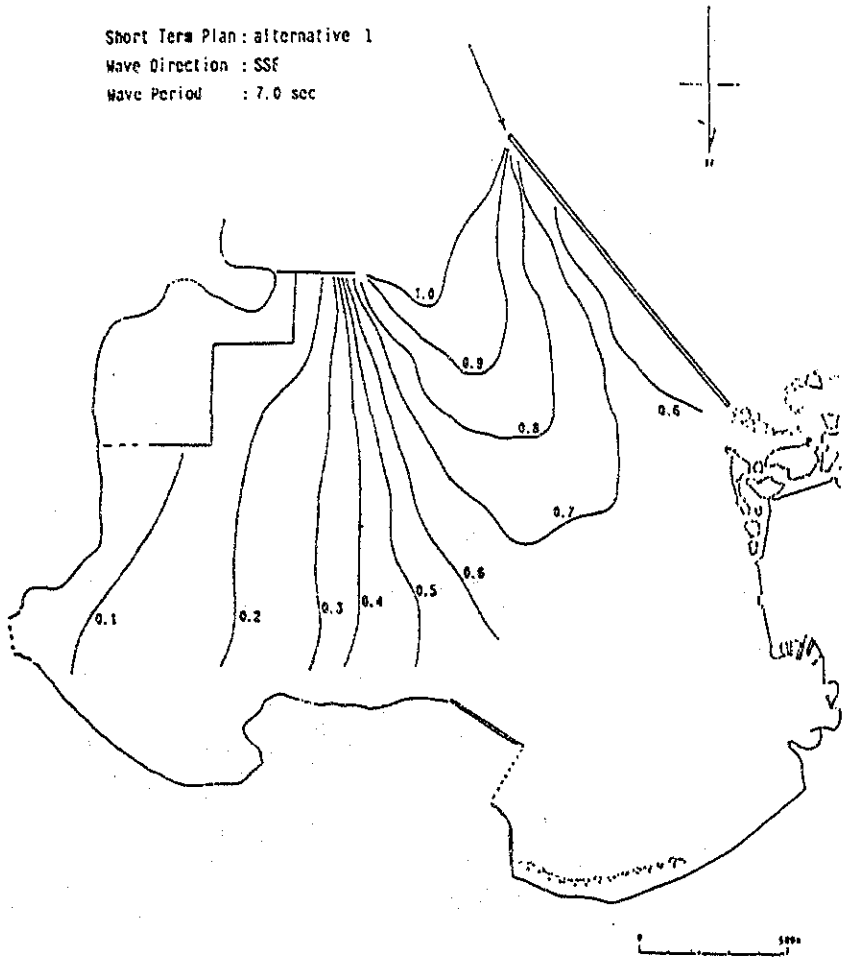
Many kinds of good effects are generated by the implementation of this project as mentioned above and this project is expected to contribute greatly to the improvement of life of residents in the Southern Province. Therefore, It can be judged appropriate to implement this Urgent Plan as soon as possible.



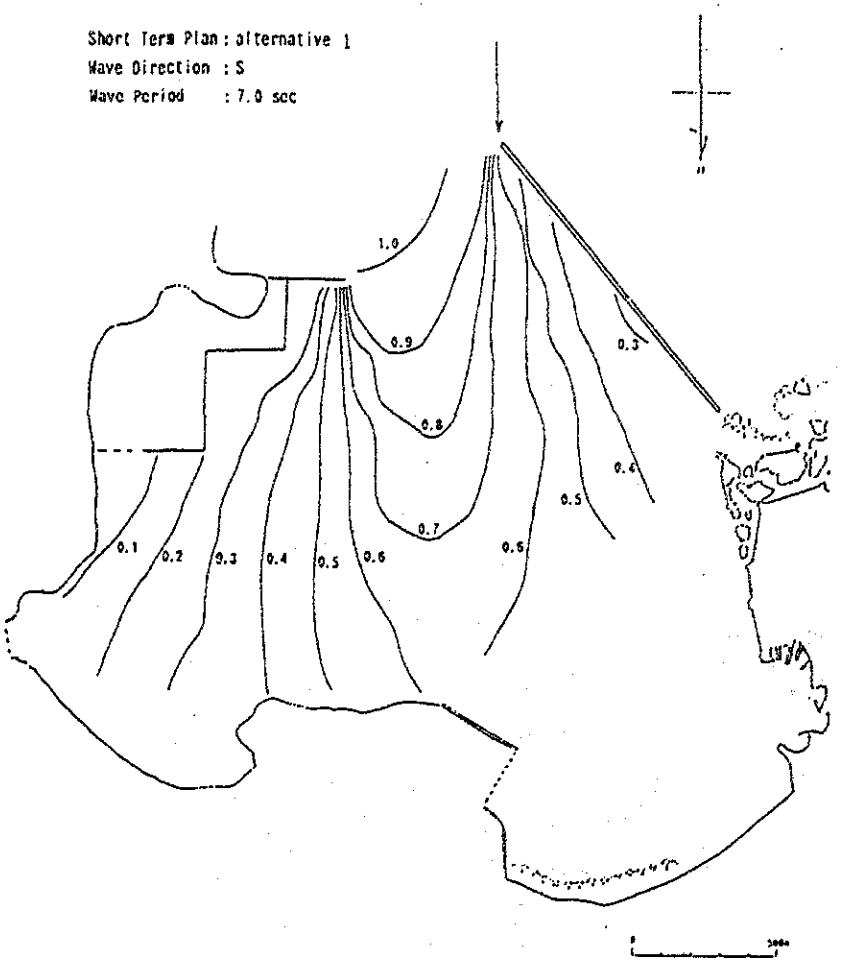
Appendix III-2-1(1) Wave Height Ratio



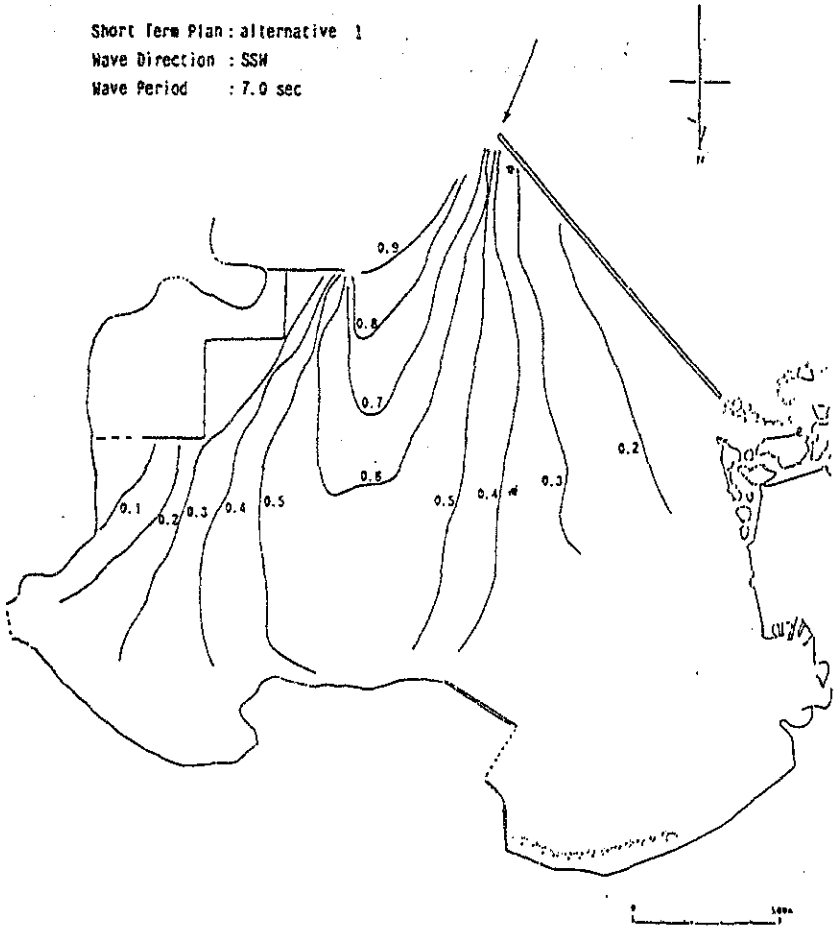
Appendix III-2-1(2) Wave Height Ratio



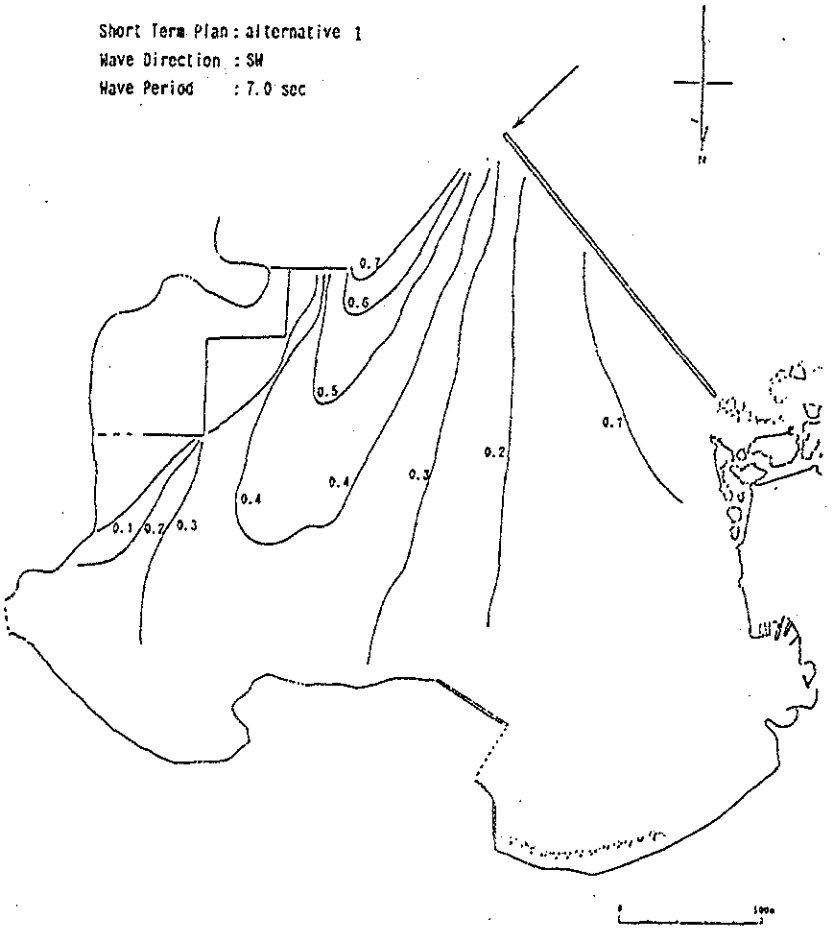
Appendix III-2-1(3) Wave Height Ratio



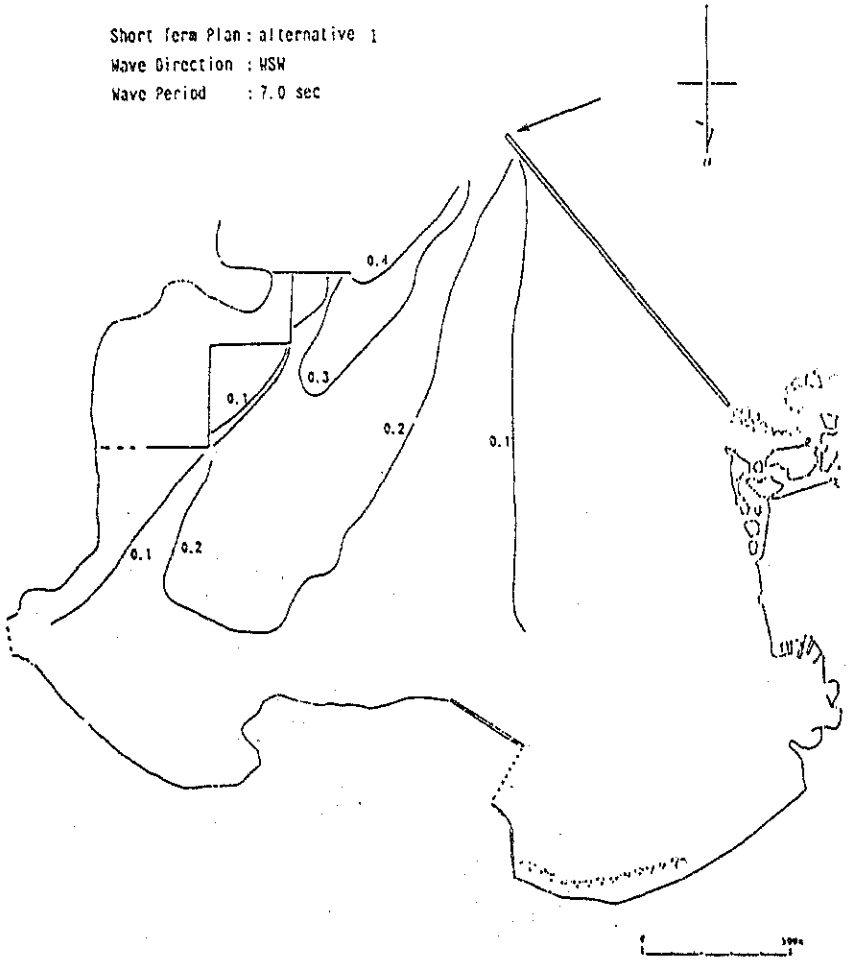
Appendix III-2-1(4) Wave Height Ratio



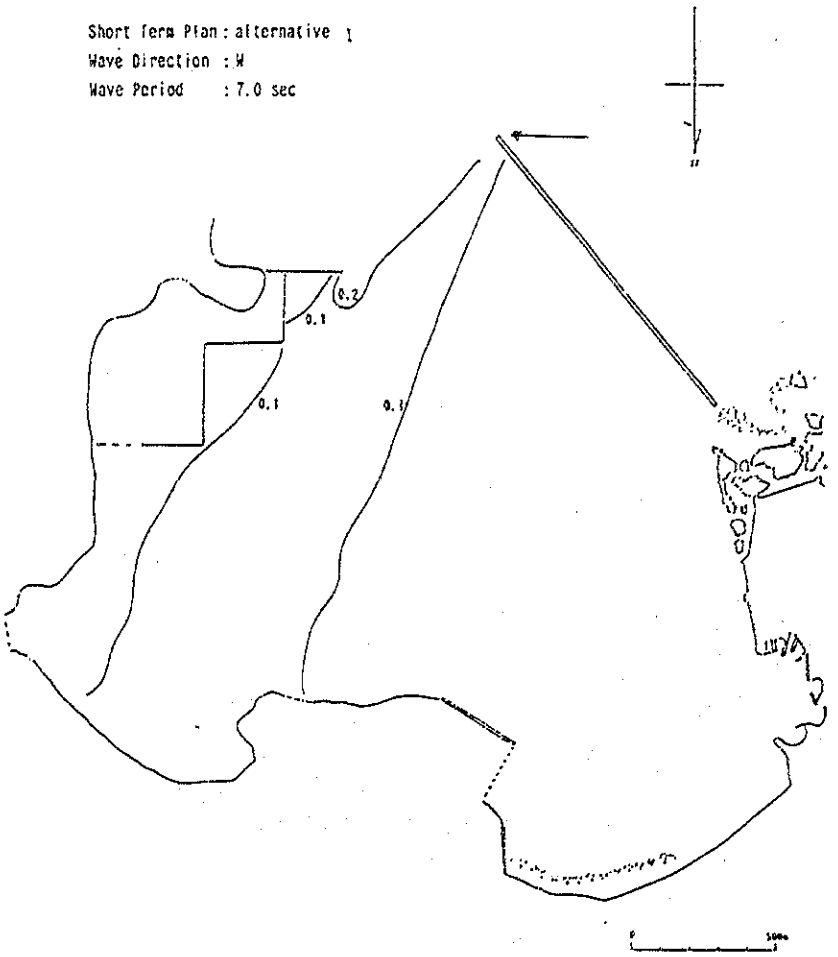
Appendix III-2-1(5) Wave Height Ratio



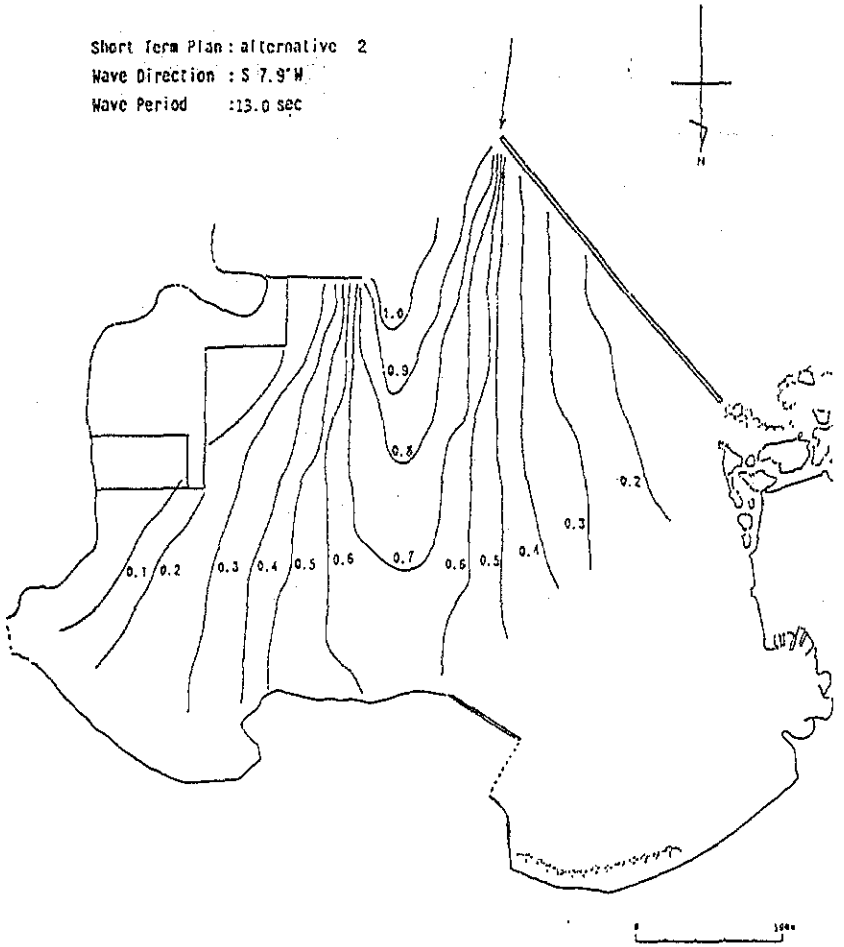
Appendix III-2-1(6) Wave Height Ratio



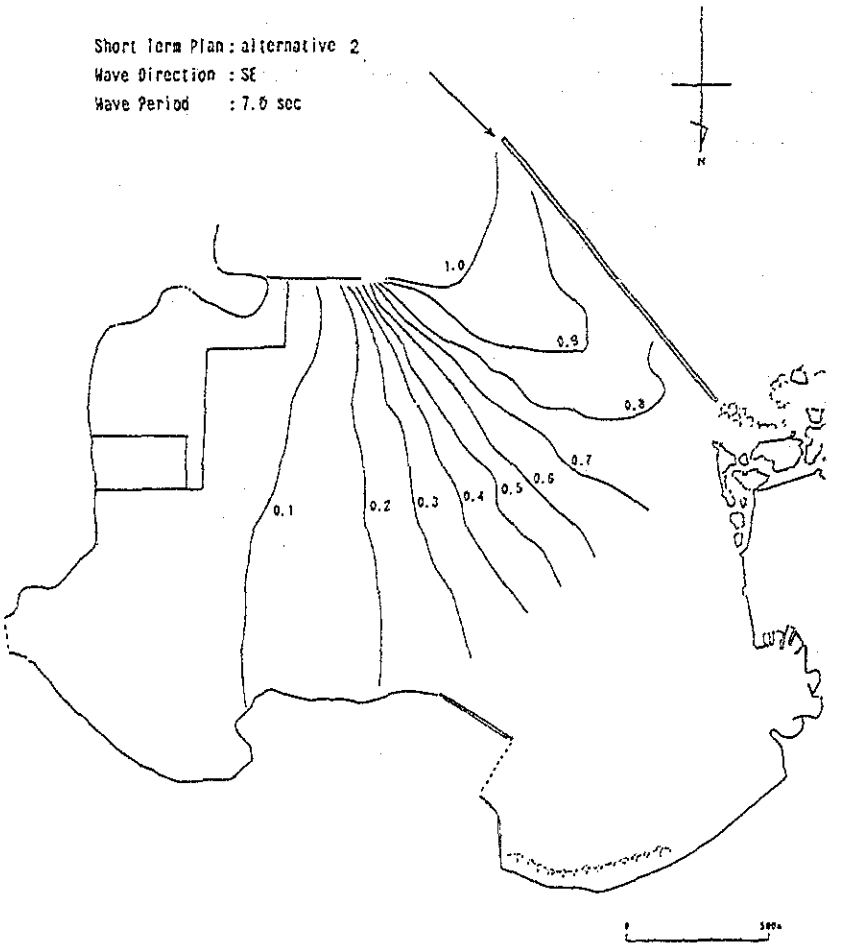
Appendix III-2-1(7) Wave Height Ratio



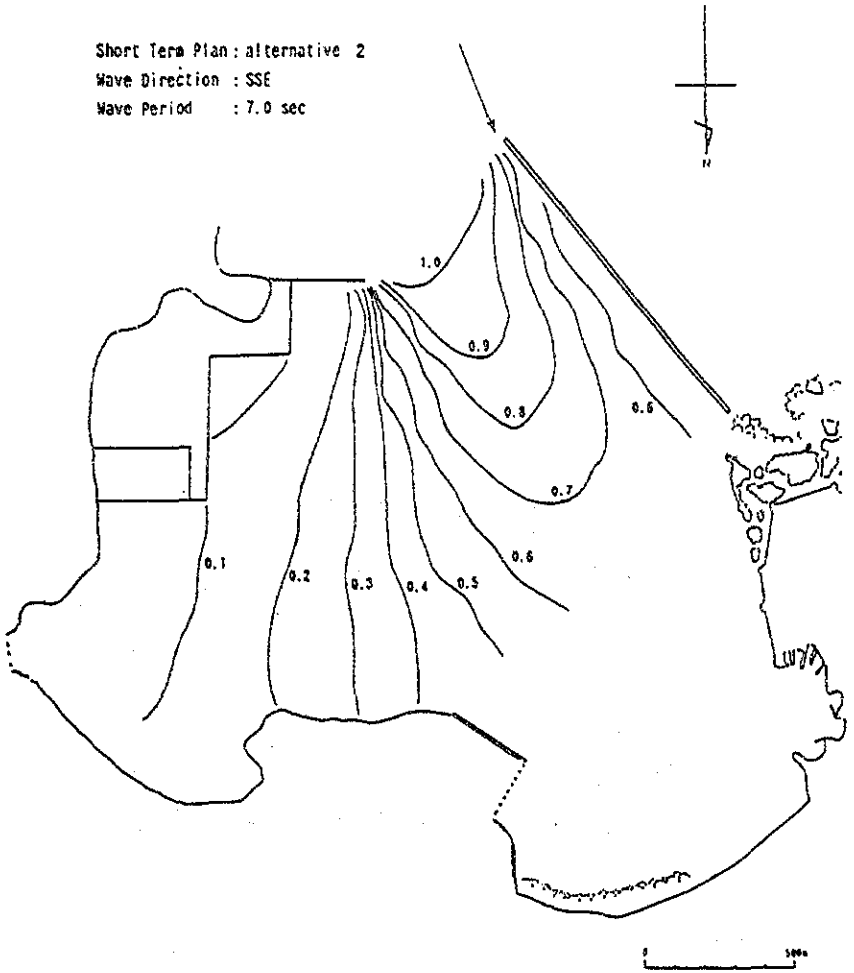
Appendix III-2-1(8) Wave Height Ratio



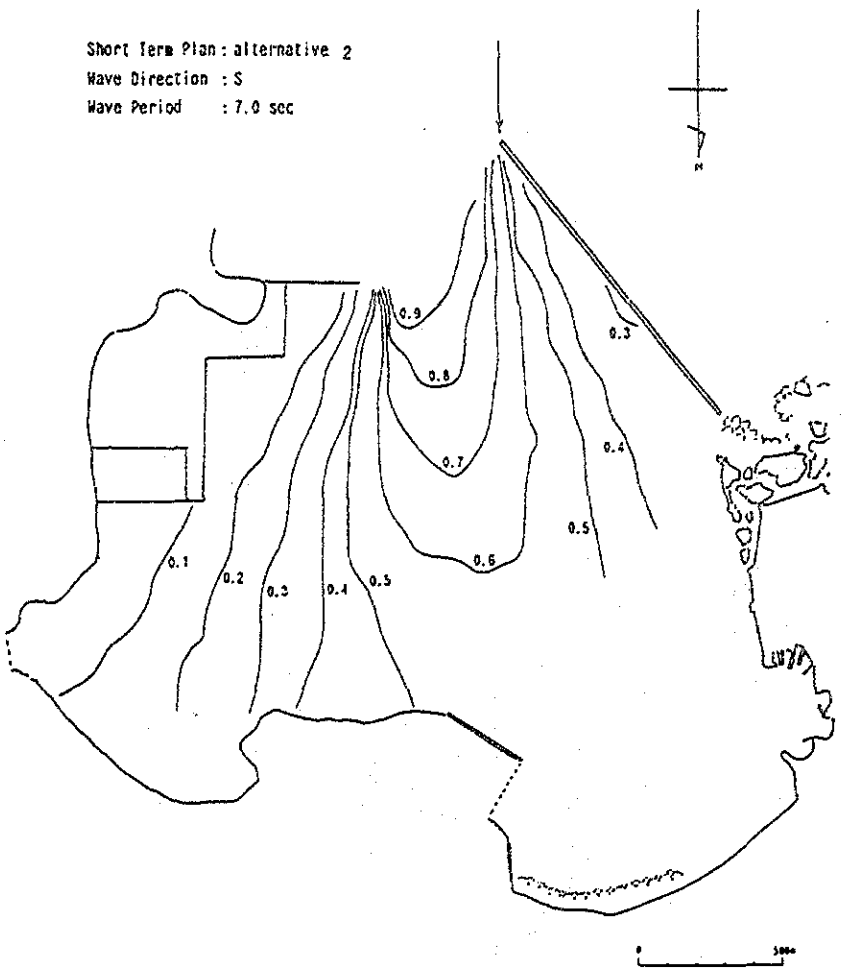
Appendix III-2-2(1) Wave Height Ratio



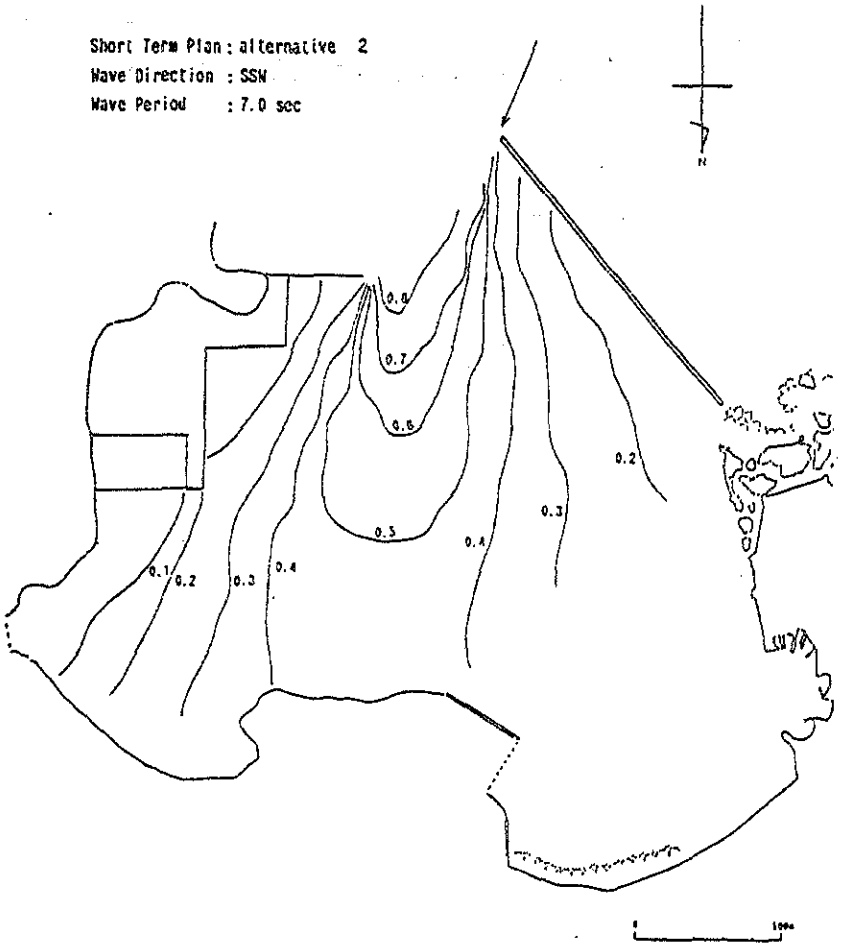
Appendix III-2-2(2) Wave Height Ratio



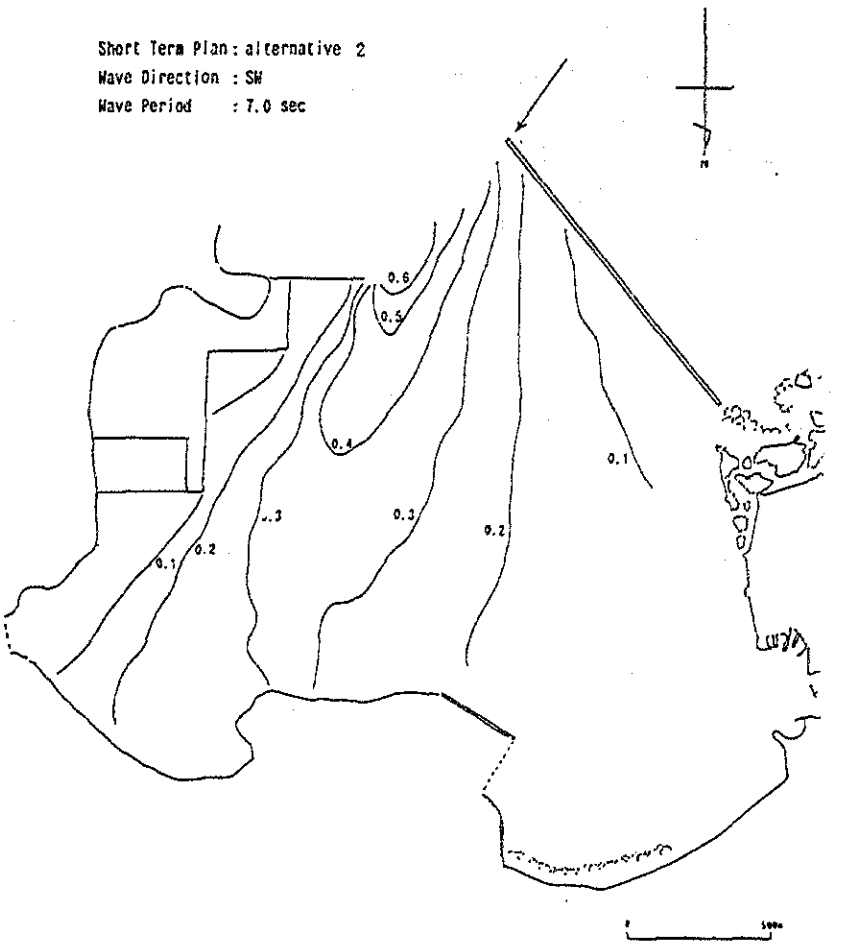
Appendix III-2-2(3) Wave Height Ratio



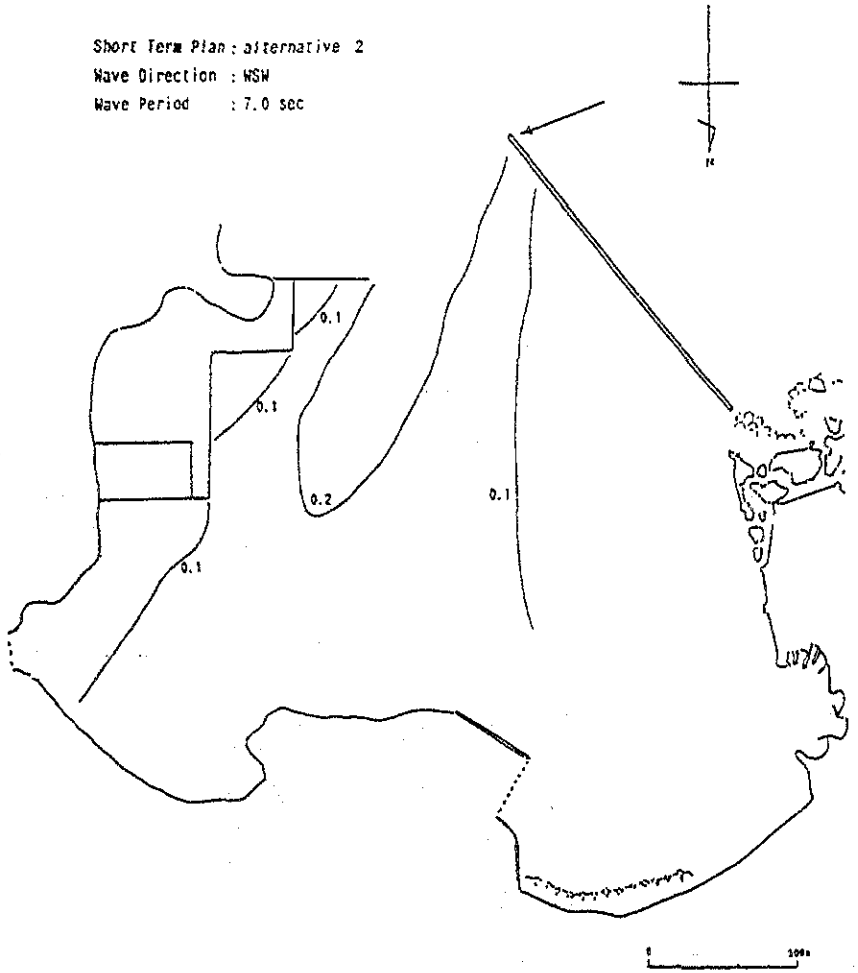
Appendix III-2-2(4) Wave Height Ratio



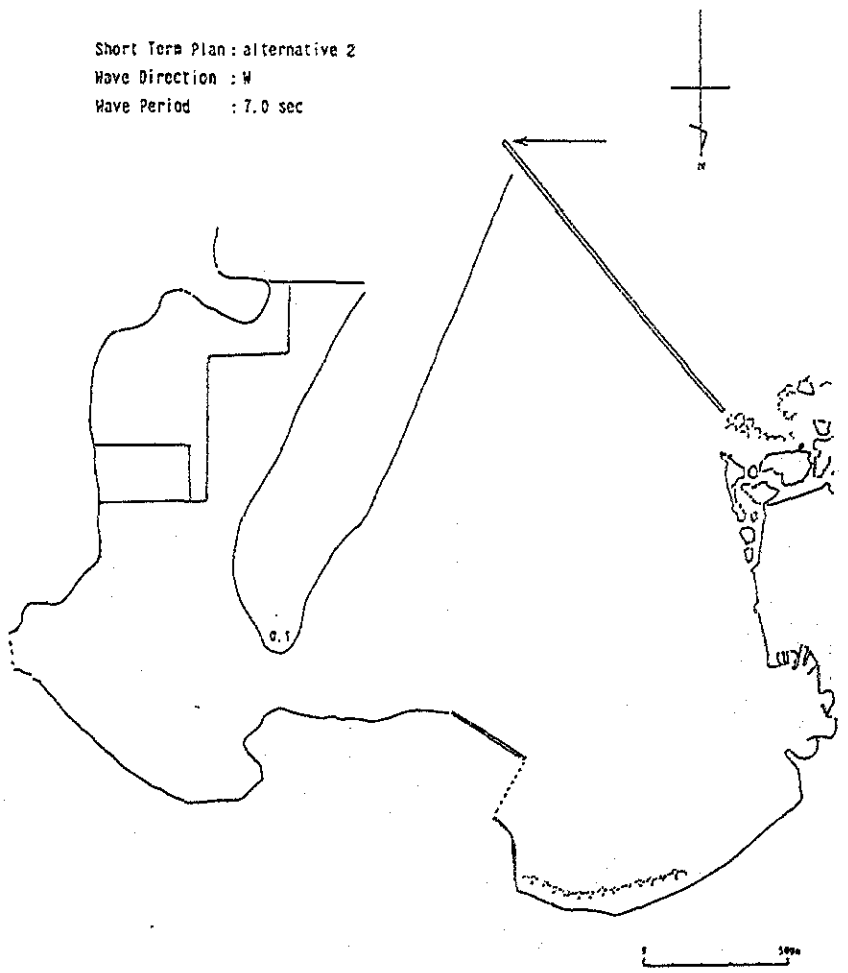
Appendix III-2-2(5) Wave Height Ratio



Appendix III-2-2(6) Wave Height Ratio



Appendix III-2-2(7) Wave Height Ratio

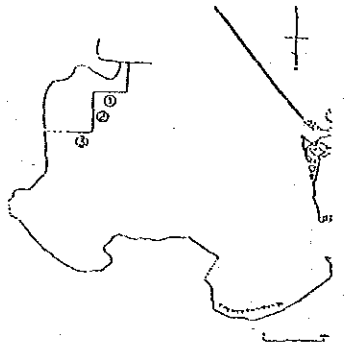


Appendix III-2-2(8) Wave Height Ratio

Appendix III-2-3 Coefficient of Diffraction for Wind Wave and Swell

Alternative 1

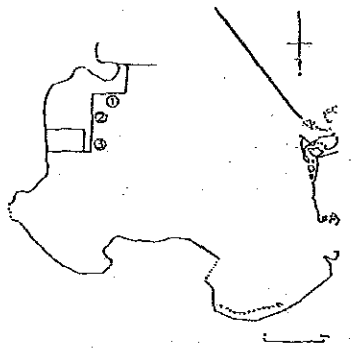
Direction / Point	SW	SSW	S	SSW	SW	WSW	W	S 9.7°W (Swell)
1	0.11	0.16	0.21	0.20	0.13	0.07	0.03	0.24
2	0.11	0.16	0.21	0.21	0.14	0.07	0.03	0.24
3	0.07	0.10	0.11	0.10	0.06	0.03	0.02	0.16



Points of Calmness Estimation

Alternative 2

Direction / Point	SW	SSW	S	SSW	SW	WSW	W	S 9.7°W (Swell)
1	0.06	0.08	0.12	0.12	0.08	0.05	0.02	0.14
2	0.06	0.09	0.13	0.15	0.11	0.07	0.03	0.17
3	0.08	0.11	0.17	0.21	0.18	0.13	0.08	0.23



Points of Calmness Estimation

Appendix III-2-4 Construction Cost of Short Term Plan 1 and 2

Unit : Thousand US$

	Description	Plan 1			Plan 2		
		Quantity	Unit	Cost	Quantity	Unit	Cost
Construction of Civil and Building	Dredging Rock Material	422,000	m^3	29,521	422,000	m^3	29,521
	〃 Other Material	1,163,000	〃	6,598	1,148,000	〃	6,513
	Southwest Breakwater	1,200	m	77,518	1,200	m	77,518
	East Breakwater	250	〃	21,401	350	〃	29,962
	Container Berth (-14.0M)	350	〃	25,891	330	〃	24,412
	Feeder Berth (- 9.0M)	170	〃	6,280	170	〃	11,789
	General/Bulk Cargo Berth (-12.0M)	280	〃	19,611	280	〃	19,611
	Oil Berth (-7.5M)	120	〃	4,425	120	〃	4,425
	Revetment	480	〃	12,588	630	〃	14,715
	Reclamation (Yard and Road)	2,530,000	m^3	22,188	2,980,000	m^3	25,254
	Pavement (Yard and Road)	283,000	m^2	19,172	326,000	m^2	22,059
	Bridge	60	m	2,402	60	m	2,402
	Navigation Aids	1	Sum	692	1	Sum	692
	Administration Building	800	m^2	920	800	m^2	920
	Transit Shed	4,000	〃	2,044	4,000	〃	2,044
	Maintenance Shop	1,000	〃	747	1,000	〃	747
	C.F.S.	2,025	〃	1,024	2,000	〃	1,024
	Cleaning Facilities	400	〃	249	400	〃	249
	Utilities (Water Supply)	1	Sum	2,615	1	Sum	2,615
	〃 (Electric Supply, Computer System)	1	〃	6,104	1	〃	6,104
	Sub-Total (1)			261,920			282,576
Procurement	Container Cargo Handling Equipment	1	Sum	22,514	1	Sum	22,514
	Cargo Handling Equipment for General/Bulk Cargo	1	〃	972	1	〃	972
	For Oil Berth	1	〃	130	1	〃	130
	Port Service Vessels (Tug-Boat)	1	〃	6,482	1	〃	6,482
	Sub-Total (2)			30,098			30,098
	Total (1) + (2)			292,018			312,674
	Engineering Service	1	Sum	16,807			17,988
	Physical Contingency (1) × 6%	1	Sum	15,715			16,954
	Tax			10,072			10,788
	Grand Total			334,612			358,404

Appendix III-6-1 Calculation of Land Transportation Costs

Land Transportation Costs 1 (Economic Prices)

No.	Items	Unit	Market Prices	Economic Prices	Remarks
①	Truck Body	Rs	780,000	624,000	7T Truck
②	Tires	Rs	48,000	27,907	6 Nos.
③	Fuel (Diesel)	Rs/liter	9.85	6.78	
④	Lubricant	Rs/liter	28.00	26.67	
⑤	Depreciation Cost	Rs/year	140,400	112,320	① x 0.9 / 5
⑥	Maintenance Cost	Rs/000km	432	409	
⑦	Driver's Wages	Rs/month	4,620	4,375	
⑧	Insurance	Rs/year	6,000	4,800	① / 130
⑨	Spare Parts	Rs/year	58,500	46,800	① x 0.075
⑩	Overhead	Rs/year	10,000	9,180	

Source: Transport Studies & Planning Center, Colombo motor dealers, Ceylon Petroleum Corporation, Ceylon Tire Corporation, Sri Lanka Central Transport Board, Private bus & truck operators, Register of Motor Vehicles, Central Bank of Sri Lanka and Government Gazette

Land Transportation Costs 2 (Economic Prices)

(Unit: Rs/000km)

No.	Items	Operation Costs	Remarks
⑪	Tires	558	② / (50,000 / 1,000)
⑫	Fuel (Diesel)	1,898	③ x 280
⑬	Lubricant	107	④ x 4
⑭	Depreciation Cost	2,246	⑤ / (50,000 / 1,000)
⑮	Maintenance Cost	409	⑥
⑯	Driver's Wages	1,050	⑦ / (50,000 / 12 / 1,000)
⑰	Insurance	96	⑧ / (50,000 / 1,000)
⑱	Spare Parts	936	⑨ / (50,000 / 1,000)
⑲	Overhead	184	⑩ / (50,000 / 1,000)
⑳	Total	7,484	

Note: Average tire life is to be 50,000 km.
Fuel and lubricant consumption are to be 280 liters/000km and 4 liters/000km, respectively.
Average annual driving distance is to be 50,000 km.
Distance between Colombo and Galle is 120 km.

Appendix III-6-2 Economic Prices of Construction Costs

(Unit: '000US$)

No.	Description	Construction Costs (Market Prices)	Foreign Currency				Local Currency					Overall Conversion Factor	Construction Costs (Economic Prices)
			Total	Traded Goods	Other Items	Transfer Items	Non-traded Goods	Skilled Labour	Unskilled Labour	Transfer Items	Total		
				1.000	1.000	0.000	0.918	0.947	0.474	0.000			
1	Dredging	1,320	91.72%	16.64%	74.92%	0.17%	8.20%	0.00%	0.00%	0.08%	8.28%	0.991	1,308
2	Rock Dredging	5,904	74.82%	5.25%	69.52%	0.05%	21.12%	3.48%	0.37%	0.21%	25.18%	0.976	5,764
3	Southwest Breakwater	15,303	74.45%	1.78%	72.65%	0.02%	18.71%	5.45%	1.20%	0.19%	25.55%	0.973	15,091
4	East Breakwater	4,280	77.01%	1.78%	75.21%	0.02%	18.71%	2.90%	1.20%	0.19%	22.99%	0.975	4,172
5	Container Wharf	25,891	67.45%	32.87%	34.25%	0.33%	18.27%	11.20%	2.90%	0.18%	32.55%	0.959	24,822
6	Wharf for Feeder	6,280	66.43%	32.86%	33.23%	0.33%	19.29%	11.19%	2.90%	0.19%	33.57%	0.958	6,015
7	General Cargo Wharf	16,882	64.84%	32.87%	31.64%	0.33%	20.85%	11.20%	2.90%	0.21%	35.16%	0.956	16,145
8	Transitional Part	2,728	64.05%	32.88%	30.85%	0.33%	21.62%	11.22%	2.90%	0.22%	35.95%	0.956	2,607
9	Oil Berth	4,424	70.86%	32.86%	37.67%	0.33%	14.89%	11.21%	2.89%	0.15%	29.14%	0.962	4,256
10	North Revetment	1,388	53.41%	16.06%	37.19%	0.16%	31.94%	4.11%	10.23%	0.32%	46.59%	0.913	1,268
11	South Revetment	11,199	71.95%	34.40%	37.20%	0.34%	13.62%	4.10%	10.20%	0.14%	28.05%	0.928	10,396
12	Reclamation	22,118	87.58%	2.08%	85.48%	0.02%	8.22%	2.12%	2.00%	0.08%	12.42%	0.981	21,688
13	Pavement	19,171	61.52%	20.61%	40.70%	0.21%	36.02%	1.60%	0.50%	0.36%	38.48%	0.961	18,430
14	Access Bridge	2,402	70.14%	40.10%	29.64%	0.40%	24.82%	4.21%	0.58%	0.25%	29.86%	0.968	2,325
15	Administration Building	920	19.76%	11.42%	8.22%	0.11%	56.73%	14.90%	8.05%	0.57%	80.24%	0.896	824
16	Transit Shed	2,044	15.17%	11.40%	3.66%	0.11%	61.18%	14.92%	8.12%	0.61%	84.83%	0.892	1,823
17	Maintenance Shop	747	15.03%	11.37%	3.54%	0.11%	61.34%	14.85%	8.16%	0.61%	84.97%	0.892	666
18	C.F.S.	1,024	20.02%	11.43%	8.48%	0.11%	56.37%	14.94%	8.11%	0.56%	79.98%	0.896	918
19	Cleaning Facilities	249	15.03%	11.24%	3.67%	0.11%	61.47%	14.85%	8.03%	0.61%	84.97%	0.892	222
20	Water Supply	2,615	89.86%	71.77%	17.37%	0.72%	5.46%	3.94%	0.69%	0.05%	10.14%	0.982	2,568
21	Electric Supply	6,104	89.87%	71.78%	17.38%	0.72%	5.44%	3.93%	0.70%	0.05%	10.13%	0.982	5,994
22	Navigation Aids	692	71.35%	55.77%	15.03%	0.56%	11.77%	10.11%	6.65%	0.12%	28.65%	0.943	653
23	Handling Equipment 1	19,085	100.00%	99.01%	0.00%	0.99%	0.00%	0.00%	0.00%	0.00%	0.00%	0.990	18,896
24	Handling Equipment 2	4,531	97.81%	96.85%	0.00%	0.97%	0.01%	2.19%	0.00%	0.00%	2.20%	0.989	4,482
25	Port Service Vessles	6,482	100.00%	99.02%	0.00%	0.99%	0.00%	0.00%	0.00%	0.00%	0.00%	0.990	6,418
26	Engineering Service	10,587	78.64%	0.00%	78.64%	0.00%	0.00%	21.36%	0.00%	0.00%	21.36%	0.989	10,467
27	Physical Contingency	9,233	70.67%	23.41%	47.03%	0.23%	19.87%	6.51%	2.75%	0.20%	29.33%	0.961	8,877
	Total	203,805	75.37%	33.31%	41.73%	0.33%	15.90%	6.37%	2.20%	0.16%	24.63%	0.967	197,095

Appendix III-6-3 Disbursement Schedule (Economic Price)

(Unit: '000 US$)

No.	Description	1992	1993	1994	1995	1996	1997	Total
1	Dredging	0	336	352	324	296	0	1,308
2	Rock Dredging	0	1,283	1,603	1,502	1,376	0	5,764
3	Southwest Breakwater	0	2,447	3,263	3,263	3,263	2,855	15,091
4	East Breakwater	0	1,397	2,220	555	0	0	4,172
5	Container Wharf	0	0	5,319	10,638	8,865	0	24,822
6	Wharf for Feeder	0	0	0	0	6,015	0	6,015
7	General Cargo Wharf	0	0	6,458	9,687	0	0	16,145
8	Transitional Part	0	0	1,044	1,563	0	0	2,607
9	Oil Berth	0	0	0	0	4,256	0	4,256
10	North Revetment	0	242	952	74	0	0	1,268
11	South Revetment	0	1,982	7,811	603	0	0	10,396
12	Reclamation	0	3,614	8,434	8,434	1,205	0	21,688
13	Pavement	0	0	0	9,615	8,815	0	18,430
14	Access Bridge	0	0	0	0	2,325	0	2,325
15	Administration Building	0	0	0	177	647	0	824
16	Transit Shed	0	0	0	0	1,823	0	1,823
17	Maintenance Shop	0	0	0	0	666	0	666
18	C.F.S.	0	0	0	197	721	0	918
19	Cleaning Facilities	0	0	0	0	222	0	222
20	Water Supply	0	0	0	947	1,621	0	2,568
21	Electric Supply	0	0	0	2,209	3,786	0	5,994
22	Navigation Aids	0	0	0	0	653	0	653
23	Handling Equipment 1	0	0	0	7,558	11,338	0	18,896
24	Handling Equipment 2	0	0	0	0	4,482	0	4,482
25	Port Service Vessels	0	0	0	3,209	3,209	0	6,418
26	Engineering Service	2,619	1,744	1,744	1,744	1,744	872	10,467
27	Physical Contingency	0	1,156	2,358	2,534	2,332	497	8,877
	Total	2,619	14,201	41,558	64,833	69,660	4,224	197,095

Appendix III-6-4 Replacement Investment Schedule

('000 US$)

Year	Water Supply	Electric Supply	Naviga-tion Aids	Handling Equipment 1	Handling Equipment 2						Engi-neering Service	Contin-gency	Total
					Tractor & Trucks	Chassis	Fork Lift	Packer & Hopper	Equip. for Oil Berth	Service Vessels			
1997													0
1998													0
1999													0
2000													0
2001					2,065						121		2,186
2002													0
2003													0
2004													0
2005													0
2006					2,065	597					157		2,819
2007													0
2008													0
2009		5,994					1,264				427	360	8,044
2010													0
2011			371		2,065						143	22	2,601
2012													0
2013													0
2014													0
2015													0
2016	2,568			18,896	2,065	597		428	129	6,418	1,829	154	33,084
2017													0
2018													0
2019													0
2020													0
2021					2,065						121		2,186
2022		5,994					1,264				427	360	8,044
2023													0
2024													0
2025													0
2026	-1,284	-4,497		-9,448			-948	-214		-3,209			-19,600

Appendix III-7-1 Handling Volume in Galle Project

YEAR	TRANSHIP ('000TEU)	LOCAL ('000TEU)	TOTAL ('000TEU)	BULK ('000TON)	Liquid ('000TON)
1997	190	36	226	397	36
1998	225	43	268	421	42
1999	225	43	268	421	42
2000	225	43	268	421	42
2001	225	43	268	421	42
2002	225	43	268	421	42
2003	225	43	268	421	42
2004	225	43	268	421	42
2005	225	43	268	421	42
2006	225	43	268	421	42
2007	225	43	268	421	42
2008	225	43	268	421	42

The same volume after 2008

Appendix III-7-4 Comparison of Port Charges

ITEMS	MAIN CHARGES	QABOOS	FUJAIRAH	FAKKAN	KHALID	RASHID	SINGAPORE	COLOMBO
DUES ON VESSEL	Port Dues, Entering Dues	974	817	899	736	715	1,156	1,030
	Light Dues		245	266	750			773
	Pilotage	831	545	510	450	420	493	1,110
	Moorings	78	150	109	20	16		587
	Tugs	571	817	1,289	381	736	1,192	
	Berthings		163	180	109	245	1,413	500
	Total (Per Vessel)	2,455	2,738	3,252	2,446	2,132	4,254	3,997
	Per GRT	0.10	0.11	0.13	0.10	0.09	0.17	0.16
	Index (Qaboos=100)	100	112	132	100	87	173	163
DUES ON TRANSHIPMENT CONTAINER(20' Loaded/Import)	Loading/Discharging	39	114	123	123	125	102	52
	Other Charges							
	Total (Per 20')	39	114	123	123	125	102	52
	Index (Qaboos=100)	100	294	315	315	322	262	133
UNSTUFFING CHARGE	Per 20'	52	95	131	131	54		
	Free Time	3(30)	20(30)	15(30)	15(30)	20(20)	(28)	(28)
	Over Time Surcharge	18	41	54	54	41		
EXCHANGE RTATE (US$)		0.385	3.67	3.67	3.67	3.67	1.946	33.033

CONDITIONS FOR CALCULATION OF CHARGES

VESSEL	:25,000 GRT, 15,000 NRT, 35,000 DWT, Weekly Service
PILOT	:2 hours for entering/departure each
TUG	:2 Tugs, 1 hour for entering/departure each
BERTHING TIME	:10 hours (8:00 - 18:00)
SERVICE TIME	:6 hours
CYCLE TIME OF CRANE	:30 Boxes/Hour
TONNAGE PER CONTAINER	:32 MT Per 20'

These charges are calculated based upon the present port tariff of each port.

Appendix III-7-2 Main Charges for Container Operations

Legend: (A) Shipping agents
(C/S) Consignees or Shippers

Charges of shifting containers from one unit to another unit (A)

01 Loaded	20'	34.90	US $
	40'	52.30	"
02 Empty	20'	26.50	"
	40'	39.75	"

Charges of supply of electricity (A)

20'	1.00	US $	per hour
40'	1.80	"	

Stevedoring charges (A)

01 Transhipment (all inclusive)	20'	51.50	US $
	40'	76.50	"

* Loading (on carriers) is free of these charges

02 Import / Export (ship-stacking)	20'	106.70	US $
	40'	160.05	"

Charges of stuffing / destuffing (A)

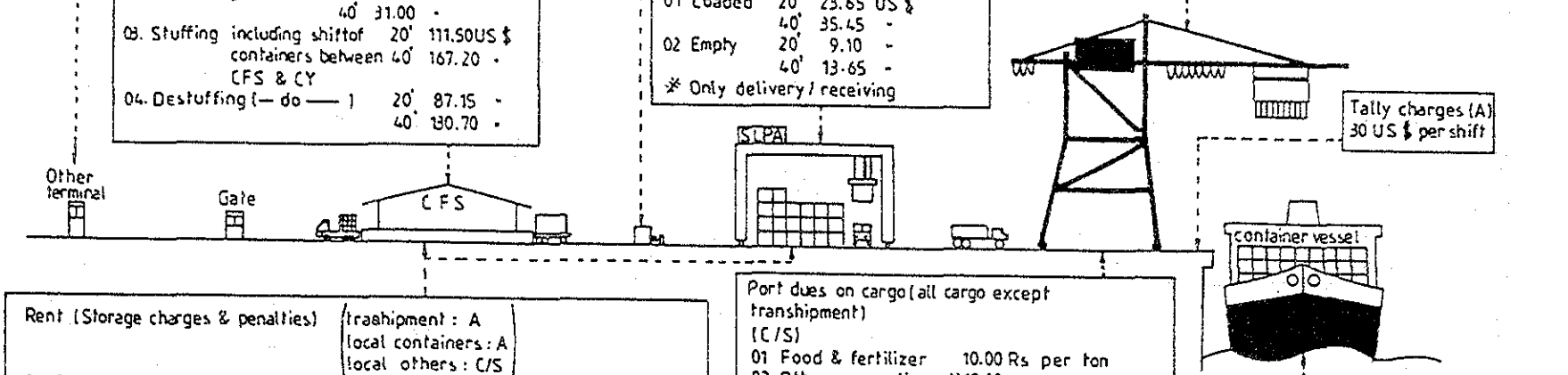
01. Stuffing	20'	11.20	US $
	40'	16.80	"
02. Destuffing	20'	20.70	"
	40'	31.00	"
03. Stuffing including shiftof containers between CFS & CY	20'	111.50	US $
	40'	167.20	"
04. Destuffing (— do —)	20'	87.15	"
	40'	130.70	"

Charges of mounting / demounting to / from chassis (A)

01 Loaded	20'	23.65	US $
	40'	35.45	"
02 Empty	20'	9.10	"
	40'	13.65	"

* Only delivery / receiving

Tally charges (A)
30 US $ per shift



Rent (Storage charges & penalties) (transhipment : A; local containers : A; local others : C/S)

01. Free time

(1) import	3	clear days (free of sat. sun. & holidays)
(2) export	7	"
(3) empty containers	3	"
(4) transhipment	28	normal days

02. Charges (in the case of the storage periods excessing the free time)

(1) Import / Export	1 ~ 7	days	6	Rs per ton. day	
	8 ~ 14	"	12	"	
	15 ~ 21	"	18	"	
	22 ~		24	"	
(2) Empty container			20'		40'
	1 ~ 31	days	6.95	US $ per day	13.85 US $ per day
	32 ~		20.75	"	41.50 "
(3) Transhipment					
(1) Loaded			5.20		10.40 "
(2) Empty	1 ~ 31	days	2.10	"	4.15 "
	32 ~ 45		6.95	"	13.85 "
	46 ~		20.75	"	41.50 "

Port dues on cargo (all cargo except transhipment) (C/S)

01 Food & fertilizer	10.00	Rs	per ton
02 Other cargo (import)	10.30	"	
03 " (export)	10.00	"	
04 Bulk cargo (except petroleum)	5~5.15	"	
05 Cars (import)	103.00	Rs	per each
(export)	100.00	"	

Tonnage (all cargo except transhipment) (A)
0.35 US $ Per ton

Wharfage (all cargo except transhipment) (C/S)

01 Export tea	20.00	Rs	per ton
02 " coconuts products	24.00	Rs	per ton
03 Tinned food electric goods etc	0.0412	CIF value	
04 Textiles (import)	77.25	Rs	per ton
(export)	75.00	"	
05 Others (import)	41.20	"	
(export)	40.00	"	

Port dues on ship (A)

01 Entry dues (except out side harbour)	4.12	US $	per 100 G_T
02 Pilotage	4.12	"	
03 Light dues	3.09	"	
04 Professional pilotage fees			
~ 30,000 DWT AM6	23.90	US $	per movement
PM6-AM6	35.85	"	
above 30,000 DWT AM6-PM6	31.85	"	
PM6-AM6	47.76	"	
05 Dockage alongside	0.20	US $	per 100 G_T hour
06 Tug charges	145.98	US $	per tug movement

Appendix III-7-3 Main Charges for Conventional Cargo Operations

Legend: (A) Shipping agents
(C/S) Consignees or shippers

Forklift charges (C/S)
(except direct delivery / receiving)

1. Up to 1 ton per package / pallet	Free	
2. Over 1 ton per package / pallet		
(1) Food & fertilizer	11.00 Rs	per ton
(2) Others	11.33	"

Hire of forklift (A) or (C/S)
(direct delivery / receiving)

1.	Forklift up to 2.5 tons	710/40 Rs	US$ per shift	
2.	" 2.5–10	285/16	per lift	
3.	" 10–15	495/28	"	
4.	" 15–25	745/42	"	
5.	" 25–	990/56	"	

Stevedoring charges (A)

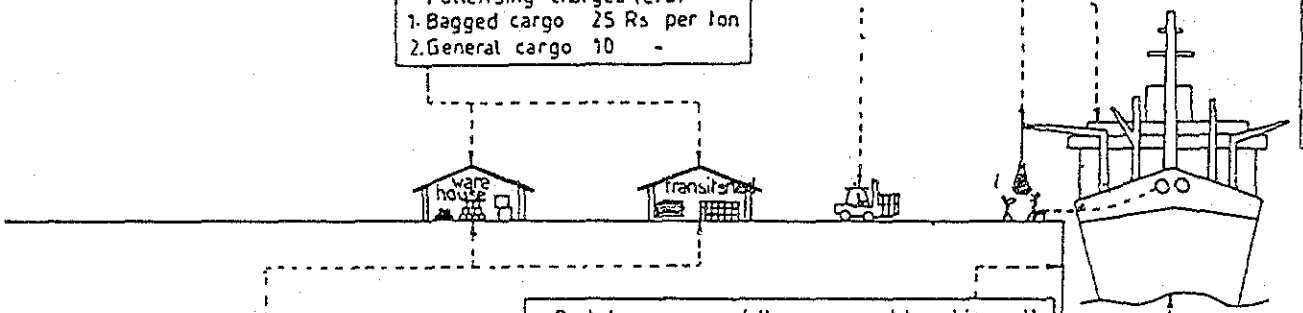
1. Import			
(1) Bagged cargo without shift gang	3.15	US$ per ton	
(2) " by shift gang	5.20	"	
(3) Others	3.65	"	
2. Export	3.60	"	
3. Bulk cargo	0.32–7.80	"	

Palletising charges (C/S)

1. Bagged cargo	25 Rs	per ton
2. General cargo	10	"

Tally charges (A)

1. Discharging			
(1) Bagged cargo	0.20	US$ per ton	
(2) Others	0.40	"	
2. Loading	0.35	"	(M/T)
	0.40	"	(W/T)



Rent (storage & penalties) (Transhipment: A / others: C/S)

1. Free time			
(1) Import	3	clear days	
(2) Export	7	clear days	
(3) Transhipment	28	normal days	
2. Charges (in the case of the storage periods exceeding the free time)			
(1) Import/ Export	1–7 days	6 Rs.	per ton day
	8–14	12	"
	15–21	18	"
	22–	24	"
(2) Transhipment	29 days–	24 Rs	per ton day

Port dues on cargo (all cargo except transhipment) (C/S)

1. Food & fertilizer		10.00 Rs	per ton
2. Other cargo	(import)	10.30	"
3. "	(export)	10.00	"
4. Bulk cargo (except petroleum)		5–5.15	"
5. Cars	(import)	103.00 Rs	per each
	(export)	100.00	"

Tonnage (all cargo except transhipment) (A)
0.35 US $ per ton

Wharfage (all cargo except transhipment) (C/S)

1. Export tea		20.00 Rs.	per ton
2. " coconuts products		24.00	
3. Tinned food, electric goods, etc		0.0412	C.I.F value
4. Textiles	(import)	77.25 Rs	per ton
	(export)	75.00	"
5. Others	(import)	41.20	"
	(export)	40.00	"

Port dues on ship (A)

1. Entering dues (except outside harbour)		4.12 US$	per 100 G/T
2. Pilotage		4.12	"
3. Light dues		3.09	"
4. Professional pilotage fees			
–30,000 DWT	AM 6–PM 6	23.90 US$	per movement
	PM 6–AM 6	35.85	"
above 30,000 DWT	AM 6–PM 6	31.85	"
	PM 6–AM 6	47.78	"
5. (1) Dockage alongside		0.20 US$	per 100 G/T hour
(2) Buoy berth		0.62 US$	per 100 G/T day
6. Tug charges		145.98 US$	per tug movement

Appendix III-7-5 Revised Construction Cost of Galle Port

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost				F.Total	L.Total	Total
			Foreign	Local	B.T.Tax	Imp. Tax			
Dredging for Channel	1,099,000	m3	12,532	3,864	492	132	14,036	4,998	19,034
Contingency			752	232	30	8			
Engineering Service			752	193	47	0			
Southwest Breakwater	1,200	m	57,710	19,808	2,328	212	64,635	24,900	80,535
Contingency			3,463	1,188	140	13			
Engineering Service			3,463	990	223	0			
East Breakwater	165	m	11,797	3,379	455	42	13,213	4,321	17,534
Contingency			708	203	27	2			
Engineering Service			708	169	44	0			
SUB-TOTAL			91,884	30,027	3,783	409	91,884	34,219	126,102
Dredging for Basin	486,000	m3	15,608	4,115	592	159	17,481	5,420	22,901
Contingency			936	247	36	10			
Engineering Service			936	208	57	0			
East Seawall	85	m	4,683	1,542	187	17	5,245	1,946	7,191
Contingency			281	93	11	1			
Engineering Service			281	77	18	0			
Container Berth	350	m	17,463	8,428	777	1,520	19,559	11,863	31,421
Contingency			1,048	506	47	91			
Engineering Service			1,048	421	73	0			
Feeder Berth	170	m	4,172	2,108	188	369	4,673	2,948	7,621
Contingency			250	126	11	22			
Engineering Service			250	105	18	0			
General Cargo Berth	280	m	12,694	6,917	588	1,151	14,217	9,577	23,794
Contingency			762	415	35	69			
Engineering Service			762	346	55	0			
Oil Berth	120	m	3,135	1,290	133	260	3,511	1,861	5,372
Contingency			188	77	8	16			
Engineering Service			188	65	13	0			
Revetment	480	m	8,800	3,788	378	68	9,856	4,713	14,569
Contingency			528	227	23	4			
Engineering Service			528	189	36	0			
Reclamation	2,530,000	m3	19,371	2,747	664	71	21,696	3,892	25,588
Contingency			1,162	165	40	4			
Engineering Service			1,162	137	65	0			
Pavement	283,000	m²	11,794	7,378	575	382	13,209	9,258	22,467
Contingency			708	443	35	23			
Engineering Service			708	369	54	0			
Bridge	60	m	1,684	718	72	201	1,886	1,093	2,980
Contingency			101	43	4	12			
Engineering Service			101	36	7	0			
Light Beacon & Guide	1	Sum	214	85	9	26	240	132	372
Contingency			13	5	1	2			
Engineering Service			13	4	1	0			
Light Buoy	12	Nos.	280	113	12	34	314	175	489
Contingency			17	7	1	2			
Engineering Service			17	6	1	0			
Administration Bld.	800	m²	182	738	28	15	204	867	1,071
Contingency			11	44	2	1			
Engineering Service			11	37	2	0			
Transit Shed	4,000	m²	310	1,734	61	34	347	2,031	2,378
Contingency			19	104	4	2			
Engineering Service			19	87	5	0			
Maitenance Shop	1,000	m²	112	635	22	12	125	744	869
Contingency			7	38	1	1			
Engineering Service			7	32	2	0			
C.F.S.	2,025	m²	205	819	31	17	230	962	1,192
Contingency			12	49	2	1			
Engineering Service			12	41	3	0			
Cleaning Facilities	400	m²	37	212	7	4	41	248	290
Contingency			2	13	0	0			
Engineering Service			2	11	1	0			
Utilities(Water Supply)	1	Sum	2,350	265	78	259	2,632	659	3,291
Contingency			141	16	5	16			
Engineering Service			141	13	8	0			
Ut. (Electric e.t.c.)	1	Sum	5,485	619	183	604	6,143	1,539	7,682
Contingency			329	37	11	36			
Engineering Service			329	31	18	0			
SUB-TOTAL			121,608	49,119	5,296	5,513	121,608	59,928	181,537
TOTAL			213,492	79,145	9,079	5,922	213,492	94,147	307,639
Container Crane	2	Nos.	12,963	0	389	994	13,741	1,422	15,163
Engineering Service			778	0	39				
Transfer Crane	5	m²	6,122	0	184	470	6,489	672	7,161
Engineering Service			367	0	18				
Tractor & Trucks	1	Sum	2,087	0	83	395	2,212	464	2,677
Engineering Service			125	0	6				
Chassis	1	Sum	603	0	18	114	639	134	773
Engineering Service			36	0	2				
Fork Lift	1	Sum	273	0	8	21	289	30	319
Engineering Service			16	0	1				
Top Lifter (40ton)	2	Nos.	1,005	0	30	77	1,065	110	1,176
Engineering Service			60	0	3				
Packer & Hopper	1	Sum	347	86	13	27	368	132	500
Engineering Service			21	5	1				
Tug Boat	1	Sum	6,482	0	194	149	6,871	363	7,234
Engineering Service			389	0	19				
Equip. for Oil Berth	1	Sum	117	13	4	9	124	27	151
Engineering Service			7	1	0				
SUB-TOTAL			31,709	105	993	2,256	31,709	3,354	35,153
GRAND TOTAL			245,201	79,250	10,072	8,178	245,201	97,501	342,792

Appendix III-7-6 Service Life & Depreciation Rate

	Service Life (Years)	Depreciation Rate (%)
Breakwater	100	1%
Quaywall	100	1%
Bridge	100	1%
Pavements	50	2%
Office Building & Furniture	20	5%
Warehouse	20	5%
Light House	20	5%
Water Tank	20	5%
Crane, Hoist & Winch	20	5%
Weighing Machine	20	5%
Tug	20	5%
Buoy	15	7%
Jetty & Shipway	13.3	7.5%
Communication Equipment	13.3	7.5%
Electrical Fitting	13.3	7.5%
Fire Fighting Equipment	13.3	7.5%
Medical & Welfare Equipment	13.3	7.5%
Office Equipment	13.3	7.5%
Passenger Craft Pontoon	13.3	7.5%
Plant Machinery & Repair Yard	13.3	7.5%
Diesel Pumping Set	13.3	7.5%
Forklift Truck	13.3	7.5%
Dump Truck	13.3	7.5%
Harbour Mooring	10	10%
Lighter	10	10%
Barge	10	10%
Trailor	10	10%
Dredger	10	10%
Launch & Boat	7	14%
Computer	7	14%
Vehicle	5	20%
Tractor	5	20%
Engineering Equipment	4	25%
Miscellaneous Equipment	4	25%

Appendix III-7-7 Handling Volume in Sri Lanka

YEAR	TRANSHIP ('000TEU)	LOCAL ('000TEU)	TOTAL ('000TEU)	BULK ('000TON)	LIQUID ('000TON)
1991	600	210	810	2,882	991
1992	764	215	979	2,838	1,010
1993	764	220	984	2,793	1,029
1994	956	240	1,196	2,748	1,049
1995	1,052	250	1,302	2,737	1,153
1996	1,054	270	1,324	3,157	1,262
1997	1,244	362	1,606	3,485	1,413
1998	1,279	369	1,648	3,579	1,538
1999	1,299	389	1,688	3,605	1,665
2000	1,299	389	1,688	3,605	1,796
2001	1,319	409	1,728	3,605	1,934
2002	1,319	409	1,728	3,605	1,934
2003	1,339	429	1,768	3,605	1,934
2004	1,339	429	1,768	3,605	1,934
2005	1,359	449	1,808	3,605	1,934

The same volume after 2005

Appendix III-7-8 Revised Construction Cost of Each Terminal in Colombo Port

JCT No.3 Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Quaywall	330	m	20,269	8,296	28,565
South Revetment	220	m	926	1,125	2,050
Reclamation	1,400,000	m3	10,410	2,186	12,596
Yard Paving	159,000	㎡	11,166	5,147	16,313
Utilities	1	Sum	7,466	925	8,391
Building	7,300	㎡	2,114	1,057	3,171
Relocation	1	Sum	3,345	3,085	6,429
Dredging	380,000	m3	1,948	589	2,536
Container Crane	2	No.	16,384	1,474	17,857
Transfer Crane	6	No.	9,620	865	10,485
Tractor & Chassis	12	Set	2,155	194	2,349
Total			85,802	24,941	110,743

JCT No.4 Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Quaywall	360	m	22,023	9,042	31,066
South Revetment	170	m	6,035	2,427	8,461
Bulhead	90	m	379	460	839
Reclamation	990,000	m3	7,339	1,550	8,889
Yard Paving	86,000	㎡	6,015	2,783	8,798
Utilities	1	Sum	4,016	497	4,514
Building	0	㎡	0	0	0
Dredging	250,000	m3	1,276	387	1,663
Container Crane	2	No.	16,318	1,468	17,786
Transfer Crane	6	No.	9,581	862	10,443
Tractor & Chassis	12	Set	2,146	193	2,339
Total			75,129	19,670	94,799

NNP Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Improvement of Quay	380	m	2,027	656	2,683
Revetment Type A	90	m	2,286	1,418	3,704
Revetment Type B	390	m	2,824	3,559	6,383
Reclamation	280000	m3	2,321	504	2,825
Yard Pavement	45750	㎡	2,763	1,152	3,915
Utilities	1	Sum	2,210	272	2,482
Wharehouse & Office	12800	㎡	6,389	5,029	11,418
Level Luffing Crane	2	No	7,291	656	7,947
Belt Conveyer	350	m	1,778	160	1,938
Packer & Palletizer	6	No	5,462	491	5,953
Wheel Loader	8	No	1,219	110	1,329
Forklift	40	No	1,651	149	1,800
Pallet & Others	1	Sum	508	559	1,067
TOTAL			38,730	14,715	53,445

Pipe Line Construction Revised Cost

Unit: 1,000 US$

Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
Excavation & Backfilling	30,800	m3	911	186	1,096
Submarine Pipeline	700	m	5,010	1,018	6,028
Onshore Pipeline	1,000	m	-	-	-
Handling Equipment	1	Sum	5,726	1,308	7,034
Dredging	320,000	m3	1,687	504	2,191
TOTAL			13,334	3,015	16,349

Others Construction Revised Cost

Unit: 1,000 US$

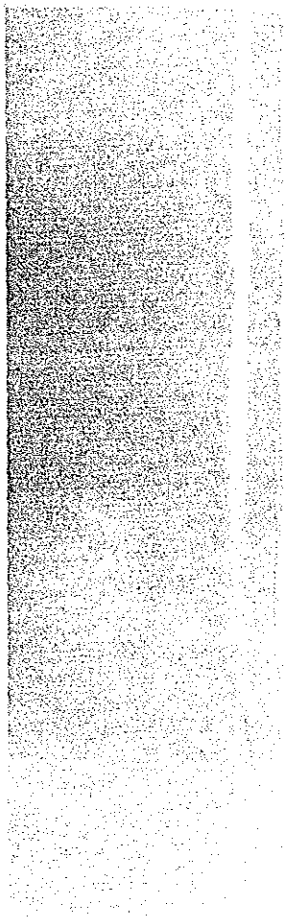
Description	Quantity	Unit	Construction Cost		
			Foreign	Local	Total
QEQ Rehabilitation					
Yard Paving	83,000	m²	5,999	2,702	8,701
Utilities	1	Sum	4,011	493	4,504
Total			10,010	3,195	13,205
Channel Dredging	1,260,000	m3	6,811	2,047	8,859
Navigation Buoy	3	No.	375	34	409
Total			7,186	2,081	9,268
Improvement of Communication System					
Equipment			2,563	231	2,793
Installation			627	171	799
Total			3,190	402	3,592

Appendix III-7-8
(Continued)

Colombo Port Revised Investment Plan

(Unit: 1,000 US$)

	1991			1992			1993			1994			1995			1996		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
JCT No.3	14,726	6,822	21,548	36,993	10,113	47,106	34,083	8,005	42,088									
JCT No.4				14,286	5,408	19,695	35,484	9,368	44,832	25,379	4,893	30,272						
New North Pier				2,684	2,067	4,751	6,158	3,571	9,729	5,264	2,188	7,452	13,733	3,867	17,601	10,891	3,022	13,913
Pipe Laying for Oil Handling				5,226	1,220	6,447	8,107	1,794	9,902									
QEQ Rehabilitation				5,057	1,612	6,666	4,954	1,583	6,537									
Channel Dredging							7,186	2,081	9,268									
Communication							2,551	321	2,872	638	81	719						
T/C for JCT No.1 JCT No.2	2,845	256	3,101															
Total	17,570	7,078	24,649	64,247	20,420	84,667	98,504	26,724	125,228	31,281	7,163	38,444	13,733	3,867	17,601	10,891	3,022	13,913



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