3. Initial Environment Examination

3.1 Outline of the Project

The purpose of the project is to construct a new port in order to make efficiency of physical distribution in Thrace region. The outline of the short-term development plan for the project is as shown in Table 3.1.1.

TABLE 3.1.1 Outline of the Project

Item	Summary of the project
1.Project Name	Marmara Ports Development Master Plan
2.Background	Terrible congestion in Hydarpasa port, Increasing future demand, especially container cargo, Shortage of port facilities in Thrace region
3.Purpose	Well-balanced port development in the Sea of Marmara New port construction in Thrace region
4.Location	North coast of the Sea of Marmara, Military owned coastal area, Approximately 20km east of Tekirdag city center
5.Executive Organization	General Directorate of the Construction of Railways, Harbors and Airports, Ministry of Transportation
6.Affected Population*	Approximately 300,000 (Tekirdag Province center, Marmara Ereglisi, Corlu, Muratli, Hayrabolu)
7.Plan	
(1)Type of Plan	New Port Development
(2)Type of Port	Foreign & domestic trade port, Commercial port, Cargo port
(3)Demand/Ships	Cargo(2005): container: 270,000TEU Maximum size of vessel: 27,000DWT(Container vessel)
(4)Wharf	2 berths(length: 390m/depth:-12m,)
(5)Breakwater	Breakwater: 150km, Revetment: 3,810m
(6)Water area	Channel: water depth -12m, Basin: max. water depth -12m
(7)Reclamation	Reclamation: 7,124,000m^3
(8)Other related development	Accuses road(Causeway): 420m

*Note: * 6.Affected population tentatively refers to population in the project area, Tekirdag and its immediate vicinity.*

3.2. Outline of the Existing Environment

And this section outlines the existing environmental quality of the proposed project area and its immediate vicinity in terms of physical, biological and socio-economical characteristics as shown in Table 3.2.1.

The study area for the proposed project is selected as the area which radiates a few km from the proposed port site situated at about 20 km from the Tekirdag Province Center towards the District Center of Marmara Ereglisi. The proposed port site is military owned coastal area which is 100m wide on average and 2.2km long and entrance is prohibited. Few houses and factories are located in the vicinity which is mostly comprised of agricultural fields and devastated land and there is no discharge of pollution load to the sea. The natural environment of the area and its immediate vicinity has been kept relatively well.

The coastal area around the site is the summer resort area along where elegant second houses are built and beaches are located. At present, it there does not seem to be any air pollution and water pollution around the site. Since there are a remains several kilometers from the site, remains would be probable around the site. Fishing area is also near the site.

TABLE 3.2.1 Outline of the Location Environment of the Project

Item	Content
1.Project Name	Marmara Ports Development Master Plan
2.Social Environment (1)Residents	There is no inhabitant.
(2)Land use (Fishing village, Fish market/ Industrial area, /Historic spot etc.)	Projected area and its vicinity are agricultural fields and devastated area where is not utilized.
(3)Economy/recreation (Agriculture, Fishery, Commerce/ Resorts)	Summer houses, beach and fishery area are situated at the vicinity.
3.Natural Environment (1)Topography/geology	Flat land consisted of sandstone, conglomerate, silt.
(2)Coast/sea area	Tidal difference is small. Waves are not so high and erosion is little.
(3)Precious fauna and flora and their living area	None in particular.
4.Pollution (1)Occurrence of complaints	None in particular.
(2)Coping with complaints	None in particular.
5.Others	None in particular.

3.3 Initial Environmental Examination

The Initial Environmental Examination(IEE) has been assessed in a tabular form in accordance with the layout recommended by OCDI in their publication "Environmental Assessment for Port development Projects", OCDI, December 1993. This is shown in Table 11.3.1. The significance of impacts is shown by the entries in the tables; those in the left column representing no impact and those in the right column representing major impacts. The potential major impacts could be:

- Dredging of sediments. This needs to be assessed.
- Disturbance due to construction of breakwaters, reclaimed land and increased turbidity of water.
- Dust from loading/unloading operations
- Interruption to free flowing coastal water
- Congestion of land traffic and maritime traffic.
  Noise from access traffic
- Effects on flora and fauna. This needs to be assessed.
- Borrow areas. The reclamation may require infill materials that may have to be transported from quarries.
- Social effects
- Cultural aspects.
- Visual impact.
- Economic impacts.

The IEE given in Table 3.3.1 is quite comprehensive and a synopsis and overview is given in Table 3.3.2. This is in accordance with JICA requirements given in the Checklist for Scoping Port and Harbours, "Environmental Guidelines for Infrastructure Projects - Ports and Harbours", JICA Environmental Guidelines, September 1992.

As can be seen in the figure there are several environmental impacts associated with the planned development which require further investigation, and an EIA is considered necessary.

The planned activities at the new port that may have a significant impact are dust, dredging, quarrying of material for reclamation, transportation infrastructure, and

the construction activities. The degree of these impacts is not yet quantitatively established but as each can be controlled by appropriate mitigation measures they should not prevent the port proceeding. These impacts should be considered in more detail and an EIA is considered necessary.

3.4 Proposed Site Surveys

Planned environmental site surveys based on the above IEE are as follows;

(1)Air Pollution Survey

(2)River Water Quality Survey

(3)SeaWater Survey

(4)Seabed Material Survey

(5)Flora and Fauna Survey

(6)Survey of Historical and Culture Assets

TABLE 3.3.1 IEE of New Port

Environmental Impact Factors	Environmental Impact	Countermeasures	Size of Impact				Reason	Recommendation
			None	Small	Large	Major		
1.Impact from construction works								
1.1 Operation of working boats, construction machines	1.1.1 Air pollution	1.1.1 Management of construction process, selection of working hour, smoke prevention fence.	X					
	1.1.2 Generation of noise and vibration	1.1.2 Selection of construction methods/machines, selection of working hours, placement of sources of noise/vibration	X					
	1.1.3 Change in terrestrial ecosystem	1.1.3 Selection of construction methods/machines	X					
1.2 Dredging, stirring of bottom soil, soil dumping into water	1.2.1 Pollution of water and bottom sediments(SS, hazadous materials)	1.2.1 Settling pond, sedimentation coagulant, selection of construction method/machines, silt curtains.				X	-Dredging of basins & berths. Dredged materials to go to reclamation	Assessment of sediments
	1.2.2 Offensive odor	1.2.2 Selection of construction method/machines, introduction of odor treatment methods.	X					
	1.2.3 Reduction of aquatic lives	1.2.3 Settlement ponds, sedimentation coagulant, selection of construction method/machines, silt curtains, selection of construction period, monitering of alternative habitats.		X			-No fishing grounds or shellfish bed nearby. Local fishing only.	Check with local fishermen
	1.2.4 Pollution of marine products	1.2.4 Settlement pond, sedimentation coagulant, selection of construction method/machines, silt curtains, selection of construction period, monitering of pollution of fishery products.	X					
	1.2.5 Devaluation of tourism resources (water color, coral reef)	1.2.5 Settlement pond, sedimentation coagulant, selection of construction method/machines, silt curtains.	X					
1.3 Soil removal	1.3.1 Changes in topography, underground water system	1.3.1 Prior elucidation of underground water system			X		-Need for reclamation materials	Assess location of borrow pits
	1.3.2 Extinction of terrestrial ecosystem	1.3.2 Transplantation of important species, vegetation.	X					
1.4 Generation of surplus soil, wastes, dumping of dredged soil on ground	1.4.1 Pollution of water/bottom sediments	1.4.1 Treatment site planning	X				-Soil to be used for reclamation	Check quantities needed
	1.4.2 Impact on terrestrial ecosystem	1.4.2 Disposal site planning	X					
1.5 Emplotment of laborers	1.5.1 Inflow of aline cultures	1.5.1 Employment planning, disclosure of information	X					
	1.5.2 Change in economic activities	1.5.2 Employment planning, vocational trainning	X					
1.6 Congestion of work vehicles and boats	1.6.1 Economic loss(traffic jam)	1.6.1 Construction of access roads			X		Roads already exist but may be small	Check capacity needed
	1.6.2 Devaluation of fishing ground	1.6.2 Alternative fishing ground	X					
2. Impact from port facilities and site								
2.1 Emergence of site (including landfill)	2.1.1 Pollution of water and bottom sediments	2.1.1 Change of face lines, dredging sludge, promotion of seawater exchange		X			-Not known at this stage	To be assessed
	2.1.2 Beach erosion and accretion	2.1.2 Change of face lines, construction of breakwater against beach erosion, littoral nourishment			X		-Concerns over littoral drift. Not quantified yet.	To be assessed.
	2.1.3 Change in coastal currents	2.1.3 Change of face lines, construction of breakwaters, selection of type of offshore structure.			X		-Concerns over littoral drift. Not quantified yet.	To be assessed.
	2.1.4 Decrease of habitats for aquatic lives	2.1.4 Transplant, discharge of seeds and saplings	X				-No effects anticipated.	None
	2.1.5 Decrease of habitats for terrestrial lives	2.1.5 Change of face lines, designation of nature conservation areas, artificial tidal flats, transplant	X					
	2.1.6 Change in scenic beauty	2.1.6 Location of facilities, selection of color, plantation		X			-New reclamed island	To be assessed
	2.1.7 Resettlement of local residents and culture	2.1.7 Transfer planning, information disclosure	X					
	2.1.8 Extinction of fishing grounds	2.1.8 Expansion of function of fishing ports, marine products transportation functions	X					
2.2 Emergence of protective facilities	2.2.1 Pollution of water and bottom sediments	2.2.1 Change of face lines, dredging sludge, promotion of sea water exchange		X				
	2.2.2 Beach erosion and accretion	2.2.2 Change of face lines, construction of breakwaters against beach erosion, littoral nourishment			X			
	2.2.3 Change in coastal current	2.2.3 Change of face lines, construction of breakwaters for wave prevention, selection of type of offshore			X			

structure
2.2.4 Decrease of habitats for aquatic lives
2.2.4 Transplant, discharge of weeds and saplings
X
2.2.5 Change of scenic beauty
2.2.5 Change in shape of facilities and selection of colors
X
2.3.1 Change in coastal currents
2.3.1 Change of face lines, construction of breakwaters for wave prevention
X
2.3.2 Decrease of habitats for aquatic lives
2.3.2 Transplant, discharge of weeds and saplings
X
2.4 Emergence of beaches
2.4.1 Change in coastal current
2.4.1 Change of face lines, construction of breakwaters for wave prevention, selection of type of offshore structure
X
2.4.2 Decrease of habitats for aquatic lives
2.4.2 Transplant, discharge of weeds and saplings
X
3.1.1 Reduction of stoppage time in ports, compulsory use of high quality oil
X
3.1.2 Strengthening of laws and regulations
X
New shipping expected
Enforcement of harbour regulation
3.1.3 Beach erosion caused by tsunmi wave
3.1.3 Speed limit, beach protection structure
X
3.1.4 Generation of wastes
3.1.4 Strengthening of laws and regulations
X
Extra waste to municipal tip
Authorities to initiate correct waste disposal practices
4.1.1 Establishment of buffer zone, enclosure, surface treatment, selection of loading machines
X
Major impacts possible from bulk materials handling
4.1.2 Establishment of buffer zone, enclosure, surface treatment, selection of loading machines, shape of apron
X
Some impacts from normal port operation
4.1.3 Zoning, sound proof breakwood
X
4.1.4 Zoning, sealing of storage facilities, deodorization facilities
X
4.1.5 Establishment of buffer zone, enclosure, surface treatment, selection of loading machines, shape of apron, monitoring of pollution of marine products
X
4.1.6 Planning for collection, treatment and disposal of wastes
X
Waste from new port
Need correctly operated municipal waste disposal site
4.1.7 Vocational training
X
5.1.1 Reduction of air pollutants (dust collection, desulphurisation, denitrification), promotion of dispersion
X
5.1.2 Facilities for waste oil treatment, oil fence
X
5.1.3 Change of zoning, containment of offensive odor, deodoriser
X
5.1.4 Facilities for waste oil treatment, oil fence, maintaining of pollution of marine products
X
5.1.5 Facilities for waste oil treatment, oil fence, establishment of nature conservation area
X
5.1.6 Facilities for waste oil treatment, oil fence, monitoring of pollution of marine products
X
6.1.1 Reduction of air pollutants(dust collection, desulphurisation, denitrification)
X
6.1.2 Reduction of discharge, drainage treatment facilities
X
6.1.3 Zoning, containment of offensive odor, deodoriser
X
6.1.4 Prevention of water pollution
X
6.1.5 Prevention of air water pollution
X

6.2 Impact from water disposal facility	6.2.1 Air pollution	6.2.1 Establishment of buffer zone, surface treatment, fence	X					
	6.2.2 Pollution of water and bottom sediments	6.2.2 Sheet cover (rain prevention) settling ponds, selection of bulkhead structure	X					
	6.2.3 Generation of offensive odor	6.2.3 Zoning	X					
	6.2.4 Change in coastal ecosystem	6.2.4 Prevention of water pollution	X					
	6.2.5 Change in terrestrial ecosystem	6.2.5 Prevention of air/water pollution	X					
	6.2.6 Formation of slums	6.2.6 Management plans for disposals site	X					
7. Impact from Traffic function								
7.1 Road Traffic	7.1.1 air pollution	7.1.1 Improvement of transportation system routes, establishment of buffer zone, road pavement, green belt, cover on a bed of trucks				X	-Some increase in road traffic.	Need for futher study
	7.1.2 Generation of noise and vibration	7.1.2 Correction of routes, establishment of buffer zone, selection of road/trackage, structure road pavement, soundproof fence				X	-Some increase in road traffic.	Need for futher study
	7.1.3 Change in terrestrial ecosystem	7.1.3 Correction of routes, establishment of buffer zone/ nature conservation area, prevention of air pollution			X		-Some land take may be necessary	Need for futher study
	7.1.4 Change in local population distribution	7.1.4 Information disclosure, enlightening the local people on the concerned project		X			-Some minor relocation may be necessary of temporaly dwellings and livestock	Need to qualify
	7.1.5 Traffic jams/accidents	7.1.5 Relocation of routes/overpass	X				-New access road	
8. Impact from industrial production activities								
8.1 Operation of factories and plants	8.1.1 Air pollution	8.1.1 Reduction of air pollutants (dust collection, desulphurisation, denitrification) promotion of dispersal	X					
	8.1.2 Pollution of water and bottom sediments	8.1.2 Reduction of discharge, drainage treatment facilities	X					
	8.1.3 Generation of noise and vibration	8.1.3 Zoning, establishment of buffer zone, soundproof fence/hood	X					
	8.1.4 Generation of offensive odor	8.1.4 Zoning, containment of offensive odor, deodorisation facilities	X					
	8.1.5 Ground subsidence	8.1.5 Regulation on the use of underground water	X					
	8.1.6 Change in coastal ecosystem	8.1.6 Prevention of water pollution, dredging of sluge	X					
	8.1.7 Change in terrestrial ecosystem	8.1.7 Establishment of nature conservation area	X					
	8.1.8 Generation of wastes	8.1.8 Planning for collection treatment and disposal of wastes	X					
	8.1.9 Change in local population distribution	8.1.9 Establishment of employment planning, information disclosure	X					
	8.1.10 Employment effect	8.1.10 Vocational training	X					
9. Impact from strage and distribution functions								
9.1 Strage functions (including outdoor strage)	9.1.1 Air pollution (dust)	9.1.1 Zoning, establishment of buffer zone, containment, sprinkling, sheet cover, surface treatment				X	-Storage area may give rise to dust problem	Need to qualify and review dust control procedures
	9.1.2 Pollution of water and bottom sediments	9.1.2 Zoning, containment, sheet cover, establishment of drains, and settling ponds	X					
	9.1.3 Generation of offensive odor	9.1.3 Zoning, containment of odor, deodorizer	X					
9.2 Cargo handling	9.2.1 Generation of noise	9.2.1 Zoning, establishment of buffer zone, selection of machines, sound proof fence and sound proof hoods	X					
	9.2.2 Employment effect	9.2.2 Vocational training	X					
10. Impact from operation of recreational facilities								
10.1 Utilisation of hotels, marinas, artificial beaches	10.1.1 Pollution of water and bottom sediments	10.1.1 Water quality control through laws and regulations, water quality improvement in the shallow coastal area including artificial beaches	X					
	10.1.2 Change in coastal ecosystem	10.1.2 Prevention of pollution of water and bottom sediments	X					
	10.1.3 Generation of wastes	10.1.3 Planning for collection treatment and disposal of wastes	X					
	10.1.4 Inflow of alien culture	10.1.4 Selection of project location, information disclosure,	X					

		enlightening the local people on the concerned						
		project						
	10.1.5 Employment effect	10.1.5 Employment planning, vocational training	X					
	10.1.6 Obstruction to fishing activiyies	10.1.6 Securing of alternative fishing grounds	X					

TABLE 3.3.2 IEE OVERVIEW (Checklist for Scoping: Ports and Harbours)

PORT: NEW PORT			
	ENVIRONMENTAL ITEM	EVALUATION A/B/C/D	REASON
SOCIAL ENVIRONMENT			
1	RESETTLEMENT	D	Land site is owned by Military
2	ECONOMIC ACTIVITIES	A	Impact is positive.
3	TRAFFIC/PUBLIC FACILITIES	C	Some increase due to cargo transportation
4	SPLIT OF COMMUNITIES	D	None anticipated
5	CULTURAL PROPERTY	B	Remains near the site, To be examined in EIA
6	WATER RIGHTS AND RIGHTS OF COMMONS	C	Reclamation & channel, To be examined in EIA
7	PUBLIC HEALTH CONDITIONS	D	None anticipated
8	WASTE	C	Reclamation by dredged materials, Some increase by port operation
9	HAZARDS(RISKS)	D	None anticipated as not dangerous goods port.
NATURAL ENVIRONMENT			
10	TOPOGRAPHY AND GEOLOGY	C	None of large scale of land change
11	SOIL EROSION	D	No evidence of erosion at present.
12	GROUNDWATER	D	None of large scale of land change
13	HYDROLOGICAL SITUATION	B	Reclamation & breakwater, To be examined in EIA
14	COASTAL ZONE	A	Reclamation & breakwater, To be examined in EIA
15	FAUNA AND FLORA	B	Reclamation, To be examined in EIA
16	METEOROLOGY	D	None of large scale of land change affecting to meteorology
17	LANDSCAPE	C	Minor visual impact by reclamation
POLLUTION			
18	AIR POLLUTION	C	Some increase of traffic, To be examined in EIA
19	WATER POLLUTION	B	Some increase of ship, To be examined in EIA
20	SOIL POLLUTION	D	None anticipated
21	NOISE AND VIBRATION	C	Some minor impact anticipated, especially in construction stage
22	LAND SUBSIDENCE	D	None anticipated
23	OFFENSIVE ODOR	D	None anticipated

A: Serious impact is expected
B: Some impact is expected
C: Extent of impact is unknown. Examination is needed.
D: No impact is expected. IEE/EIA not necessary.

4. Assessment of Environmental Impacts

Reclamation and dredging have the most potentially adverse effects. As shown in the Figure 4.1.1, the new port construction is designed in front of the military owned coastal area in Tekirdag. This will minimize the effects on the area adjacent to the site.

4.1 Current Flow

To assess the impact of the port development in the short-term development plan, wind driven currents are identified by means of computer simulation. The simulation area encompasses 60 km^2 of surface water, about 6 km offshore and 10 km in the east-west direction.

Single layer differential model which can take into consideration stress on sea surface is adopted for the simulation. Equations of the model are shown in Equation 4.1. Grid size of the simulation is 200 meters. Dominant wind comes from NE with wind velocity of 2.21 m/sec according to site observation. Volume and location of fresh water discharges are shown in Figure 4.1.1. The discharge volume of the river was estimated mainly based on its river basin area, average annual precipitation of Tekirdag and runoff coefficient. Tidal component is excluded because it is negligibly small.

EQUATION 4.1

Equation of continuation

$$\frac{\partial \zeta}{\partial t} + y\frac{\partial}{\partial x}\left[(\zeta + D)u\right] + \frac{\partial}{\partial y}\left[(\zeta + D)v\right] = 0$$

Equations of motion

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = fv - g\frac{\partial \zeta}{\partial x} + Ah\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right) + \frac{\rho_a}{\rho}\gamma_a{}^2\frac{W_x\sqrt{W_x^2 + W_y^2}}{(\zeta + D)} - \gamma_b{}^2\frac{u\sqrt{u^2 + v^2}}{(\zeta + D)}$$

$$\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = -fu - g\frac{\partial \zeta}{\partial y} + Ah\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right) + \frac{\rho_a}{\rho}\gamma_a{}^2\frac{W_y\sqrt{W_x^2 + W_y^2}}{(\zeta + D)} - \gamma_b{}^2\frac{v\sqrt{u^2 + v^2}}{(\zeta + D)}$$

where, x, y :Orthogonal Cartesian coordinates
u, v :Velocity components in x-, y- directions, respectively
t :Time
ζ :Elevation of water surface from the still water level positive upward
D :Water depth(D_{max}=20 m)

f :Coriolis parameter(f=2 ω sin ϕ; ω=2 π/(24×3600) rad/s; ϕ=41°)

g :Gravitational acceleration

ρ_a :Density of air

ρ :Density of sea water

γ_a :Surface friction factor(0.0016)

Wx, Wy :Wind velocity in x-, y- directions, respectively

γ_b :Bottom friction factor(D<20 m;0.0026, D≧20 m; 0.0015)

Ah :Horizontal eddy viscosity(1×10^4 cm^2/s)

Simulation was carried out in the case of north-eastern wind. Simulation cases are as follows:

Case 1: Present Geometry

Case 2: Short-term Development Plan

Calibration of the model was carried out in line with the current data observed at the two points 1 km and 1.6 km offshore the military owned area.. The currents calculated at two points are approximately 1.5 cm/s and 2 cm/s. The simulation has shown that the wind driven current in the offshore area flows along the coastline in the direction of NW-W.

Results of the calculation are shown in Figure 4.1.2 and Figure.4.1.3. Differences in current velocity between the present geometry and the future are presented in Figure 4.1.4. In the future case, changes in current velocity of more than 2 cm/s are limited to the adjacent area at the base of the reclaimed land while a slight decrease is shown in the western area along the coast of the port.

4.2 Water Pollution

(1)Changes in Water Quality(COD)

Water quality is mainly measured by five elements: (a) general features such as temperature, salinity, pH, colour, transparency, oil and grease, and organic material concentration measured by chemical oxygen demand (COD) or biochemical oxygen demand (BOD); (b) turbidity measured by suspended solids (SS); (c) eutrophication-related factors measured by dissolved oxygen (DO), nitrogen (N) and phosphorus (P); (d) harmful or toxic substances including heavy metals such as mercury, cadmium, lead,

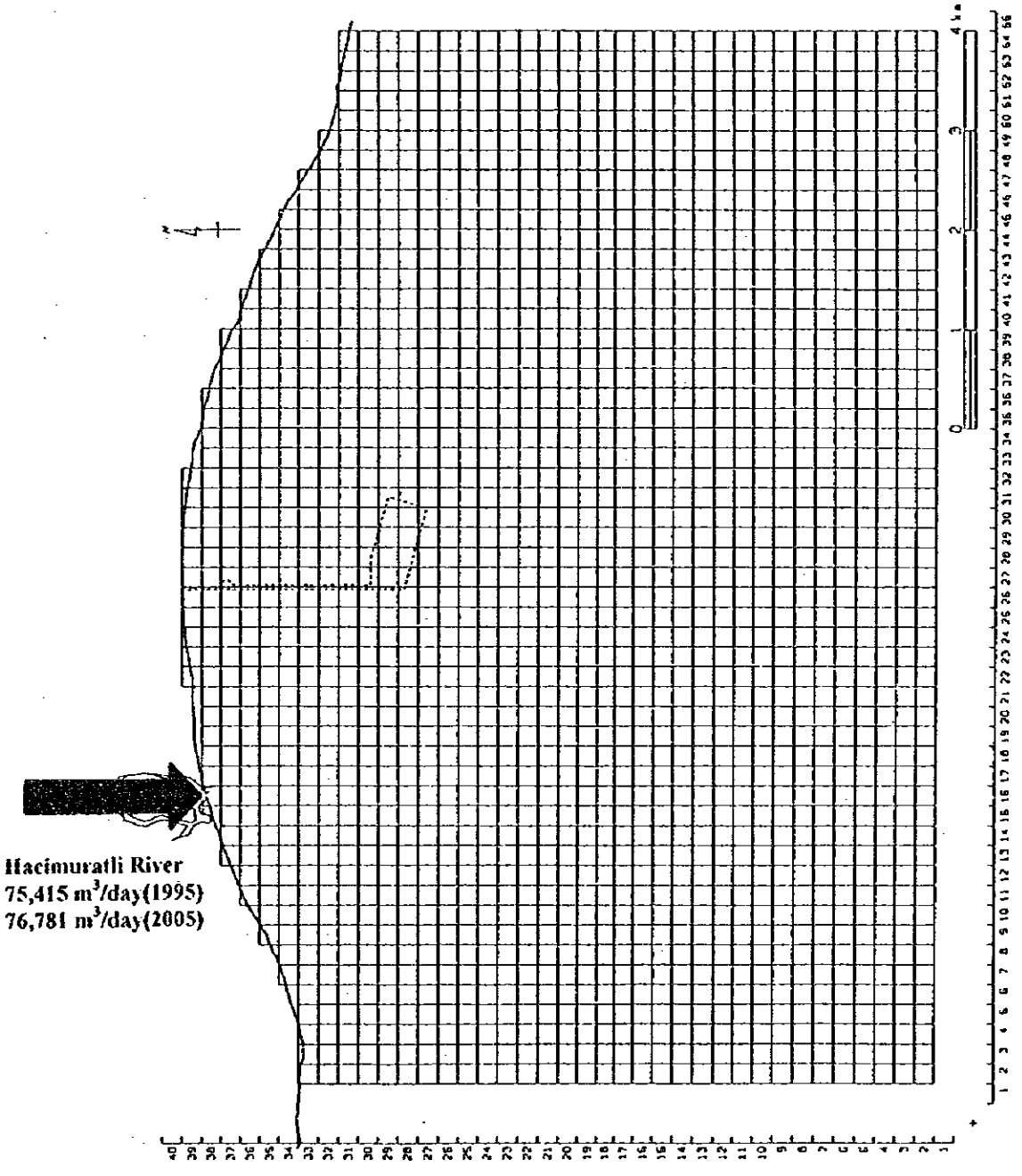

FIGURE 4.1.1 Calculation area, Location of fresh water discharge & Current observation points

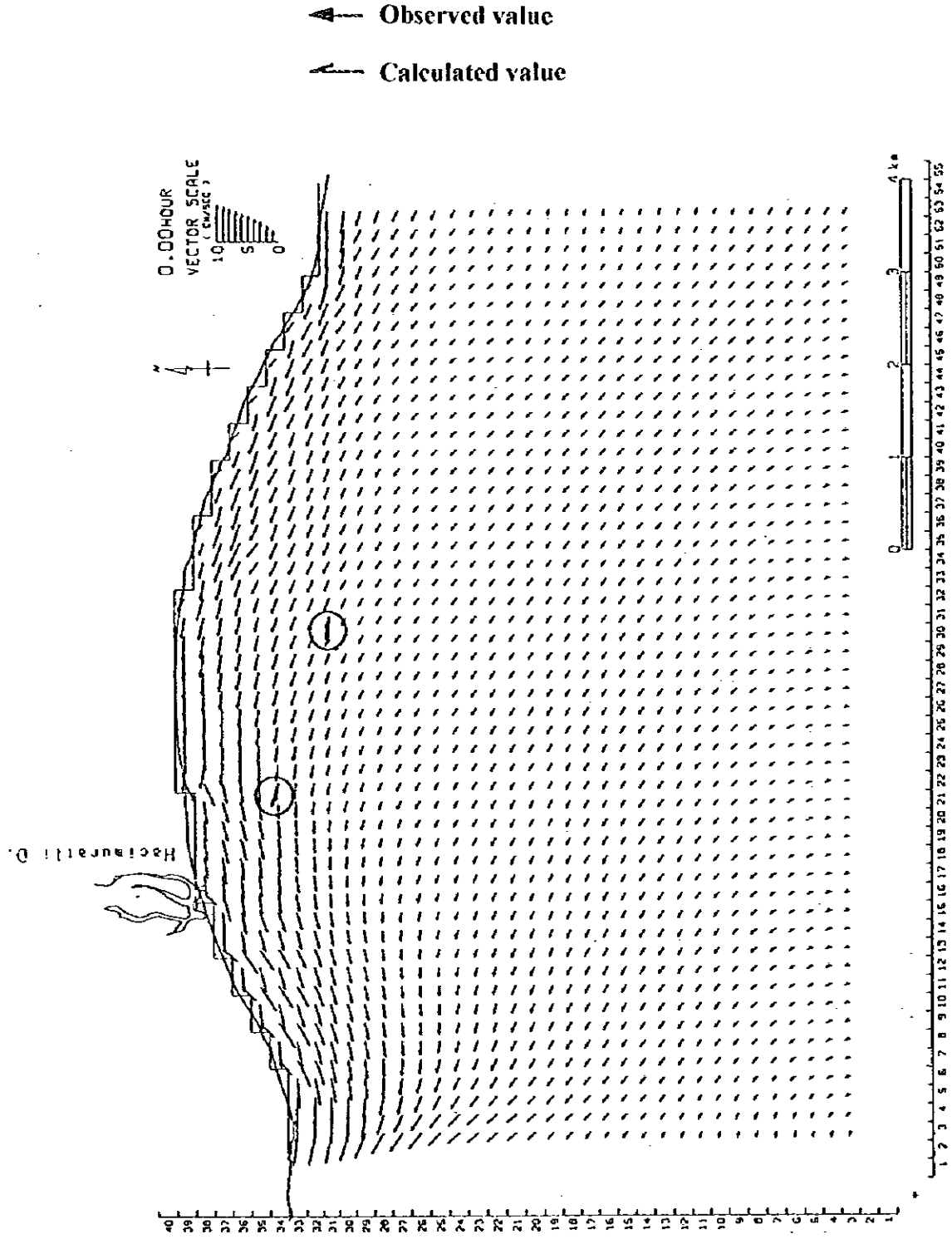

FIGURE 4.1.2 Current direction and velocity indicated with vector array (Case 1: Present geometry)

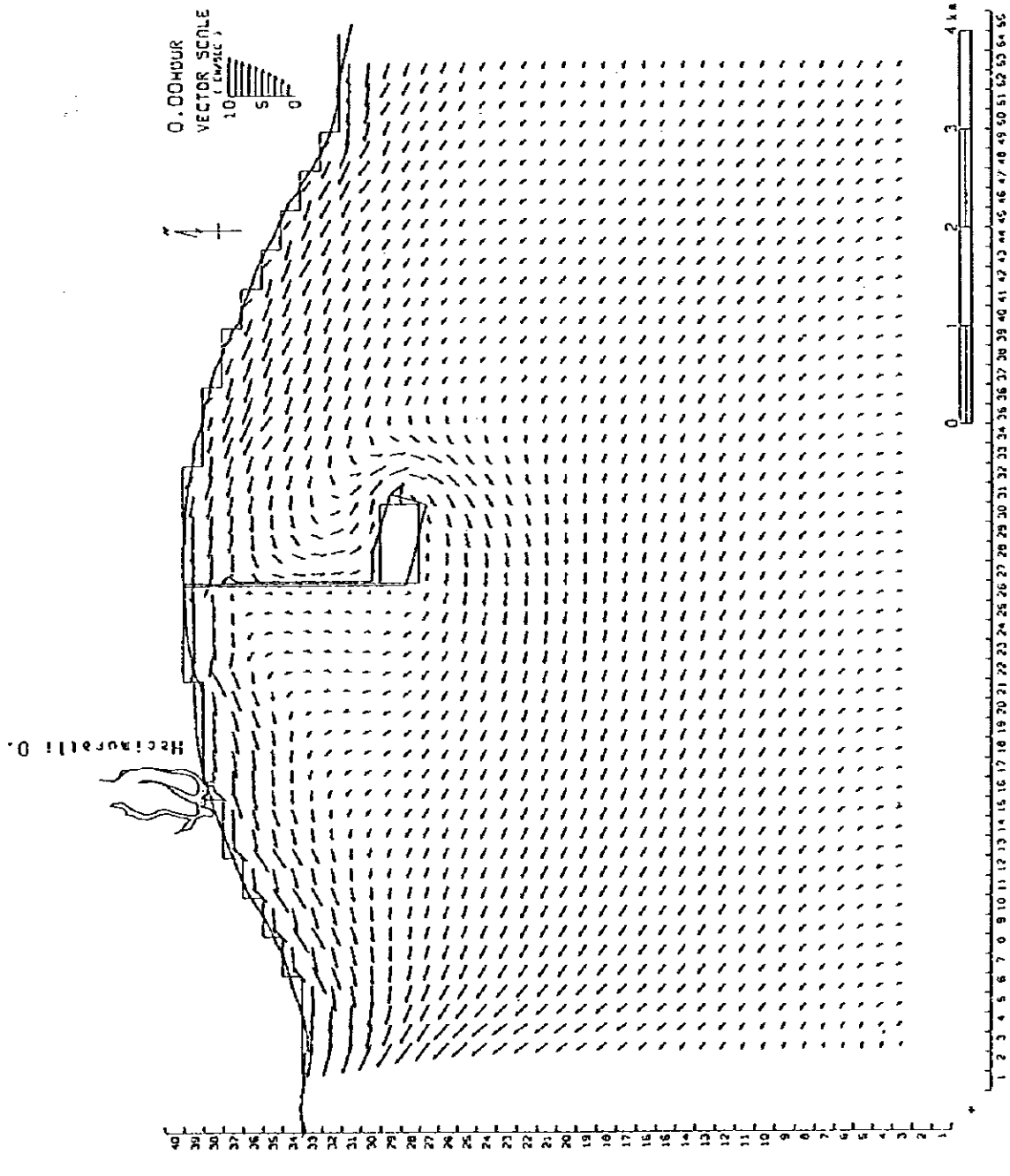

FIGURE 4.1.3 Current direction and velocity indicated with vector array (Case 2: Short-term Development Plan)

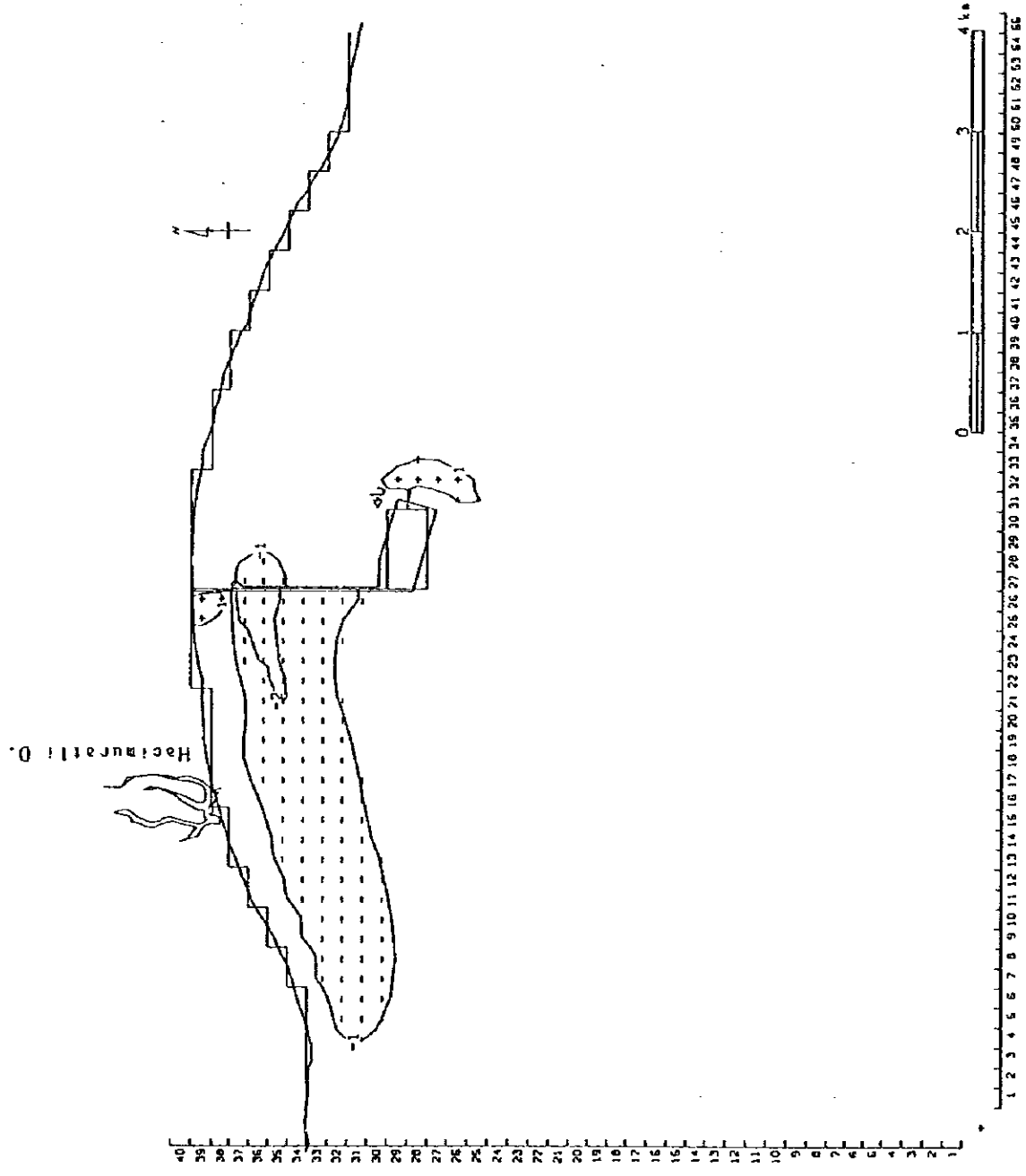

FIGURE 4.1.4 Difference of current velocity (unit: cm/s)

and pesticides; and (e) sanitation-related factors determined by measuring the amount of coliform bacteria.

Since COD is usually used for an indicator of the dispersion of water pollution, water quality is assessed by COD dispersion model on wind driven current. The model used is a single layer differential model and its equations are indicated in Equation 4.2.

EQUATION 4.2

COD diffusion.

$$\frac{\partial S(D+\zeta)}{\partial} = -\frac{\partial}{\partial x}\left[Su(D+\zeta)\right] - \frac{\partial}{\partial y}\left[Sv(D+\zeta)\right] + \frac{\partial}{\partial x}\left[K(D+\zeta)\frac{\partial S}{\partial x}\right] + \frac{\partial}{\partial y}\left[K(D+\zeta)\frac{\partial S}{\partial y}\right] + Ls$$

where x, y :Orthological cartesian coordinates

u, v :Velocity components in x-, y- directions, respectively

t :Time

D :Water depth

ζ :Elevation of water surface from the still water level positive upward

K :Horizontal diffusion coefficient

S :Concentration of COD

Ls :Load

The COD load at the mouth of the Hacimuratli river is 75,752 kg/day in 1995 and 157,434 kg/day in 2005. These COD loads were estimated based on the value added by manufacturing industries, COD unit productivity by industry. The location of discharge point is the same as Figure 4.1.1.

A computer simulation was carried out for two cases, one to assess the present water quality and the other to assess water quality after completion of the short-term plan.

Based on the water quality survey shown in chapter 3, COD concentration at the boundary of simulation area is assessed as in Figure 4.2.1. The simulation was carried out under the following conditions and the result of the present case is compared with the COD concentration observed. (See Figure 4.2.2).

Diffusion factor: 10^4 cm^2/s

Simulation period: 1,200 hours

Results of the simulation are shown in Figure 4.2.3 and 4.2.4 indicating contour lines of COD dispersion. Differences in COD concentration between the present and the future are presented in Figure 4.2.5. A slight increase, maximum of 6 ppm, is seen in the elliptical area around the reclaimed land which is 3 km in short diameter and 5 km in long diameter (See Figure 4.2.5). In the adjacent area along the coast of the mouth of Hacimuratli river, a maximum increase of 10 ppm is seen.

COD concentration around the harbour would be 20 ppm which is the same as the coastal sea area at present, however, it is within the criteria of water quality, class I which is the strictest in classification and has no substantial adverse effect.

Though higher concentration adjacent to the mouth of the river shows an extension to the west of the mouth, the area of higher concentration is limited. The reason of the extension in 2005 is mainly that the load from the river is doubled.

(2)Dispersion of Suspended Solids(SS)

Disposition of rubble, dredging and other construction works in water cause resuspension of sediments and turbid water. Resuspension of sediments in water generally leads to an increase in the level of suspended solids(SS) and in the concentration of organic matter, possibly to toxic or harmful levels. It also reduces sunlight penetration.

The master plan and short-term development plan proposed in this report have a larger volume of reclamation than basin capital dredging. Because of the limited dredging in volume and in area in the short-term development plan, borrow dredging for reclamation will be conducted. Moreover, since dredged material mainly includes sandy shell which is easy to precipitate and the current in and around the dredging area is very small, dispersion of SS would not expand to large area. On the other hand, there is a large volume of quarry run for mound of revetment from a quarry, however, as it consists of rock/gravel that is confined to disposal facility and as spillways are equipped around reclaimed land, dispersion of SS can be controlled.

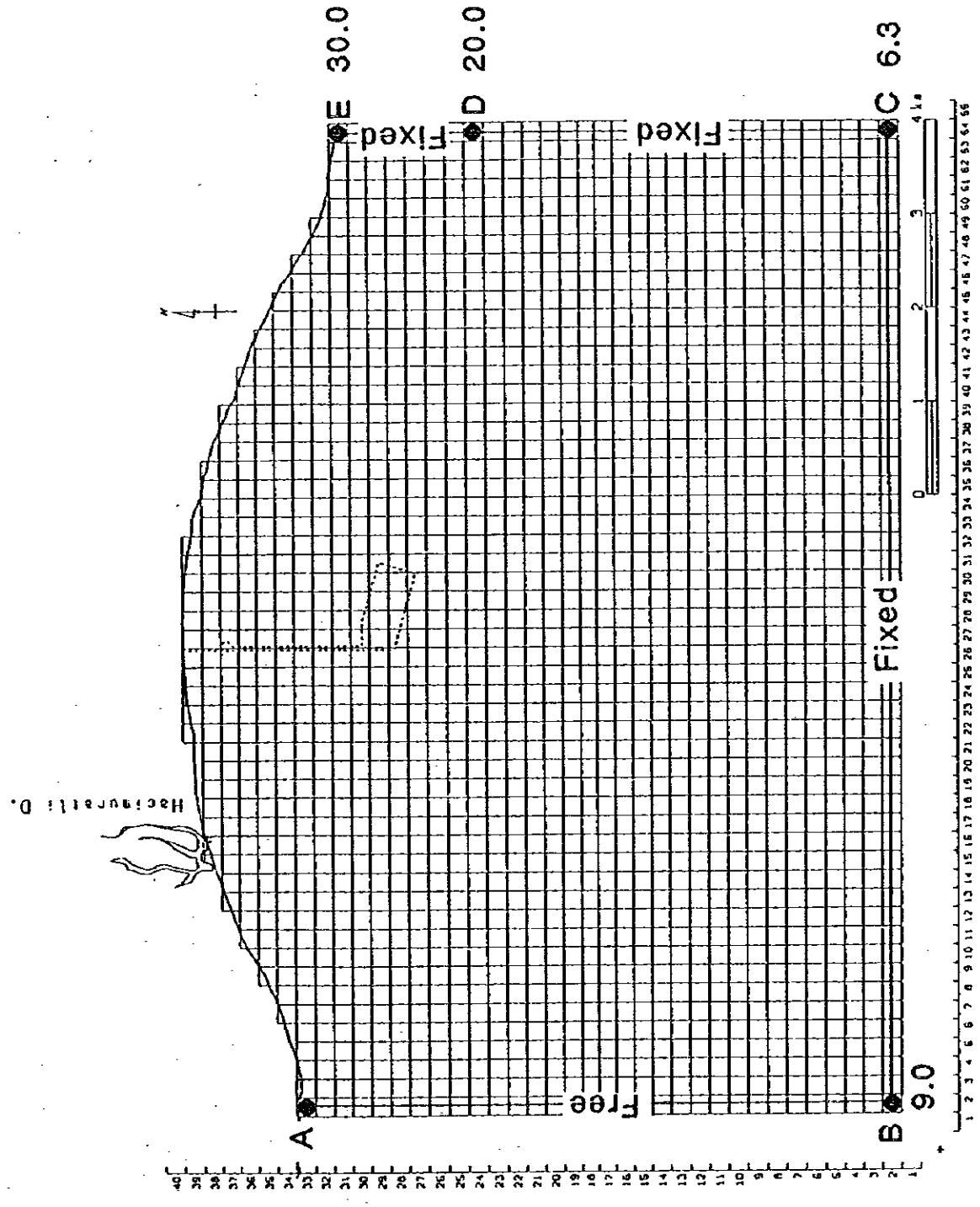

FIGURE 4.2.1 Boundary condition for COD concentration (mg/L)

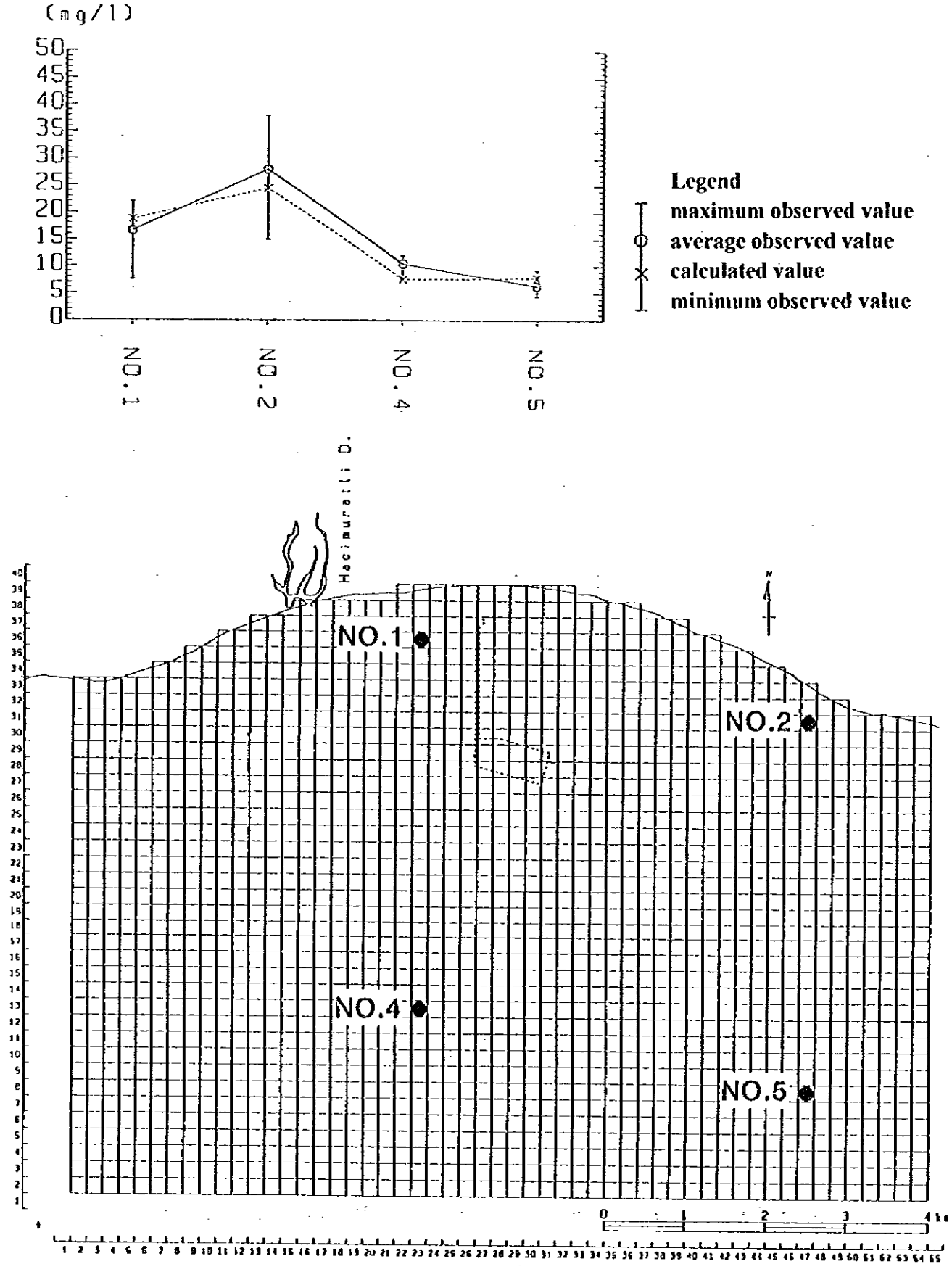

FIGURE 4.2.2 COD concentration estimated and observed & Sampling points

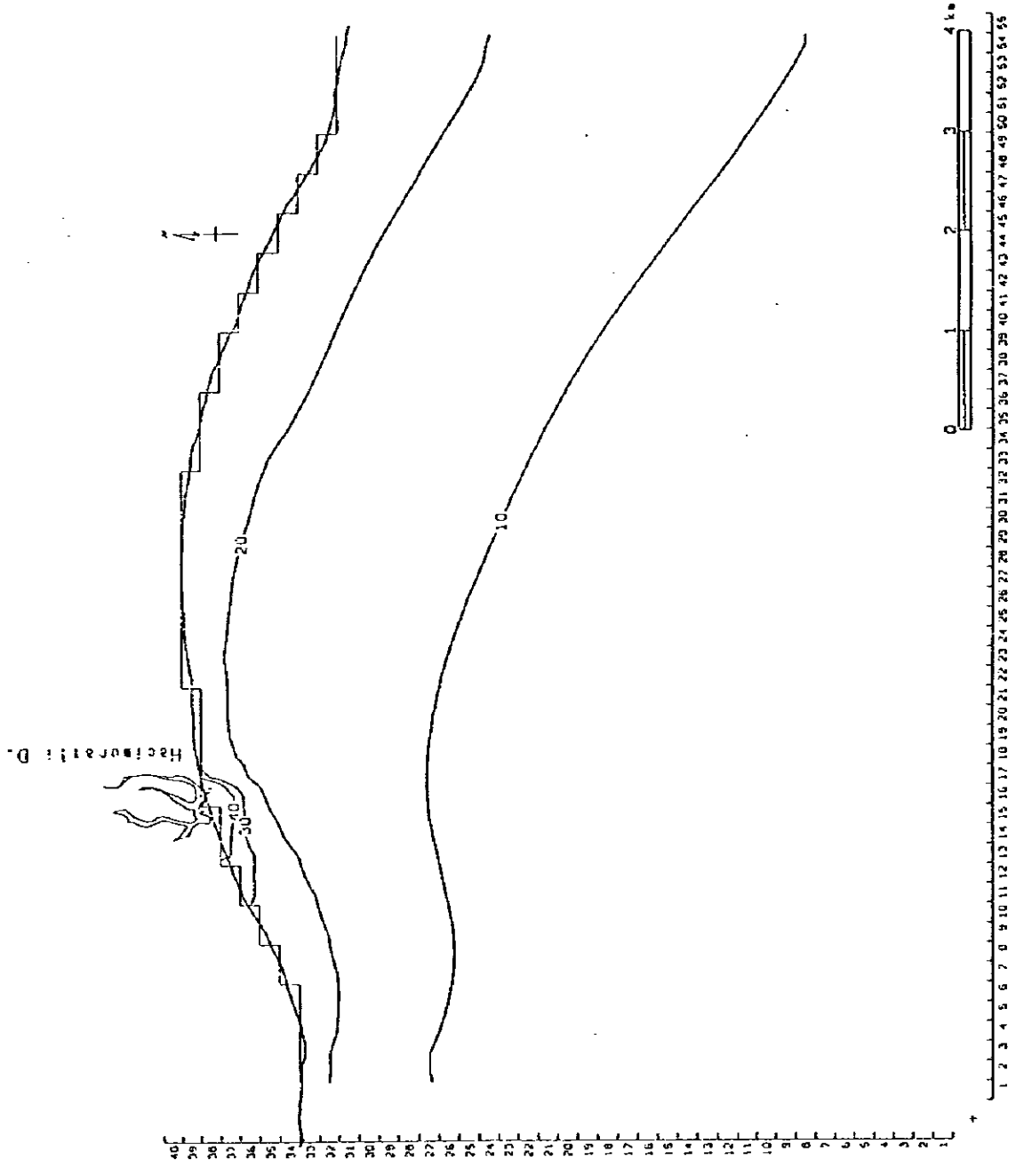

FIGURE 4.2.3 Distribution pattern of COD concentration at Present

(unit; mg/L)

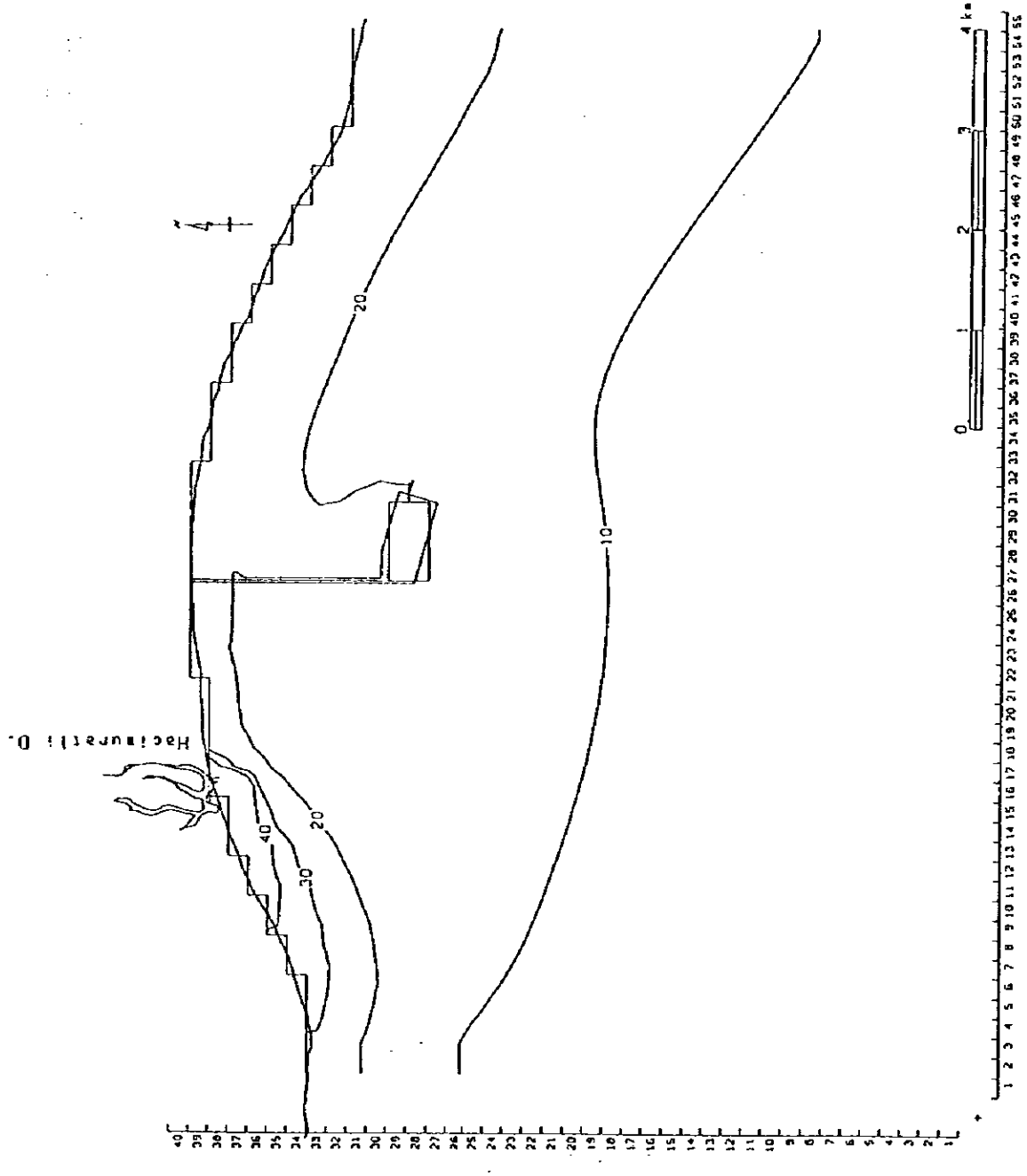

FIGURE 4.2.4 Distribution pattern of COD concentration in future

(unit; mg/L)

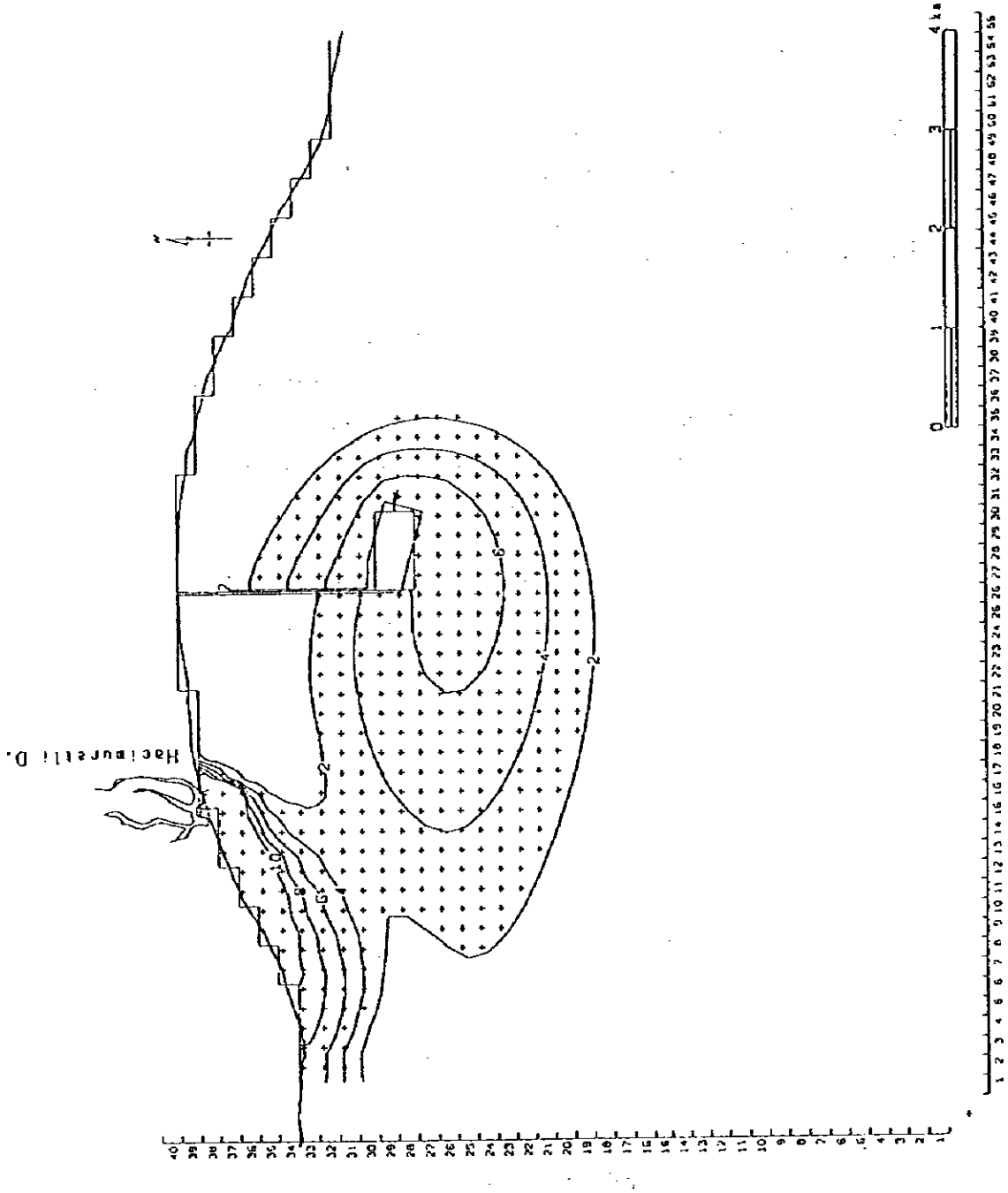

FIGURE 4.2.5 Difference of COD concentration

(unit; mg/L)

4.3 Shoreline change

Marine structures or land reclamation usually cause changes in currents and wave movements, which may result in changes in the shoreline configuration (e.g. beach erosion or accretion). Erosion and accretion take place alternately due to the change of onshore-offshore littoral transport and alongshore littoral drift.

A computer simulation was carried out to identify the impacts on the shoreline after port construction of the short-term development plan. The simulation consists of three types of calculations, namely, ① calculation of breaking wave indexes, ② calculation of alongshore drift, ③ calculation of beach erosion and accretion.

Calculation of breaking wave indexes is as follows;

(1)Representative waves which effect on the characteristics of present shoreline are determined based on emergence frequency of waves in this sea area.

(2)Transformation of each representative wave is figured out and breaking wave indexes along the shoreline are calculated.

According to the above breaking wave indexes, volume of alongshore drift is calculated. To calculate the volume, the equation by Ozasa & Brampton has been applied.

$$Q = \frac{1}{(\rho_S - \rho)g(1-\gamma)}(E \cdot C_g)_b \times (K_1 \sin\alpha_b \cos\alpha_b - K_2 \frac{\partial H_b}{\partial x} \cdot \cot\beta \cdot \cos\alpha_b)$$

$$E_b = \frac{1}{8}\rho g H_b^{\,2}$$

where,

Q	:Volume of alongshore drift (m^3/s)
K_1, K_2	:Parameter
ρ_S	:Density of sand(2.65 t/m^3)
ρ	:Density of sea water(1.03 t/m^3)
g	:Gravitational acceleration(9.806 m/s^2)
γ	:porosity of sand(0.4)
E	:Energy density of wave(ton·m·m/s/m)
Cg	:Group velocity of wave(m/s)
α_b	:Direction of breaking wave
H_b	:Wave height(m)

tan β :Slope of sea bottom

Suffix b means figures related to breaker zone

Shoreline changes are calculated by means of equation of continuation. This calculation model is based on conditions that sand would not be transported through perpendicular direction of shoreline and would be drifted only along the shoreline.

The simulation area includes approximately 18 km between Tekirdag and Marmara Eregli (See Figure 4.3.1). To calibrate the model, two shoreline configurations in the year 1957 and in the year 1987 were used. Two representative waves (deepwater wave) from east side and west side were determined based on wave height distribution by direction at the site which is given in Part II.(See Figure 4.3.2, 4.3.3, 4.3.4 & 4.3.5)

Calibration of the model was carried out by using above representative waves and parameters K_1 and K_2, which were concluded as 0.1000 and $1.620K_2$ respectively. The simulation results for the past 31 years from 1957 to 1987 are shown Figure 4.3.6.

Results of simulation 10 years into the future without the new port and after completion of the short-term development plan are shown in Figure 4.3.11 and 4.3.12. The impact of port construction was assessed by comparing the difference between the above two simulation results.(See Figure 4.3.13)

According to this figure, tombolo will be formulated by the sheltering of new port construction, shoreline will experience accretion (sediment) of about 2.0 km in length at the connection of reclaimed area, and will be eroded at both ends of the accretion area with length of 3.5 km at east and with length of 3.0 km at west. The width of beach erosion at east end is predicted to be approximately 30 meters for ten years.

To protect the beach from erosion, groin stretching over breaker zone 1.5 km east from the connection of causeway will be necessary. Its length will be 500 meters. By this countermeasure, adverse effects of the implementation of the short-term plan are deemed to be limited to a certain area and not to be serious.

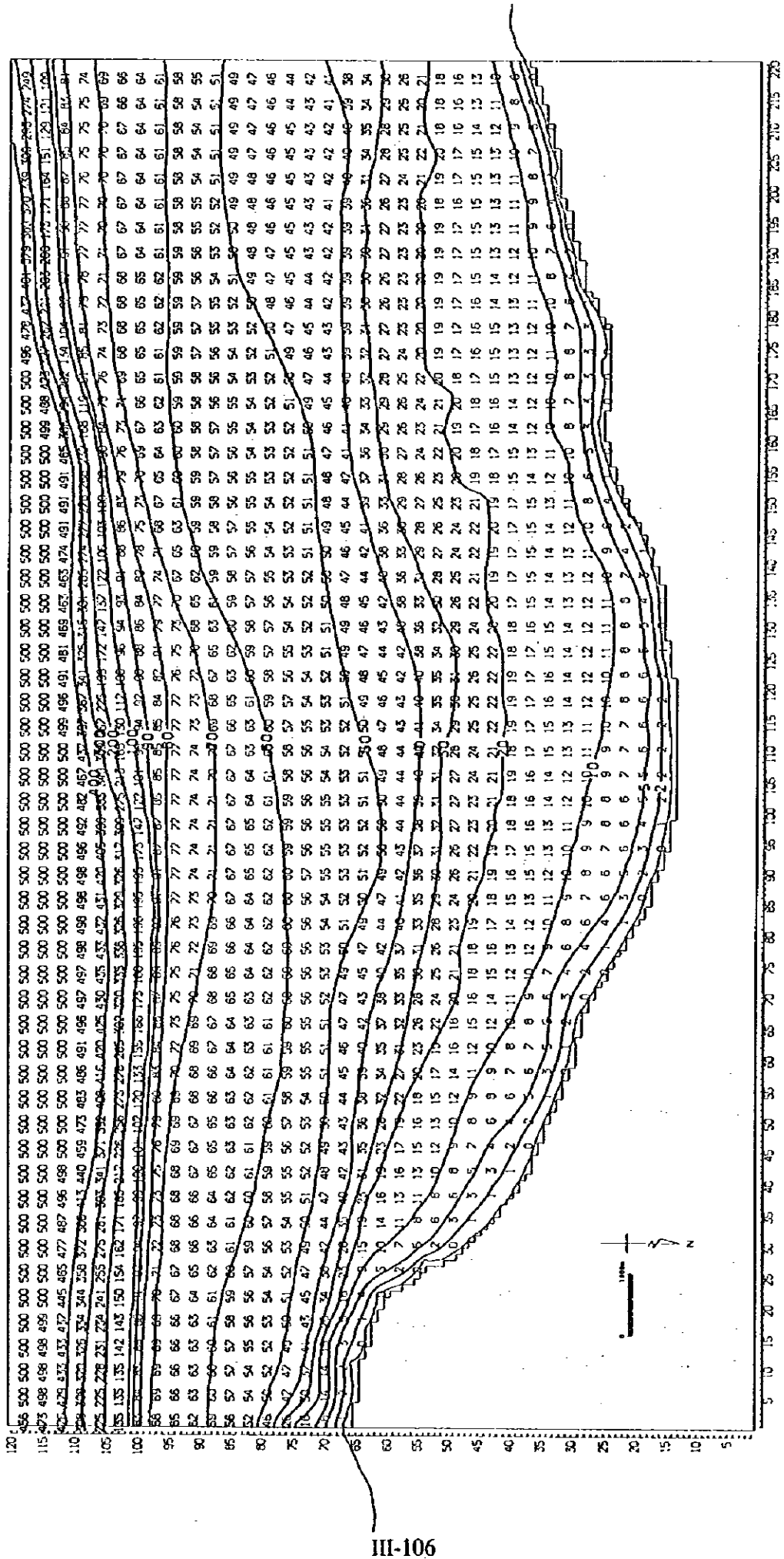

FIGURE 4.3.1 Simulation area and water depth (unit: m)

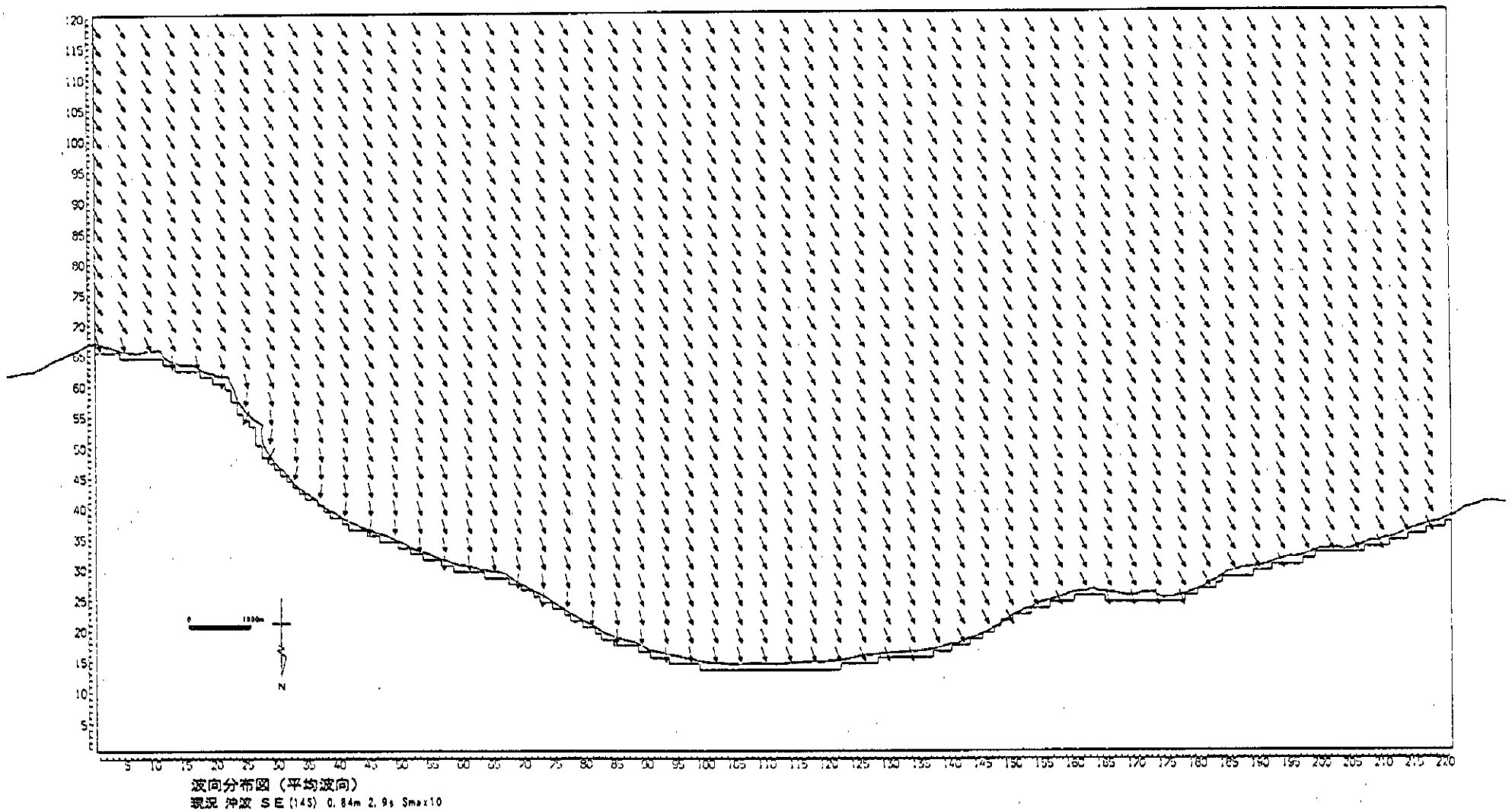

FIGURE 4.3.2 Distribution of wave direction (N145°E)

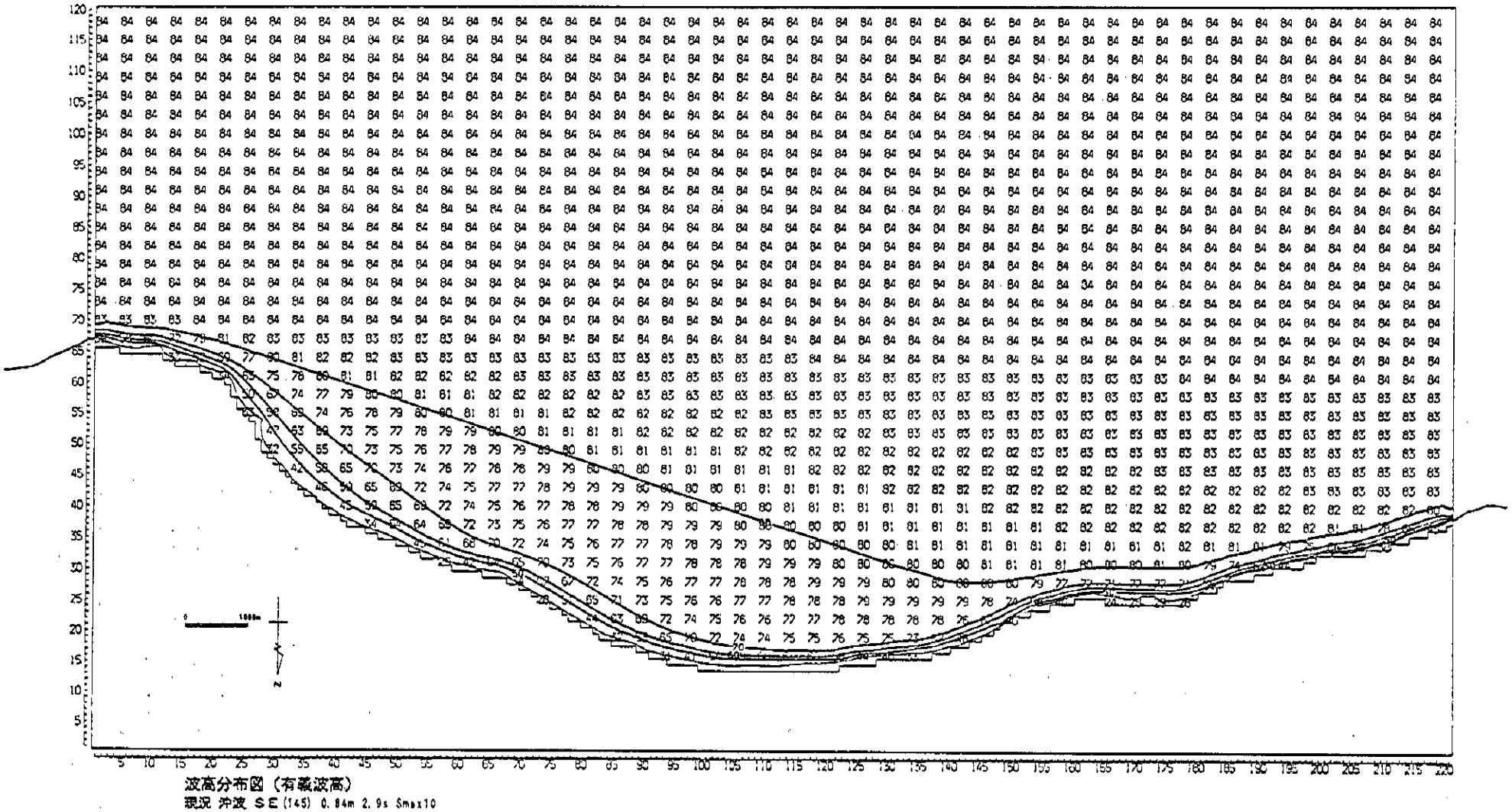

FIGURE 4.3.3 Distribution of significant wave height (N145°E, unit; cm)

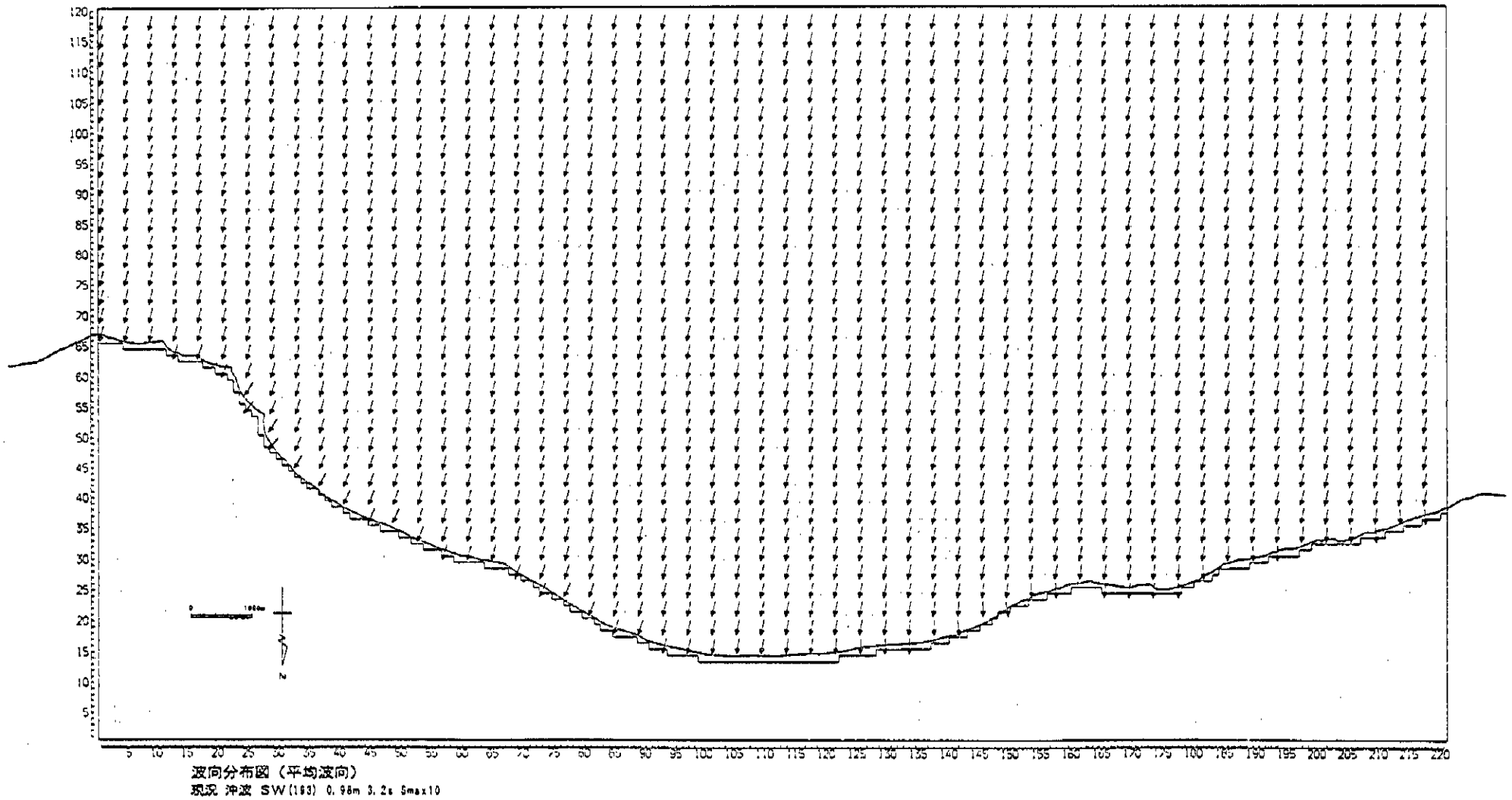

FIGURE 4.3.4 Distribution of wave direction (193°E)

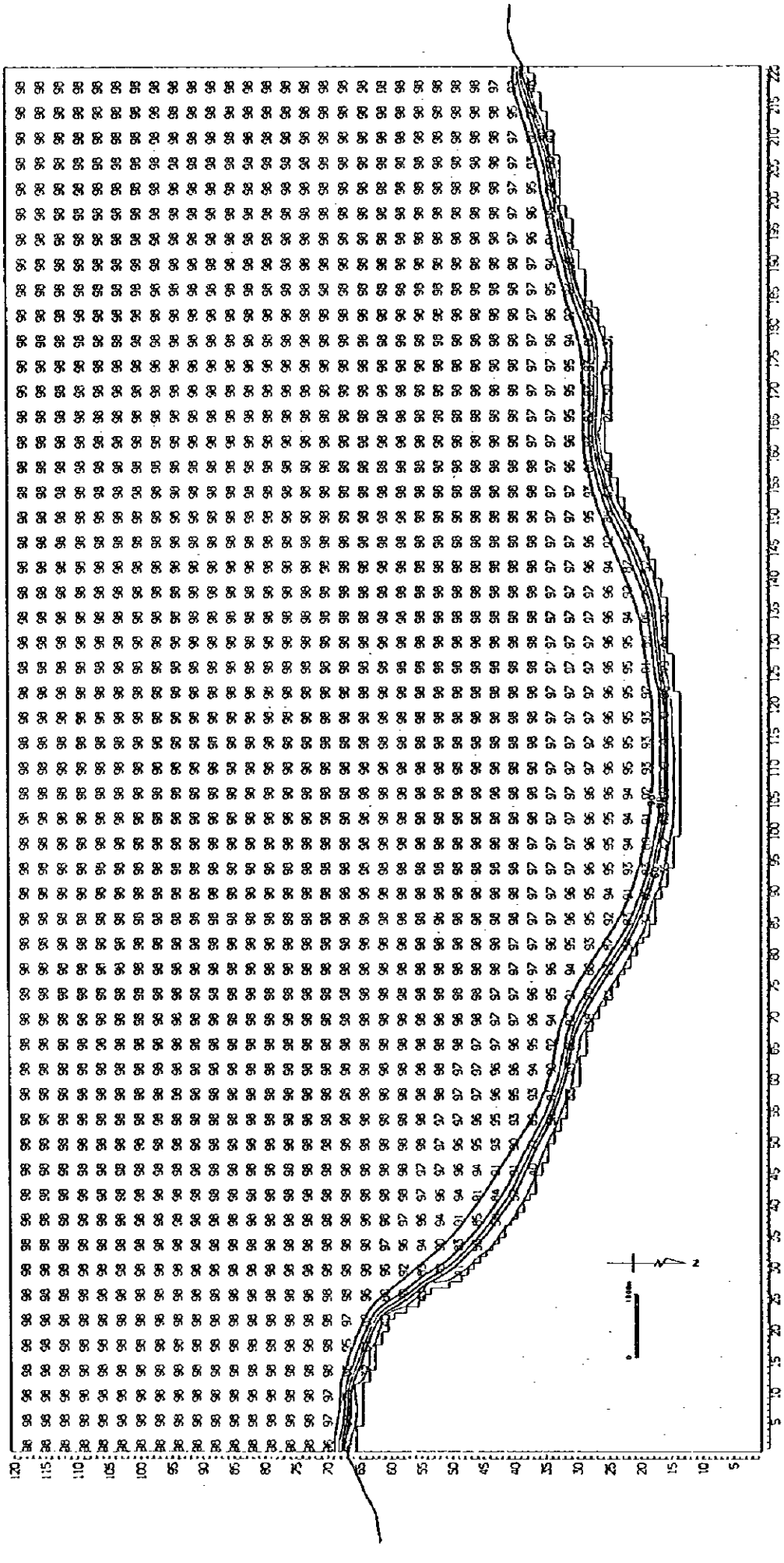

FIGURE 4.3.5 Distribution of significant wave height (193°E, unit; cm)

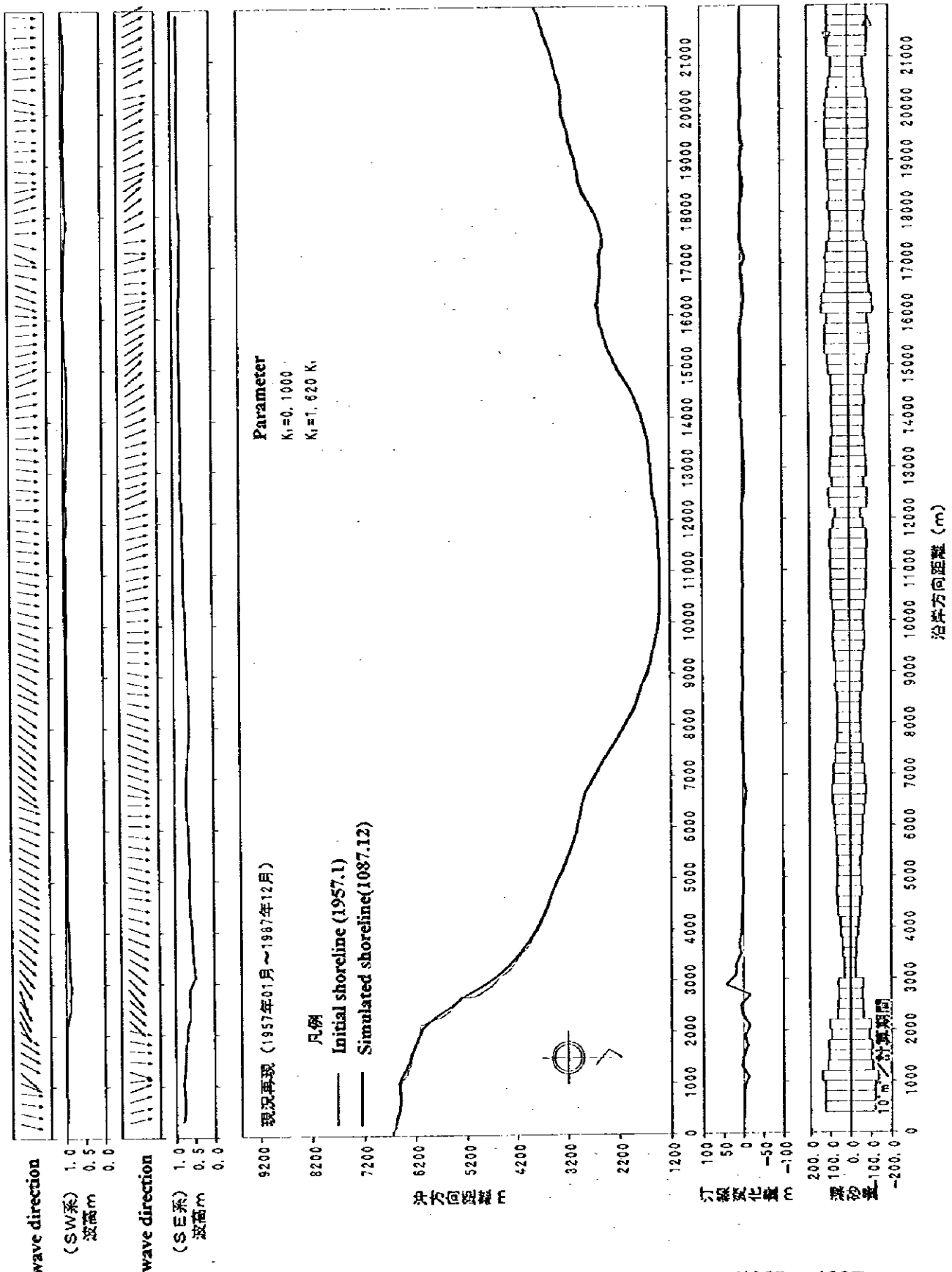

FIGURE 4.3.6 Simulation result of shoreline changes (1957 to 1987)

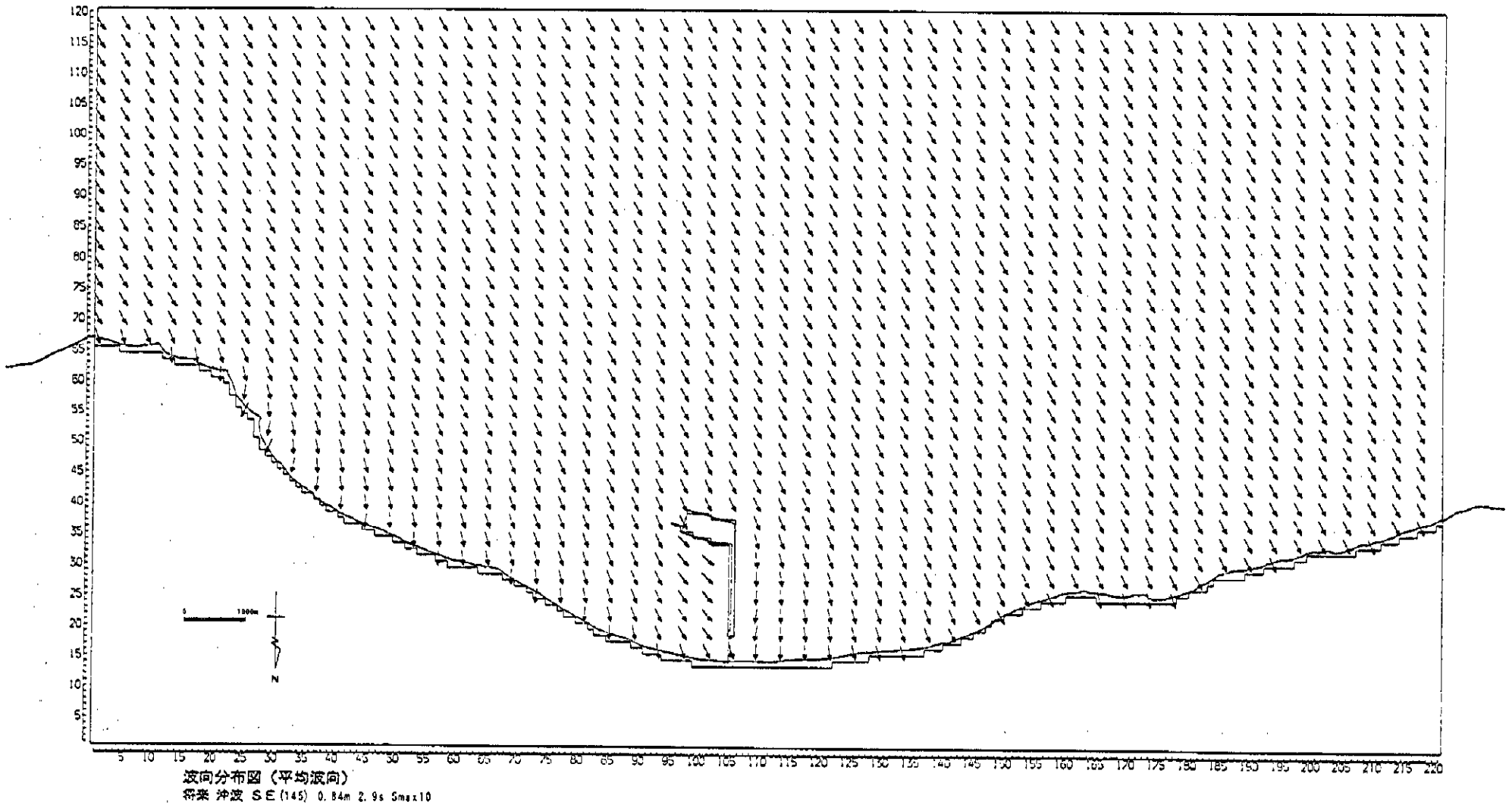

FIGURE 4.3.7 Distribution of wave derection (2005, N145°E)

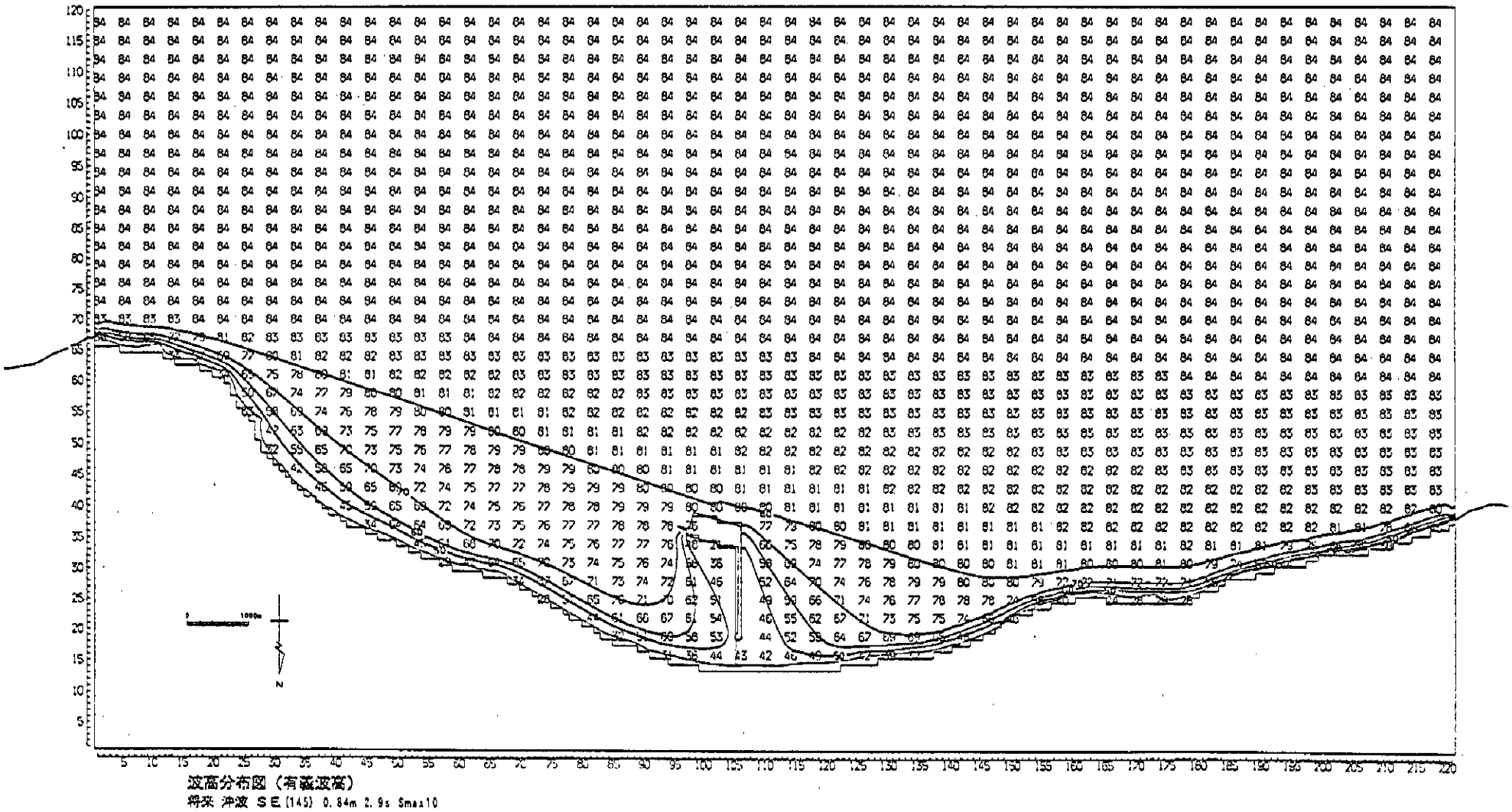

FIGURE 4.3.8 Distribution of significant wave height (2005, N145°E, unit; cm)

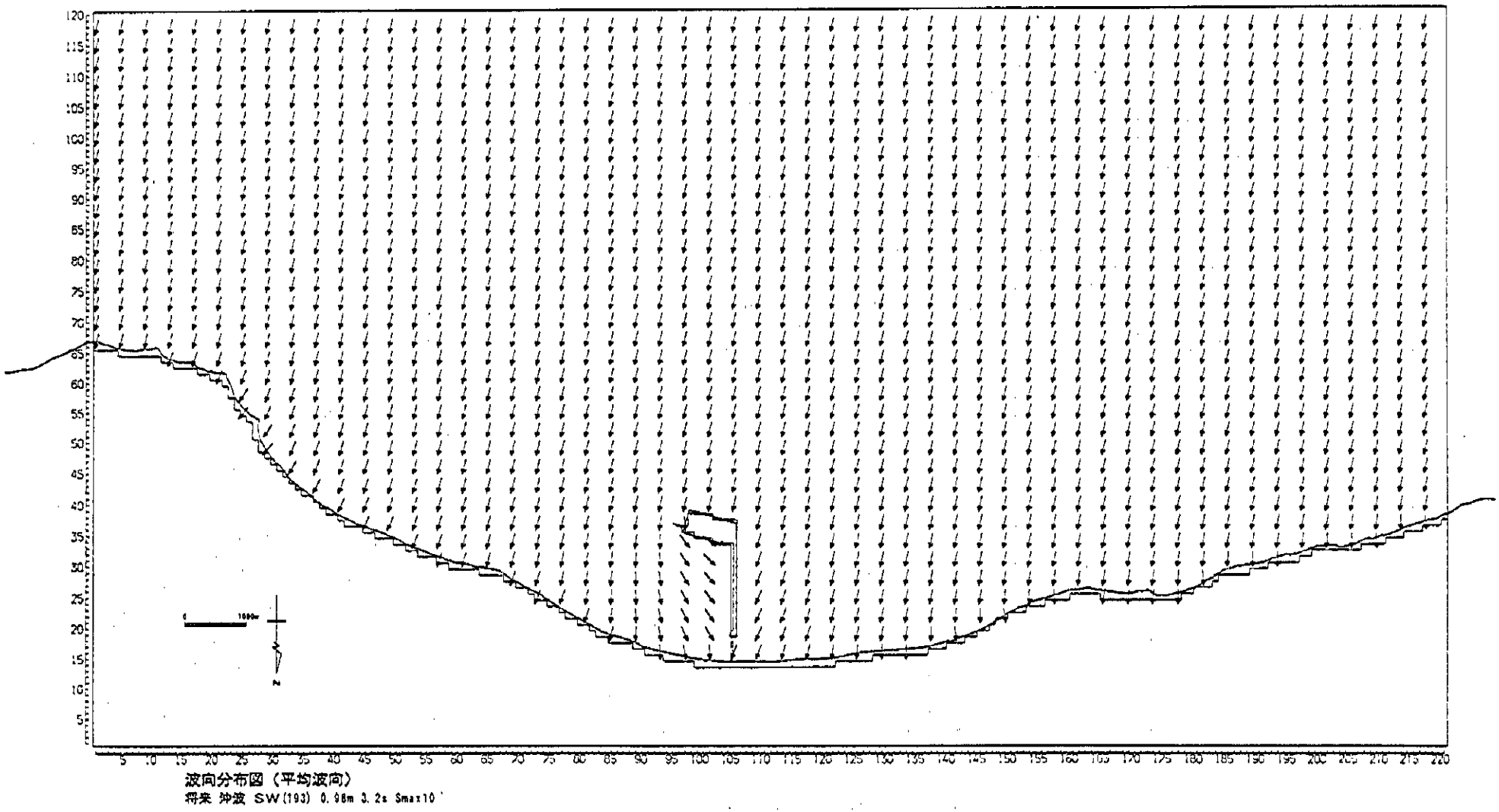

FIGURE 4.3.9 Distribution of wave direction (2005, N193°E)

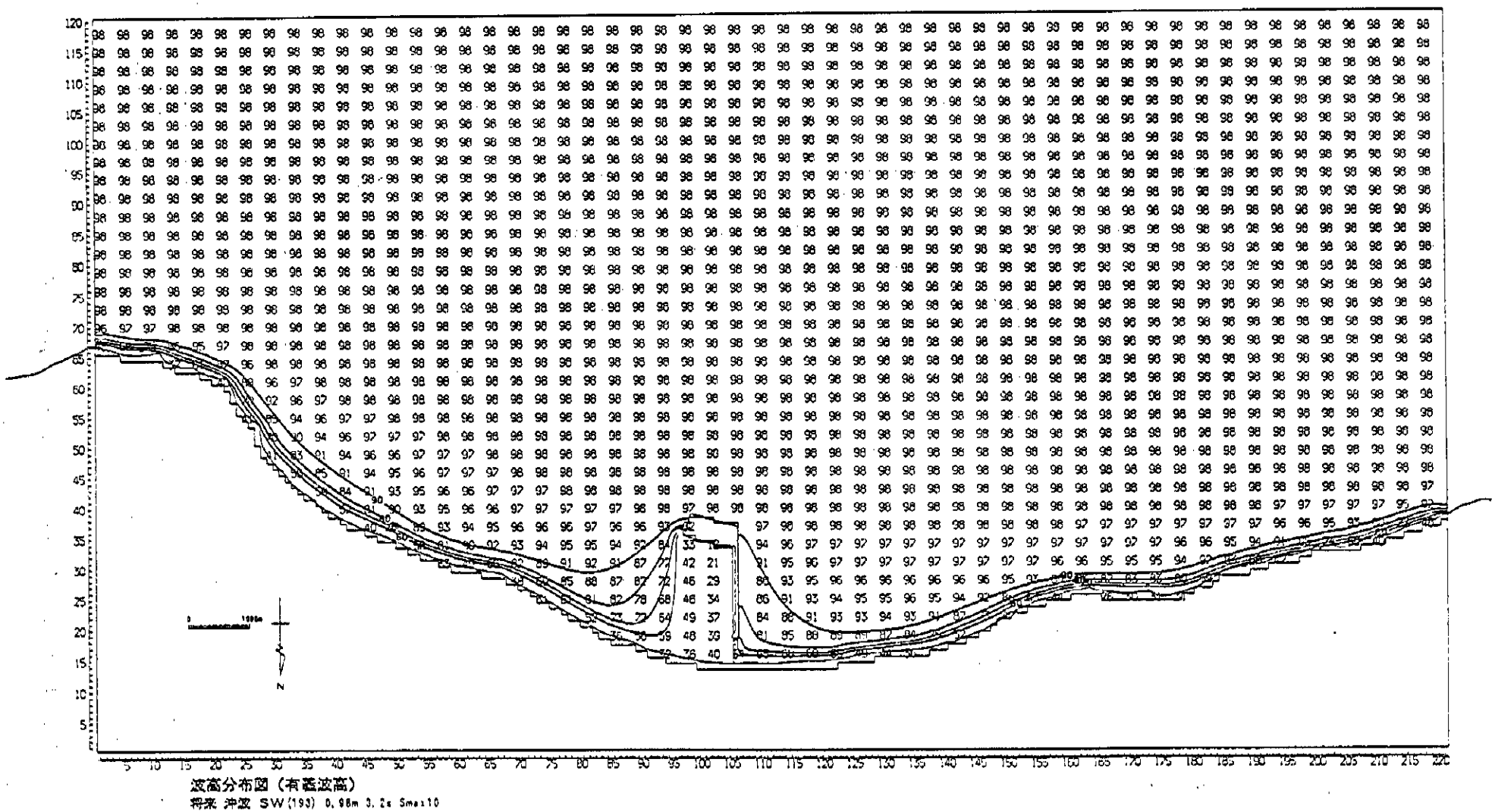

FIGURE 4.3.10 Distribution of significant wave height (2005, N193°E, unit; cm)

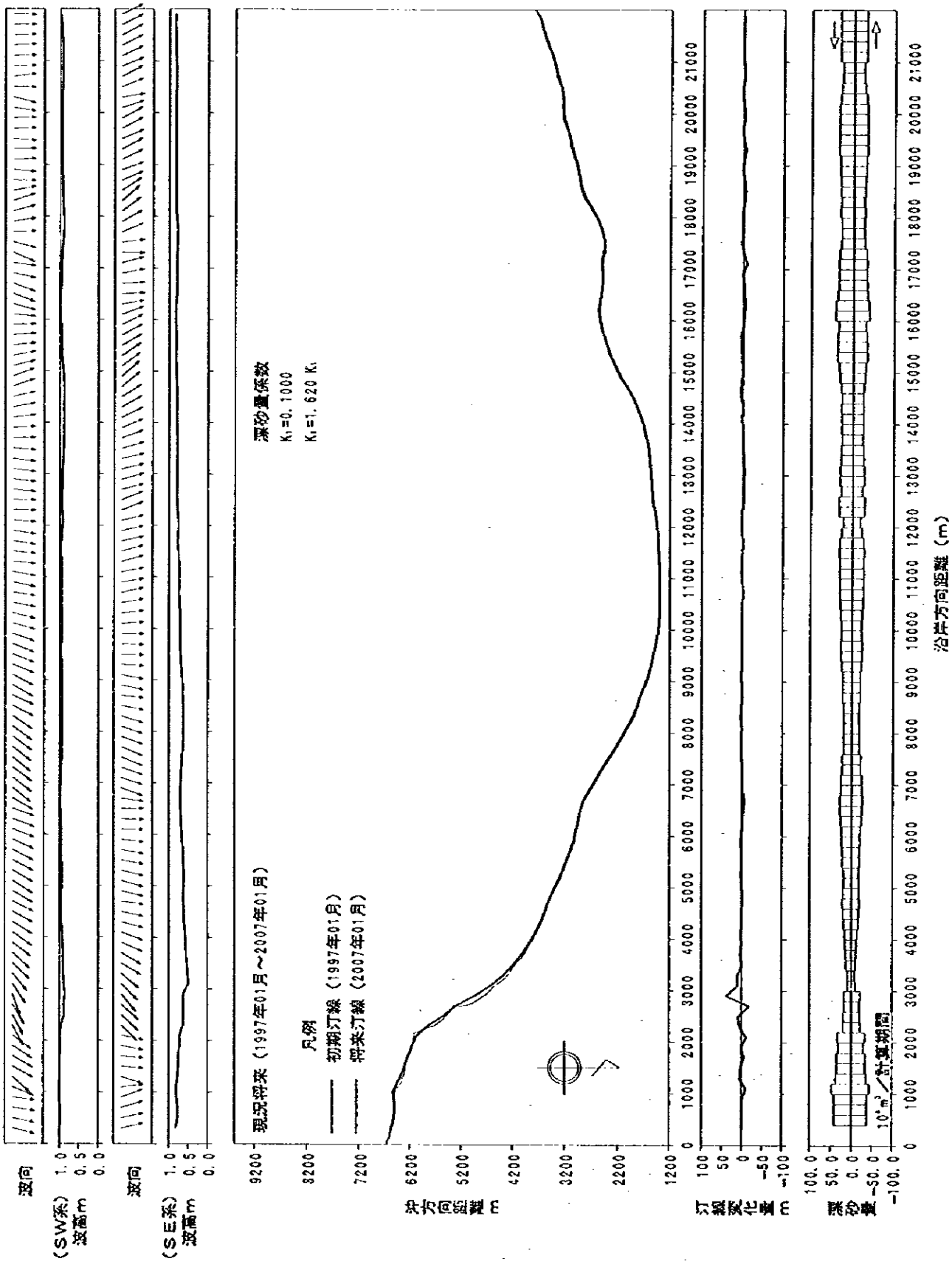

FIGURE 4.3.11 Estimated shoreline (Present geometry)

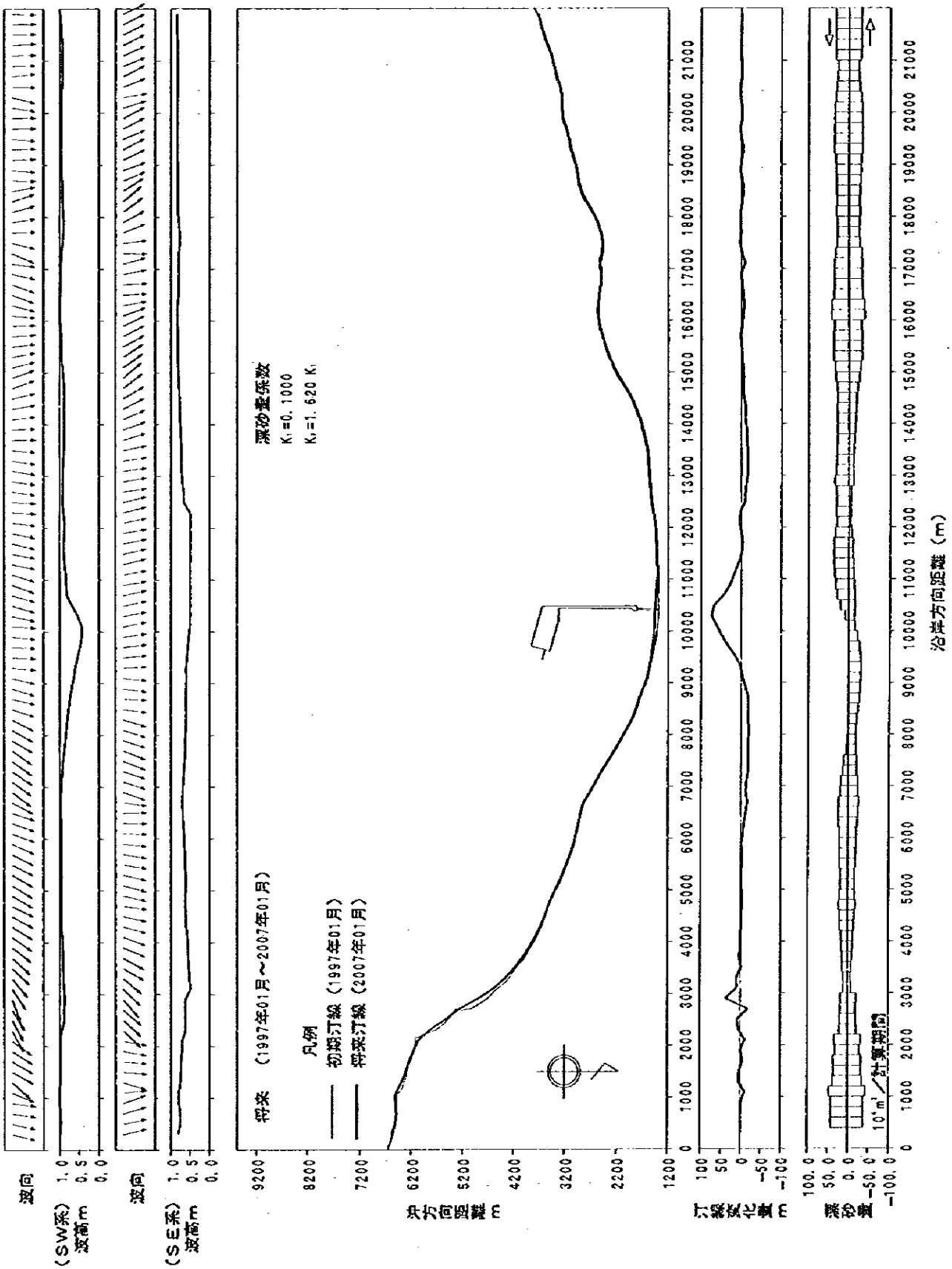

FIGURE 4.3.12 Estimated shoreline (Short-term development plan)

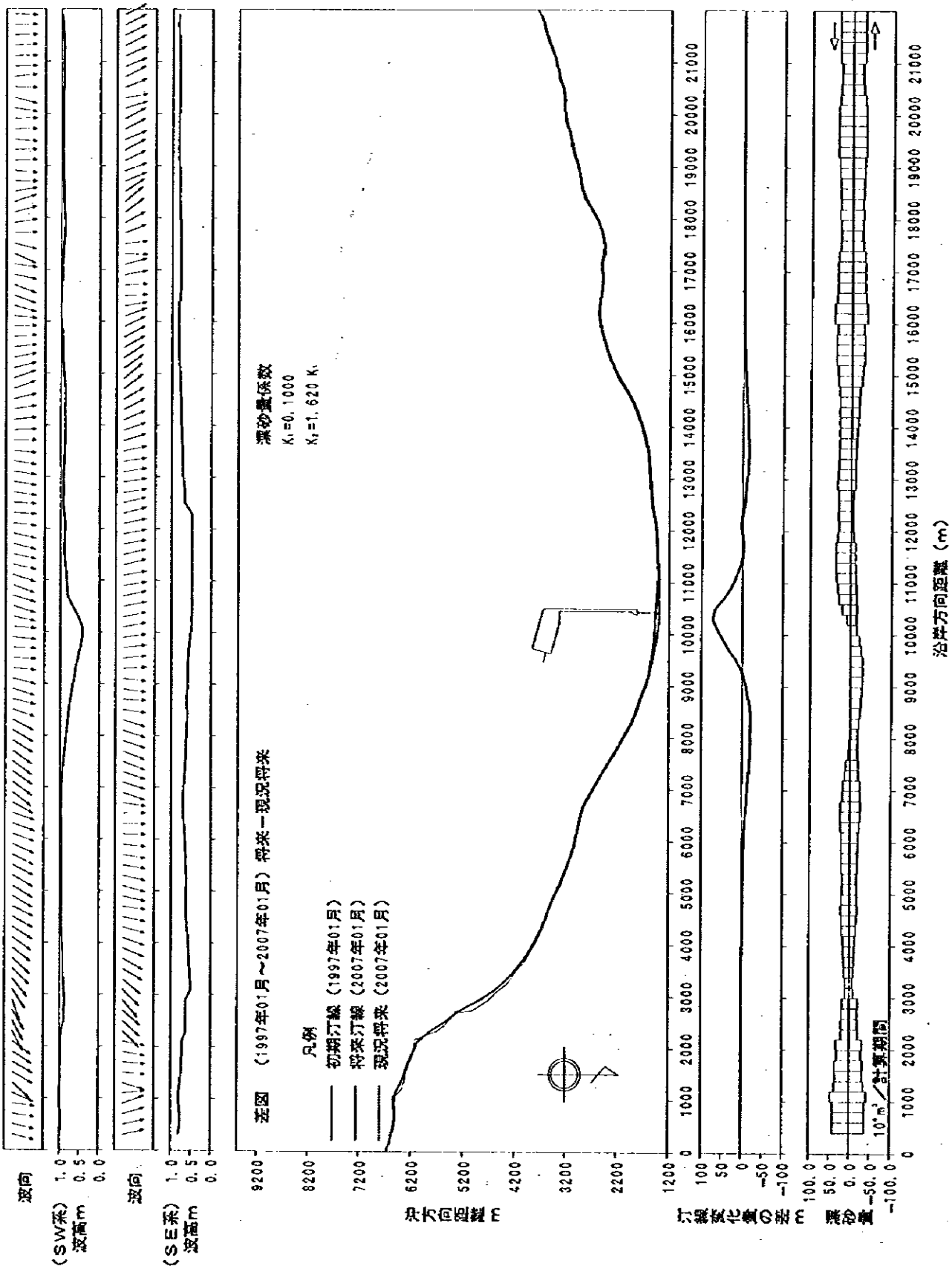

FIGURE 4.3.13 Difference of shoreline changes

4.4 Air Pollution

For the calculations of air pollution concentration, the Gaussian plume model is used. Equation of this model is as follows;

EQUATION 4.4

$$C_{(x,y,z)} = \frac{10^6}{3600 \cdot 2 \cdot \pi} \times \frac{Q}{U_h \sigma_y \sigma_z} \times \exp\left(-\frac{y^2}{2 \cdot \sigma_y^2}\right) \times \left[\exp\left(\frac{-(z-h)^2}{2 \cdot \sigma_z^2}\right) + \exp\left(\frac{-(z+h)^2}{2 \cdot \sigma_z^2}\right)\right]$$

where; $C_{(x,y,z)}$:Concentration of pollutant at the required point (x,y,z), (mg/m^3)

Q :Emission discharge (kg/h)

σ y :Standard deviation of horizontal distribution of plume concentration (m)

σ z :Standard deviation of vertical distribution of plume concentration (m)

x :Downwind distance(m)

y :Crosswind distance(m)

z :Receptor height above ground(m)

U_h :Wind velocity measured at 10m(m/sec)

h :Physical stack height

The air quality parameters, namely ①Suspended particulate, ②Settled particulate, ③Sulfur Oxides, ④Nitrogen Oxides, ⑤Hydrocarbons, ⑥Carbon monoxide were analysed;

In the calculations, heavy duty, diesel powered trucks and the diesel using handling equipment are taken as sources of pollution load in the port. The total number of trucks are 300 veh./hr according to the estimated port oriented traffic volume in 2005. Trucks are also assumed to move a distance of 2 km. within the port area.

There are 47 units of cargo handling equipment according to the estimations for the year 2005. Ten (20%) are assumed to be working at the same time with an average of 300 HP engines.

TABLE 4.4.1 Emission from Traffic in the Port

Polluting Parameter	Emission (g/hr.km)
Particulate Matters	0.75
Sulfur-oxides	1.5
Nitrogen-oxides	21
Hydrocarbons	2.1
Carbon-monoxide	12.7

Source; United States Environmental Protection Agency (USEPA)

TABLE 4.4.2 Emission from Cargo Handling Equipment

Polluting Parameter	Emission (g/HP.hr)
Particulate Matters	0.5
Sulphur-oxides	0.89
Nitrogen-oxides	14.9
Hydrocarbons	0.85
Carbon-monoxide	2.62

Source; USEPA

The coastline in the region extends from East to West. So the effective winds that may cause air pollution in the neighboring settlements must be coming from E, S and W, and the secondary directions in-between. Seasonal dominant wind velocities are used in the calculations. The dominating wind directions are NE during summer, spring and autumn, and NW in winter. The dominating direction that is effective in the area is SE for all seasons. The dominant wind velocity from SE is 2.3 m/s in spring, 2.5 m/s in winter and summer, and 2.4 m/s in autumn.

The concentrations for particulate and gases are calculated at a height of 2 m above ground level and at distances of minimum 100 meters and maximum. 500 meters in the direction of wind and 0 to 100 meters perpendicular to the wind direction.

The vessels are assumed to be using generators for energy while berthing and assumed to be moved by tugboats for mooring and departing, so no gases will be emitted from them. All the pollution is assumed to be coming from a point source.

TABLE 4.4.3 Determination of the pollution load to be used in the model

Pollution	Heavy duty - diesel powered trucks				Cargo handling equipment				Σ
Parameter	Emission (g/veh.km)	No. (veh/hr)	Σ d (km)	Σ (kg/hr)	Emission (g/HP.hr)	HP	No. eqp.	Σ (kg/hr)	total (kg/hr)
Particulate Matter	0.75	300	2	0.45	0.5	300	10	1.5	1.95
Sulfur-oxides	1.5	300	2	0.9	0.89	300	10	2.67	3.57
Nitrogen-oxides	21	300	2	12.6	14.9	300	10	44.7	57.3
Hydrocarbons	2.1	300	2	1.26	0.85	300	10	2.55	3.81
Carbon-monoxide	12.7	300	2	7.62	2.62	300	10	7.86	15.48

The Turkish Air Quality Control Regulation defines two different categories of ambient air quality standards for suspended /settled particulate matters, sulfur-oxides, nitrogen-oxides, hydrocarbons and carbon-monoxide, namely long-term and short-term standards. The long - term standard (LTS) refers to the yearly arithmetic average at a measurement point. In terms of short - term standards (STS), which are more relevant for the results of dispersion modeling, the Air Quality Control Regulation defines the limit values as in the table below. In that table, the concentrations of particulate and gases at (100, 0, 2) to (500, 0, 2) in winter are also given for comparison.

TABLE 4.4.4 Result of Air Pollution Calculation (Winter, 2 m in height)

Pollution Parameter	STS ($\mu g/m^3$)	Ci($\mu g/m^3$) (100, 0, 2)	Ci($\mu g/m^3$) (200, 0, 2)	Ci($\mu g/m^3$) (300, 0, 2)	Ci($\mu g/m^3$) (400, 0, 2)	Ci($\mu g/m^3$) (500, 0, 2)
Suspended Particulate	300	735	250	132	84	77
Settled Particulate	650	125	31	13	7	4
Sulfur-oxides	400	350	119	63	40	36
Nitrogen-oxides	600 (NO)	5613	1911	1010	641	586
Hydrocarbons	140	373	127	67	43	39
Carbon-monoxide	30000	1516	516	273	173	158

As seen in the results, for short term standards suspended particulate are above the limit at (100, 0), hydrocarbons at (100, 0) and nitrogen-oxides till (500, 0). The port area is 1.5 km away from the nearest settlement. So the decreasing trend in the concentrations show that it will not have any effect in the residential areas although there exists a level of pollution already. For the working areas closest to the sources,

workers can use filters, but it must not be disregarded that for the calculations all the emission is assumed to be coming from a single point source. In fact the conditions will be on the safe side as this total emission will be discharged from a wide area, but not from a point source.

As for the big settlement areas like Marmara Ereglisi, Çorlu or Tekirdag, the port will not have any air pollution impact.

4.5 Impacts on Marine & Aquatic Species

Dredging and filling works will be carried out in the site for the construction of breakwaters, berthing facilities and wharf structures. An area of approximately 450,000 square meters will be filled for port construction. Some areas in front of berthing facilities will be dredged down to the required depth by cutter suction dredger. Dredged material and rock/gravel from quarry sites will be used for filling of reclamation area.

Large scale dredging is a widespread physical alteration to marine ecosystems. Its effects include the alteration of bottom topography, the destruction of biota and their habitat, and massive sediment resuspension. Suspended sediments, particularly fine silts and clays, can smother marine organisms by clogging their respiratory and feeding organs, take up oxygen and reduce light available for photosynthesis. Upon settling, these sediments can bury benthic organisms, and render hard substrates unsuitable for colonization. Nutrients trapped in filling sediments may cause eutrophication, a biological process initiated by excessive nutrient enrichment.

There will be inevitable potential impacts during the construction period. Impacts related to dredging and filling works depend on the nature of material and the volume to be dredged and filled and the sensitivity of the habitat. Land reclamation will result in loss of habitat in filling sites. Dredging activity will similarly bring negative effects. Suspended sediment levels during dredging may force adult fish to vacate the area.

However, those impacts are local and temporary. The construction area has no spawning and nursery property for fish species and commercial shellfish beds are quite far from the site. Shortly after dredging and filling is completed, turbidity should decrease to normal levels. Loss of benthic invertebrate habitat during construction period is also to be temporary and of short duration. Benthic re-colonization should be quite rapid and occur within a few years after construction. At the time of filling and dredging, planktonic organism such as larvae may experience slightly increased mortality rates due to adverse conditions. Sand-gravel and small size stone bottom composition of the area and small current velocity around the site will not result in much turbidity in dredging. Filling material which will come from the quarry site close to the area is free from toxic and biological properties which means there will be no impact on water quality.

During the construction period, to keep turbidity in control and prevent filling materials from drifting by waves and currents, cofferdams and spillway will be used around the reclamation work area. Construction area does not lie on shellfish beds and is not an attractive spot for pelagic fish schools in migration season due to the shallow water depth. Therefore, port construction will not effect fishery activities.

After construction, though stagnant water will be a concern around the basin, this will not cause eutrophication since there will not be an excess nutrient loading resulting from port operations. Marine traffic will not effect fishery activities due to the fact that there won't be any waiting ship out of harbour. This is a major problem for other port areas in the Sea of Marmara.

After completion of breakwater and revetments construction, these facilities themselves will behave like an artificial reef hosting many different species of fish and invertebrate, because of the gentle slope type rubble mound structure.

Thus, potential effects related to the port construction and operation are considered as local impacts. In addition, the adverse conditions associated with marine construction works are also considered to be temporary and reversible.

4.6 Dust Emitting Works

During the construction stage of the short-term development plan, different dust emission sources including reclamation, excavation, temporary unpaved roads, concrete batching plant and temporary storage of filling earthen material will pose a potential problem.

However, since the reclamation works, a potentially major source of dust, will take place 2 km offshore for container yard and 0.5 km offshore for small vessel wharf, no impact is expected. Other dust emissions will be contained within the vicinity of the site itself during construction and with application of proper mitigation measure such as hosing the immediate vicinity of the area, the effect of dust on the environment during construction should remain at acceptable levels.

No dust emission source is estimated during operation of container terminal.

4.7 Fuel Emissions

Heavy machinery such as bulldozers, mobile cranes, pneumatic drills, air compressors, trucks, dredger, floating construction plant, tugboats will be used in construction activities. The type of fuel used by this construction machinery will be diesel. In addition, smaller site vehicles will consume gasoline. The daily diesel consumption of the construction equipment will be provided from oil tank lorries. Gasoline will be obtained from local gas stations. Gasoline consumption is expected to be significantly less than the diesel consumption.

The operating principles of diesel engines are significantly different than those of gasoline engines. In comparison with uncontrolled conventional gasoline-powered engines, diesel engines emit considerably less carbon monoxide (CO) and hydrocarbons (HC); but, more nitrogen oxides (NO_x) and suspended particulate matter (SPM).

In light of the emission factors presented above, air emissions of the construction equipment are less than the emissions encountered on a typical highway of moderate traffic load. In this regard, no significant air quality impacts are expected due to small amount of heavy-duty vehicles operating during the construction It should also be noted that emissions of both construction machinery during the construction stage will be temporary.

Fuel will be used for heating in the activity units and other units. The characteristics of the fuel to be used in heating (Number 4 fuel oil) are described below:

TABLE 4.7.1 Number 4 Fuel Oil Characteristics

Flaming Point (°C)	65
Yield Point (°C)	-6
Water and deposit (%)	0.5
Ash (%)	0.1
Distillation Temperature °C (minimum)	240
Distillation Temperature °C (maximum)	360
Viscosity 38° C. (sec).	45
Density (relative to water 15°C)	0.90

TABLE 4.7.2 COMPONENTS

Carbon (%)	86
Hydrogen (%)	12
Sulphur (%)	1.2
Other (%)	0.9

The combustion emissions will provide the limitations stated in "Conservation of Air Quality Regulations" on the condition that the heating will be done in accordance with the suitable technique and equipment. The limitations stated in the Regulations are as follows:

Sootiness, Baccarat scale ≤ 3
Carbonmonoxide (3% O_2) mg/m³ ≤175 (0.9 kg/hour)
Sulphurdioxide (3% O_2) mg/m³ ≤1700 (15.3 kg/hour)

The emission measurements will be done by official institutions. Emissions from vessel traffic during operation stage will not have adverse affects, since berthing activities of container vessels will be handled by tugboats and only generators will be in operation while they are berthing in the port.

4.8 Transport, Use and Storage of Fuels

During the construction of port, mainly conventional construction materials and equipment will be transported, stored and used. In terms of shipment and handling of such dangerous materials as gasoline, diesel fuel, fuel-oil, hydraulic oil, welding gases and other chemically active agents, paints and solvents, related providers and transporters will carry out fully all necessary safety and security measures.

Machine fuels, hydraulic oils and solvents are flammable. However, they present no unusual hazard to either workers or the environment when properly transported, stored and used.

It is concluded that potential environmental impacts and risks associated with transportation, on-site storage and handling of various fuels, gases and chemicals during construction can be minimized by complying with the relevant legislation and implementing good housekeeping practices. Under these circumstances, no related adverse

impacts are expected during the construction stage of the port.

4.9 Noise and Vibration

The noise assessment involves identifying the major sound sources during construction and operation. The noise emitted by construction is the combination of dredging, reclamation, heavy machinery, construction traffic and other individual sources located in the construction site.

TABLE 4.9.1 Noise Level of Construction Equipment

Equipment	Noise Level (dB)			Noise Level 15 m. away		
	Low	Medium	High	Low	Medium	High
Excavator	105	120	130	70	85	95
Compressor	110	115	120	75	80	85
Concrete mixer	110	115	125	75	80	90
Concrete Pump	110	115	120	75	80	85
Mobile crane	110	115	120	75	80	85
Fixed crane	115	120	125	80	85	90
Loader	105	115	120	70	80	85
Stable generator	105	110	120	70	75	85
Striking Hammer	115	125	135	80	90	100
Lifter	115	120	125	80	85	90
Pile driver	130	135	140	95	100	105
Pneumatic Key	115	120	125	80	85	90
Pump	100	105	110	65	70	75
Rock driller	115	125	135	80	90	100
Scraper	115	120	130	80	85	95
Tractor	110	120	130	75	85	95
Truck	115	120	130	80	85	95

Source: Irwin and Gref, 1979

The noise levels during the construction stage will be within the limits stipulated in the Noise Control Regulation, which are 70 dBA for continuous noise during building constructions and 100 dBA for impulsive noise during daytime construction, measured 1 m from the closest residential area. During the construction

of access roads, the noise standard of 75 dBA will be also applied. As far as the machinery to be used is concerned, no vibration is expected outside the construction boundary.

The dosage of noise that the workers can be exposed to during an 8 hour shift is stated to be 80 dBA in the Regulations. In order not to damage the sense of hearing of the workers, earflaps or earplugs will be provided.

TABLE 4.9.2 Work Gear and Equipment Upper Noise Levels

EQUIPMENT	NOISE LEVEL LEQ. (dBA)
CRAWLER SKIP 60-67 kw	110
BULLDOZER	120
EXCAVATOR	105
CONCRETE BREAKER	110
CRAWLER CRANE	105
VIBRATING CYLINDER	110
CONCRETE MIXER	115
CONCRETE PUMP	115
GRADER	120
ROCK DRILLER	125
COMPRESSOR	115
TRACTOR	120
LOADER	115
ELECTRIC MOTORS (300 Hg, 1200 rev/min)	105
PUMPS (300 Hp, 1600 rev/min)	120

Source: Noise Control Regulations

TABLE 4.9.3 Duration to meet the noise level

Time (hrs / day)	Upper Noise Level (dBA)
7.5	80
4	90
2	95
1	100
0.5	105
0.25	110
1/8	115

Source: Noise Control Regulation

As sound energy travels from source to receiver, the sound level decreases as a

result of divergence with distance and natural absorption of acoustic energy. Sound level reduction is a result of natural absorption of acoustic energy by atmosphere, terrain and vegetation. The temporary impact from noise created by construction is important mainly for residential areas. Summer houses and recreational facilities are located on the east side of the construction area. Atmospheric absorption and terrain effects are not significant for the port area due to the proximity of nearby summer houses located on a higher plain. Vegetation absorption is also negligible because the field between port side and houses is mostly barren land.

The houses generally are used during the summer season and there are no residential areas in other directions. The closest summer house development complex is located more than 1500 meters away from proposed port construction site. It is estimated that noise level will not exceed critical levels given by standards thanks to the sufficient distance between sources and residential area.

The noise sources in the harbour in operation stage can be classified as follows;

(1)The noise during the movement of the cranes
(2)The traffic noise
(3)The noise of the sea vehicles
(4)Harbour noises

The noise levels of the cranes working during the loading-unloading are expected to be 110 dBA. This high level of noise is a result of the horizontal movement of the crane.

While storing the load in the back and removing it from the harbour, there will be an intense truck traffic. The noise level out of this traffic is assumed to be 120 dB. The permanent noise level is expected to be 80 dBA 20 m. from the vehicles.

The workers in that area (especially those outdoors) should use earflaps in order to protect themselves. Also rubber wedges can be fixed to the movable parts of the cranes so that the noise level will be decreased at least 20 dBA. It is assumed that permanent noise level within the port area borders will not exceed the equivalent limits envisaged by Noise Control Regulations for the industries

Also the noise of the ships that anchor and discharge in the harbour and of the vehicles that lead them to the harbour will affect the area. However, the level of noise produced by these can be overwhelmed by other noises. Only while anchoring, they create a particular interval noise.

The noise of the workers in the harbour is rather lower than the other noises, as they are overwhelmed by louder noises.

The area where the establishment will be made is outside the centre of population. However, by the enlargement of the establishment, there will be an increase in the traffic noise from the main road.

The noise caused by the trucks when compared to new road surface can be assumed to reduce wheel road noises at a greater level. Improving the road surface to a better quality will also result in a decrease in the noise level.

TABLE 4.9.4 Equivalent Noise Levels for Industry

Level of Noise	Leq dBA	
Type of Noise	Morning (0600-2200)	Evening (2200-0600)
Permanent Industry Noise	65	55
Momentary Industry Noise	70	60

However, noise level will be much less than in construction period and plant, silencers, improved road and transportation structure will reduce noise impacts. Anyhow, every effort will be made to restrict noisy activities to working hours when ambient noise levels are higher and the impact will be less obtrusive.

4.10 Social Infrastructure for Construction Workers

It is expected that the majority of the construction workers will be local residents. A temporary dormitory will be built at the site for migrant workers from other areas. Limited kitchen type facilities as well as parking space for private vehicles of the workers will also be provided. It will be made certain that the sanitation needs of the construction workers will be provided adequately. Further, housing requirements of certain construction personnel may be accommodated through rental housing in Tekirdag, Çorlu or through various summer houses available in the vicinity of the site.

No significant impacts are anticipated due to the on-site accommodation of the construction workers. However, the incremental demand of the non-resident construction workers for social and technical infrastructure services (education, health-care, security, communications, etc.) may create negative short-term impacts over the construction stage.

4.11 Hazards for Health and Environment

During the construction stage of the port, the risks posed to human health and safety are those typically associated with major construction works. In this regard, DLH and its contractor will use knowledge, experience and established safety procedures to ensure that the site is safe for all employees in terms of safety of excavations, scaffolding, access platforms, and heavy machinery such as cranes.

During operation, the risks are similar to those found in other safety operating container ports throughout the world.

4.12 Landscape Activities

After the completion of the construction work, appropriate planting will be provided within the port boundaries by taking natural landscape and vegetation into account. Planting will consist of mainly trees and other indigenous species. Landscaping details will be worked out prior to the start of operation. The purpose of the landscaping program is not only to provide visual screening of the project facilities, but also to create a pleasant surrounding for the operation.

4.13 Visual Impacts

Visual impacts consist of two primary components; the physical change in the visual resource and the response of the viewer to that change. Changes in the visual resource would include alterations to both the character and the quality of the resource. A change in character refers to inconsistency with existing architectural style and land use; on the other hand, a change in quality implies impairment of existing viewscapes or lines-of-sight. Viewer response depends upon exposure, which is determined by the line-of-sight, distance and number of viewers.

The proposed site is bordered on the west by coastal lands, much further small residential areas and then Tekirdag province, on the east by summer houses development, on the south by the Sea of Marmara, and on the north by agricultural and barren lands and small residential developments. Potential visual impacts resulting from the proposed port are based on the analysis of potentially sensitive viewshed receptors. These receptors represent view-sheds occurring in nearby summer houses that have a line-of-sight to the proposed port area.

The function and thus the visual characteristics of the proposed port will be industrial in nature. Comparison to the areas around proposed port will display a significantly different view, and thus, will not be consistent with the current landuse patterns of these areas. However, in land use plans, the area is already planned to be a military port area.

Offshore breakwaters, berthing facilities, gantry cranes and container storage areas will cause significant inconsistency with the existing character of the area. Administrative and social facilities, on the other hand, will occupy a considerably smaller section of the land area and much less visual impact. In addition, the land facility design will involve extensive vegetative landscaping to minimize potential visual impacts.

Although the proposed port will be in the line-of-sight of these summer houses; however, since the proposed port will be located to the west of these houses, it will not block the scenic view of the Sea of Marmara. To the west of the proposed port, open land and Istanbul Highway is located. Thus, there will be no significant impact at the west side.

Overall, the proposed port will have a visual impact only on the receptors located to the east of the project site. This visual impact, however, will be mitigated significantly with proper landscaping and screening.

4.14 Impact on Recreational Areas

There are no national parks, natural preservation areas or lands in the immediate vicinity of the proposed site. Thus, the proposed port will not create any adverse impact on such areas.

The recreational activities, such as swimming and water-sports, are quite common during the summer months. Since the proposed port will be located about 1500 m away from the summer houses, it will not create an adverse impact on the coast line to the east of the project site. In the same way, the port will not create an additional adverse impact on the west coastline. Since there will be no discharge from either port facilities or vessels, there will not be an adverse impact on surrounding beaches.

4.15 Solid Wastes

Solid wastes will be generated associated with excavations and dredging as well as their utilization. The domestic wastes generated by the construction workers and other construction wastes such as various containers, packaging material and scrap metals will be disposed of properly at a site designated by the local authorities.

During certain stages of the construction stage of the proposed port, domestic solid waste generation may increase due to the expansion of the construction work force. This may create a slight burden on local solid waste disposal sites temporarily. The disposal of the domestic wastes of workers over the construction period may create minor adverse impacts on the existing local infrastructure.

In operation stage, solid waste output will be much less and easily handled by local infrastructure.

4.16 Water Supply and Wastewater

Water supply the during construction stage will be obtained from existing municipal water supply. The construction of water supply line is not expected to create any significant adverse impacts. In addition, the amount needed will not bring any severe burden on the existing municipal water supply.

During construction stage, temporary collection system will be arranged to handle construction wastewater. Proper care will be taken to avoid the sewage resulting from the presence of the labor force on the unserviced construction site creating public health problems and environmental pollution. Sewage generated at the site will be contained in a holding tank and then dumped to a site approved by local authorities. Thus, no adverse impacts are expected due to the disposal of construction wastewater.

There will be collection systems for storm water and wastewater of land facilities. Ditches will be constructed along the site roads to collect storm water and they will discharge into the existing drainage system at the site boundary. The storm water drainage collected from the buildings will be discharged into the Sea of Marmara.

As part of civil construction works, construction of the storm and wastewater collection systems will not have adverse impacts. No adverse impact is anticipated in terms of water quality in the near field marine environment due from discharge of collected runoff either.

4.17 Electrification

The port will be connected to the existing TEDAS grid system nearest to Tekirdag province. TEDAS will have the responsibility of routing of the power transmission lines. The construction of the electrification system is not expected to have an adverse affect on the residential areas.

4.18 Groundwater Impacts

As far as the port area is concerned, there is no groundwater usage or groundwater supplies nearby. In addition, there will be no discharge from port facilities that may seep and contaminate groundwater zone. All surface runoff is collected by stormwater systems and discharged to the Sea of Marmara.

Thus, there will be no adverse impact on groundwater resulting from port activities.

APPENDIX 1

DATA GENERATED IN THE AIR QUALITY SURVEY

Site - 1

In - Situ Measurements

Date	Units	February 28	February 28	March 1	March 1	March 1	March 1	March 2	March 2
Time		18:00	24:00	06:00	12:00	18:00	24:00	06:00	12:00
Wind Direction.		NNE	NNE	NNE	NE	NNE	NNE	NNW	NE
Wind Speed	($m\ s^{-1}$)	5.6	5.8	1.8	8.9	2.9	1.8	1.5	5.3
Temperature	(°C)	6.1	6.0	3.5	8.7	3.4	3.3	1.6	8.5
Solar Flux	($cal\ cm^{-2}\ min^{-1}$)	0	0	6.3	54.5	0	0	3.5	43.2
Cloud cover	(8/8)	8.0	8.0	2.0	0.0	0.0	0.0	5.5	5.0
SO_2	($\mu g\ m^{-3}$)	8.9	12.4	4.4	3.3	3.0	16.0	13.1	4.4
CO	($\mu g\ m^{-3}$)	100	73	817	613	612	502	844	140
NO_2	($\mu g\ m^{-3}$)	29	6.2	28	28	100	78	35	91
NO	($\mu g\ m^{-3}$)	3.3	1.4	9.0	17	2.6	14	15	3.2
O_3	($\mu g\ m^{-3}$)	61	79	62	82	73	70	67	84
Cl_2	($\mu g\ m^{-3}$)	54.5	43.3	11.9	80.8	13.1	0.8	9.0	43.1
HC	($\mu g\ m^{-3}$)	2.7	.52	2.6	3.1	2.3	1.3	1.8	1.1
F^-	($\mu g\ m^{-3}$)	0.039	0.021	0.018	0.029	0.021	0.025	0.029	0.003
Cl^-	($\mu g\ m^{-3}$)	1.6	1.7	1.2	0.9	1.0	0.6	2.0	0.7
HCl	($\mu g\ m^{-3}$)	0.28	0.17	0.31	0.14	1.94	0.68	0.06	0.05
HF	($\mu g\ m^{-3}$)	4.9	1.3	0.2	2.1	0.1	2.7	4.8	0.1
H_2S	($\mu g\ m^{-3}$)	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim

Site - 1
Suspended particles (<10 um)

Date	Units	February 28	February 28	March 1	March 1	March 1	March 1	March 2	March 2
Time		18:00	24:00	06:00	12:00	18:00	24:00	06:00	12:00
Mass	($\mu g\ m^{-3}$)	21	18	32	38	21	19	17	28
Pb	($\mu g\ m^{-3}$)	0.011	0.006	0.026	0.104	0.013	0.024	0.021	0.140
Cd	($\mu g\ m^{-3}$)	0.06	0.14	0.11	0.06	0.36	0.17	0.11	0.03

Site - 1
Sedimentary dust (>10)

Date	Units	February 28	February 28	March 1	March 1	March 1	March 1	March 2	March 2
Time		18:00	24:00	06:00	12:00	18:00	24:00	06:00	12:00
Mass	($ng\ cm^{-2}\ h^{-1}$)	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim
Pb	($ng\ cm^{-2}\ h^{-1}$)	1.08	0.34	0.24	0.39	0.32	1.30	0.37	0.08
Cd	($ng\ cm^{-2}\ h^{-1}$)	0.005	0.004	0.004	0.003	0.001	0.005	0.001	0.002
Tl	($ng\ cm^{-2}\ h^{-1}$)	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim

Site -2
In - Situ Measurements

Date	Units	March 3	March 3	March 3	March 4	March 4	March 4	March 5	March 5
Time		12:00	18:00	24:00	06:00	18:00	24:00	06:00	12:00
Wind Direction.		SSE	NW	NW	NE	ENE	NW	NW	S
Wind Speed	($m\ s^{-1}$)	1.6	1.0	0.6	6.2	4.1	1.4	1.1	3.9
Temperature	(°C)	8.7	4.1	3.2	11.8	8.5	3.8	3.0	9.2
Solar Flux	($cal\ cm^{-2}\ min^{-1}$)	53.0	0.0	7.0	40.5	0.0	0.0	7.5	52.5
Cloud cover	(8/8)	0.0	0.0	0.0	6.0	7.0	3.0	6.0	1.0
SO_2	($\mu g\ m^{-3}$)	8.3	114	134	9.8	9.5	3.0	23	29
CO	($\mu g\ m^{-3}$)	717	7604	6200	875	965	1900	113	958
NO_2	($\mu g\ m^{-3}$)	19	400	275	40	49	68	81	96
NO	($\mu g\ m^{-3}$)	8.3	192	139	17	15	32	22	43
O_3	($\mu g\ m^{-3}$)	89	57	42	80	71	22	31	44
Cl_2	($\mu g\ m^{-3}$)	31	167	3	39	48	26	30	18
HC	($\mu g\ m^{-3}$)	0.94	22	18	6.9	2.6	12	3.1	15
F^-	($\mu g\ m^{-3}$)	0.029	0.039	0.045	0.027	0.020	0.066	0.026	0.037
Cl^-	($\mu g\ m^{-3}$)	1.5	0.4	1.0	10.5	1.2	1.1	1.6	0.8
HCl	($\mu g\ m^{-3}$)	1.7	6.9	2.4	0.4	1.5	1.6	0.62	1.13
HF	($\mu g\ m^{-3}$)	0.20	0.30	3.41	3.41	0.18	2.17	2.45	1.9
H_2S	($\mu g\ m^{-3}$)	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim

Site - 2
Suspended particles (<10 um)

Date	Units	March 3	March 3	March 3	March 4	March 4	March 4	March 5	March 5
Time		12:00	18:00	24:00	06:00	18:00	24:00	06:00	12:00
Mass	($\mu g\ m^{-3}$)	54	37	95	43	27	37	41	64
Pb	($\mu g\ m^{-3}$)	0.025	0.038	0.057	0.028	0.041	0.11	0.035	0.023
Cd	($\mu g\ m^{-3}$)	0.35	0.18	0.57	0.48	0.32	0.30	0.43	0.33

Site - 2
Sedimentary dust (>10)

Date	Units	March 3	March 3	March 3	March 4	March 4	March 4	March 5	March 5
Time		12:00	18:00	24:00	06:00	18:00	24:00	06:00	12:00
Mass	($ng\ cm^{-2}\ h^{-1}$)	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim
Pb	($ng\ cm^{-2}\ h^{-1}$)	0.65	0.05	0.20	0.34	0.81	0.03	0.09	0.44
Cd	($ng\ cm^{-2}\ h^{-1}$)	0.0628	0.0003	0.0004	0.0035	0.0024	0.0075	0.0078	0.0032
Tl	($ng\ cm^{-2}\ h^{-1}$)	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim

Site - 3
In-Situ Measurements

Date	Units	March 5	March 5	March 6	March 6	March 6	March 6	March 7	March 7
Time		18:00	24:00	06:00	12:00	18:00	24:00	06:00	12:00
Wind Direction.		SSE	NW	NW	SSE	SSE	NE	NW	NNE
Wind Speed	($m\ s^{-1}$)	1.2	1.7	1.4	4.7	4.9	1.5	1	4.7
Temperature	(°C)	8.2	4.8	2.4	10.6	8.2	3.1	3.9	10.6
Solar Flux	($cal\ cm^{-2}\ min^{-1}$)	0.0	0.0	6.5	47.4	0.0	0.0	5.5	45.5
Cloud cover	(8/8)	1.0	0.0	0.0	0.0	3.0	0.0	3.0	4.0
SO_2	($\mu g\ m^{-3}$)	17	21	51	8.3	20	50	26	14
CO	($\mu g\ m^{-3}$)	452	321	429	118	235	1435	3700	452
NO_2	($\mu g\ m^{-3}$)	96	106	87	17	74	102	157	34
NO	($\mu g\ m^{-3}$)	9.0	16	4.6	2.4	11	32	54	9.0
O_3	($\mu g\ m^{-3}$)	84	17	31	89	71	35	31	86
Cl_2	($\mu g\ m^{-3}$)	33	6	17	31	27	23	82	109
HC	($\mu g\ m^{-3}$)	2.1	7.7	0.47	0.55	1.5	1.6	13	4.1
F^-	($\mu g\ m^{-3}$)	0.031	0.049	0.048	0.045	0.056	0.053	0.074	0.045
Cl^-	($\mu g\ m^{-3}$)	1.37	1.67	1.07	0.79	1.47	1.16	0.92	0.84
HCl	($\mu g\ m^{-3}$)	1.97	0.75	0.88	0.60	9.95	0.19	1.37	0.57
HF	($\mu g\ m^{-3}$)	2.97	0.46	1.05	0.99	0.16	0.20	2.27	3.82
H_2S	($\mu g\ m^{-3}$)	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim

Site - 3
Suspended particles (<10 um)

Date	Units	March 5	March 5	March 6	March 6	March 6	March 6	March 7	March 7
Time		18:00	24:00	06:00	12:00	18:00	24:00	06:00	12:00
Mass	($\mu g\ m^{-3}$)	24	72	33	37	40	45	44	52
Pb	($\mu g\ m^{-3}$)	0.095	0.104	0.026	0.067	0.032	0.080	0.098	0.160
Cd	($\mu g\ m^{-3}$)	0.23	3.15	0.29	0.24	0.22	0.41	0.57	0.76

Site - 3
Sedimentary dust (>10)

Date	Units	March 5	March 5	March 6	March 6	March 6	March 6	March 7	March 7
Time		18:00	24:00	06:00	12:00	18:00	24:00	06:00	12:00
Mass	($ng\ cm^{-2}\ h^{-1}$)	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim	<det. lim
Pb	($ng\ cm^{-2}\ h^{-1}$)	0.57	6.59	0.12	0.05	0.04	0.10	0.54	0.90
Cd	($ng\ cm^{-2}\ h^{-1}$)	0.010	0.013	0.006	0.005	0.047	0.001	0.013	0.020
Tl	($ng\ cm^{-2}\ h^{-1}$)	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim	<det.lim

APPENDIX 2

DATA GENERATED IN SEA WATER QUALITY SURVEY

TEKIRDAG SEA WATER MEASUREMENTS

Parameter		Site 1	Site 1	Site 1	Site 1
		Surface	Surface	Bottom	Bottom
	Unit	Sample-1	Sample-2	Sample-1	Sample-2
Depth	m	5.2			
Air Temp	°C	7.8			
Water temp	°C	7.3	7.1	7.4	7.5
Color	Pt-Co	11	11	4	5
Odor		Natural	Natural	Natural	Natural
Taste		Natural	Natural	Natural	Natural
Transperency	m	2			
pH		8.19	8.17	8.19	8.19
COD	mg L^{-1}	22	22	15	7.6
SS	mg L^{-1}	7	7	40	37
DO	mg L^{-1}	9.1	9.4	8.0	7.8
Number of coliform group	per 100 mL	190	205	9	10
Number of Fecal coliform group	per 100 mL	ND	ND	ND	ND
Surface active agent	mg L^{-1}	0.65	0.66	0.19	0.17
Oil and Petrol	mg L^{-1}	8.8	6.5	16.6	17.3
Phenol	mg L^{-1}	0.0015	0.0016	<0.001	<0.001
Residual substance from tarr	mg L^{-1}	ND	ND	ND	ND

Parameter	Unit	Site 2 Surface Sample-1	Site 2 Surface Sample-2	Site 2 Bottom Sample-1	Site 2 Bottom Sample-2
Depth	m	5.0			
Air Temp	°C	8.1			
Water temp	°C	7.6	7.4	8.1	8.2
Color	Pt-Co	5	5	2	3
Odor		Natural	Natural	Natural	Natural
Taste		Natural	Natural	Natural	Natural
Transperency	m	2.33			
pH		8.07	8.05	8.02	8.03
COD	mg L^{-1}	38	34	25	15
SS	mg L^{-1}	6	8	42	35
DO	mg L^{-1}	9.6	9.9	8.4	8.1
Number of coliform group	per 100 mL	34	38	4	6
Number of Fecal coliform group	per 100 mL	ND	ND	ND	ND
Surface active agent	mg L^{-1}	0.46	0.50	1.11	1.15
Oil and Petrol	mg L^{-1}	27.1	25.2	29.8	26.1
Phenol	mg L^{-1}	<0.001	<0.001	<0.001	<0.001
Residual substance from tarr	mg L^{-1}	ND	ND	ND	ND

Parameter	Unit	Site 3 Surface Sample-1	Site 3 Surface Sample-2	Site 3 Bottom Sample-1	Site 3 Bottom Sample-2
Depth	m	5.3			
Air Temp	°C	7.6			
Water temp	°C	8.0	8.2	8.2	8.3
Color	Pt-Co	3	1	3	2
Odor		Natural	Natural	Natural	Natural
Taste		Natural	Natural	Natural	Natural
Transperency	m	2.5			
pH		8.10	8.15	7.94	8.00
COD	mg L^{-1}	7.6	15.2	12.4	8.6
SS	mg L^{-1}	16	13	50	53
DO	mg L^{-1}	8.0	8.2	8.8	8.4
Number of coliform group	per 100 mL	2	1	8	7
Number of Fecal coliform group	per 100 mL	1	2	ND	ND
Surface active agent	mg L^{-1}	0.26	0.29	0.32	0.34
Oil and Petrol	mg L^{-1}	19.4	19.7	52	49
Phenol	mg L^{-1}	<0.001	<0.001	<0.001	<0.001
Residual substance from tarr	mg L^{-1}	ND	ND	ND	ND

Parameter		Site 4	Site 4	Site 4	Site 4	Site 4	Site 4
		Surface	Surface	Middle	Middle	Bottom	Bottom
	Unit	Sample-1	Sample-2	Sample-1	Sample-2	Sample-1	Sample-2
Depth	m	50.0					
Air Temp	°C	8.0					
Water temp	°C	8.1	8.3	8.2	8.1	8.4	8.3
Color	Pt-Co	9	9	10	10	10	10
Odor		Natural	Natural	Natural	Natural	Natural	Natural
Taste		Natural	Natural	Natural	Natural	Natural	Natural
Transperency	m	3.6					
pH		8.18	8.17	8.20	8.18	8.16	8.15
COD	mg L^{-1}	12	12	10	9.2	12	7.8
SS	mg L^{-1}	11	12	36	31	45	41
DO	mg L^{-1}	8.4	8.7	9.3	9.1	9.0	8.7
Number of coliform group	per 100 mL	1	1	55	57	8	8
Number of Fecal coliform group	per 100 mL	ND	ND	ND	ND	ND	ND
Surface active agent	mg L^{-1}	0.20	0.20	0.39	0.40	0.65	0.68
Oil and Petrol	mg L^{-1}	3.0	3.1	29.2	27.1	55.2	52.1
Phenol	mg L^{-1}	0.0052	0.0050	0.0029	0.0024	<0.001	<0.001
Residual substance from tarr	mg L^{-1}	ND	ND	ND	ND	ND	ND

Parameter	Unit	Site 5 Surface Sample -1	Site 5 Surface Sample-2	Site 5 Middle Sample-1	Site 5 Middle Sample-2	Site 5 Bottom Sample-1	Site 5 Bottom Sample-2
Depth	m	52					
Air Temp	°C	8.1					
Water temp	°C	7.9	7.7	8.0	8.2	8.0	7.8
Color	Pt-Co	1	1	6	6	1	1
Odor		Natural	Natural	Natural	Natural	Natural	Natural
Taste		Natural	Natural	Natural	Natural	Natural	Natural
Transperency	m	4.3					
pH		8.09	8.07	8.12	8.11	8.10	8.11
COD	mg L^{-1}	8.7	4.4	4.8	4.4	9.2	6.3
SS	mg L^{-1}	25	29	47	51	46	50
DO	mg L^{-1}	9.8	9.6	9.9	9.8	9.1	9.3
Number of coliform group	per 100 mL	27	29	53	51	5	3
Number of Fecal coliform group	per 100 mL	1	1	ND	ND	ND	ND
Surface active agent	mg L^{-1}	0.26	0.29	0.39	0.41	0.52	0.55
Oil and Petrol	mg L^{-1}	63.2	61.8	2.8	2.5	0.6	0.8
Phenol	mg L^{-1}	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Residual substance from tarr	mg L^{-1}	ND	ND	ND	ND	ND	ND

Parameter		Site 6	Site 6	Site 6	Site 6	Site 6	Site 6
		Surface	Surface	Middle	Middle	Bottom	Bottom
	Unit	Sample-1	Sample-2	Sample-1	Sample-2	Sample-1	Sample-2
Depth	m	51					
Air Temp	°C	8.2					
Water temp	°C	7.9	8.0	8.0	7.8	8.1	8.3
Color	Pt-Co	2	3	9	7	8	9
Odor		Natural	Natural	Natural	Natural	Natural	Natural
Taste		Natural	Natural	Natural	Natural	Natural	Natural
Transperency	m	3.7					
pH		8.00	7.96	8.06	8.07	8.07	8.07
COD	mg L^{-1}	4.1	5.7	8.6	10.3	12.6	8.4
SS	mg L^{-1}	1.0	1.8	43	39	42	51
DO	mg L^{-1}	10.01	10.2	9.6	9.8	9.3	9.0
Number of coliform group	per 100 mL	5	3	3	1	6	5
Number of Fecal coliform group	per 100 mL	ND	ND	ND	ND	ND	ND
Surface active agent	mg L^{-1}	0.33	0.33	0.19	0.21	1.70	1.72
Oil and Petrol	mg L^{-1}	9.6	10	60.2	55.3	33.4	33.9
Phenol	mg L^{-1}	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Residual substance from tarr	mg L^{-1}	ND	ND	ND	ND	ND	ND

ND: Not detected

APPENDIX 3

FLORA INVENTORY

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
GYMNOSPERMAE														
Cupressus sempervirens		+										-	Out Tr.	4
Juniperus oxycedrus ssp. oxycedrus					+							-	Wide	4
Pinus brutia		+										E Medit.	W, S Tr.	5
P. pinea		+										-	Out Tr.	5
ANGIOSPERMAE (DICOTYLEDONES) ACERACEAE														
Acer negundo		+												3
A. tataricum					+									1
AMARANTHACEAE														
Amaranthus albus	+		+	+								-	Wide	3
A. blitoides			+									-	Wide	2
A. deflexus	+		+									-	Wide	3
A. retroflexus	+		+									-	Wide	3
ANACARDIACEAE														
Pistacia terebinthus ssp. terebinthus	+				+							Medit.	NW, W Tr.	1
Rhus coriaria	+				+							-	Wide	5
APOCYNACEAE														
Vinca herbacea			+		+							-	Wide	1
ARALIACEAE														
Hedera helix					+							-	Wide	3
ARISTOLOCHIACEAE														
Aristolochia bodamae			+									-	NW Tr.	2

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
ASCLEPIADACEAE														
Cynanchum acutum ssp. acutum	+		+	+								-	Wide	3
BORAGINACEAE														
Alkanna tinctoria ssp. tinctoria	+			+		+						Medit.	Wide	3
Anchusa azurea var. azurea	+		+	+								-	Wide	3
A.. officinalis			+									Euro-Sib.	Wide	2
A.. stylosa						+						-	Wide	1
Asperugo procumbens			+									Euro-Sib.	Wide	3
Buglossoides arvensis	+		+									-	Wide	3
Cerinthe minor ssp. auriculata	+		+		+	+						-	Wide	3
Echium angustifolium	+					+	+					E Medit.	Wide	3
E. italicum	+			+								Medit.	Wide	4
E. plantagineum	+		+			+	+					Medit.	Wide	3
Heliotropium europaeum	+		+									Medit.	Wide	4
Lithospermum purpurocaeruleum					+							Euro-Sib.	N, S Tr.	4
Myosotis ramosissima ssp. ramosissima							+				+	-	Wide	4
Nonea atra			+									Euro-Sib.	Thracia	2
N. ventricosa			+	+								Medit.	Wide	3
CAMPANULACEAE														
Asyneuma limonifolium ssp. limonifolium						+						-	Wide	2
Legousia pentagonia	+					+						E Medit.	Wide	4
L. speculum-veneris	+		+			+						Medit.	Wide	4

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
CAPRIFOLIACEAE														
Lenicera caprifolium	+				+							-	NW, NE Tr.	2
Sambucus ebulus	+				+			+				Euro-Sib.	Wide	3
CARYOPHYLLACEAE														
Agrostemma githago			+									-	Wide	3
Dianthus leptopetalus					+							-	Wide	3
Moenchia mantica ssp.mantica	+					+	+					-	Wide	4
Petrorhagia velutina			+			+	+					-	Wide	4
Saponaria officinalis			+									-	Wide	3
Silene conica	+					+						-	Wide	3
S. conoidea	+		+			+						-	Wide	3
S. vulgaris var. vulgaris			+		+							-	Wide	2
Vaccaria pyramidata var. grandiflora	+		+									-	Wide	4
CHENOPODIACEAE														
Arthrocnemum fruticosum	+								+			-	Wide	3
Atriplex tatarica var. tatarica	+			+								-	Wide	3
Beta maritima var. maritima	+					+						-	E Tr.	1
Chenopodium album ssp. album var. album	+		+			+						-	Wide	4
Salsola ruthenica	+											-	Wide	3
S. soda	+											-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
CISTACEAE														
Cistus salviifolius	+				+							-	Wide	3
Tuberaria guttata var. guttata	+				+	+						-	Out Tr.	3
COMPOSITAE														
Achillea setacea	+		+									-	Wide	2
Anthemis arvensis	+		+	+								-	Wide	2
A. austriaca			+	+								-	Wide	4
A. tinctoria var. tinctoria	+		+	+	+							-	Wide	3
Bellis perennis	+					+	+	+				Euro-Sib.	Out Tr.	3
Calendula arvensis	+					+	+	+				-	Out Tr.	3
Cardopatium corymbosum	+			+			+					-	Wide	3
Carduus nutans ssp. leiophyllus	+			+			+	+				-	NW, E Tr.	3
Carduus pynocephalus ssp. albidus	+							+				-	Wide	4
Carlina corymbosa	+			+				+				Medit.	NW, S Tr.	4
Carthamus lanatus	+			+			+	+				-	Wide	3
Centaurea cyanus			+	+								-	Wide	3
C. depressa								+				-	Wide	2
C. diffusa			+	+				+				Medit.	Wide	3
C. iberica			+	+				+				-	Wide	3
C. salonitana			+									Euro-Sib.	N Tr.	1
C. solstitialis ssp. solstitialis	+			+				+				-	Wide	4

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Chondrilla juncea var. juncea	+			+			+		+			-	Wide	4
Cichorium intybus	+			+			+	+				-	Wide	4
Cirsium arvense ssp. arvense	+							+				-	N Tr.	3
C. italicum						+						Medit.	N Tr.	2
Conyza bonariensis	+			+		+		+				-	Wide	4
C. canadensis	+			+		+		+				-	Wide	4
Crepis foetida ssp. foetida	+		+			+						-	W, S Tr.	4
C. foetida ssp. rhoeadifolia	+					+						-	Wide	4
C. sancta	+					+		+				-	Wide	4
C. setosa				+		+						Euro-Sib.	Wide	2
C. zacintha						+						Medit.	Wide	3
Crupina vulgaris	+						+					-	N, Mid. Tr.	3
Echinops ritro	+			+			+					-	Wide	3
Filago pyramidata	+							+				-	Wide	4
Helianthus annuus		+										-	Thracia, E Anatolia	5
Inula viscosa	+			+			+					Medit.	Wide	4
Jurinea consanguinea	+				+							-	Wide	2
Lactuca saligna	+		+	+								-	Wide	3
L. serriola	+		+	+		+						Euro-Sib.	Wide	4
Lapsana communis ssp. intermedia					+							-	Wide	3
Leontodon tuberosus	+				+	+	+					-	Out Tr.	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Logfia arvensis	+							+				-	Wide	4
Notobasis syriaca				+								-	Wide	3
Onopordum illyricum	+			+			+	+				-	Wide	3
Pallenis spinosa	+					+						-	Wide	3
Picnomon acarna	+			+				+				Medit.	Wide	3
Picris altissima	+			+			+					Medit.	Wide	3
Pilosella xauriculoides					+							-	Wide	2
Pulicaria dysenterica	+							+				-	Wide	4
Rhagadiolus stellatus var. edulis	+					+						-	Wide	3
Scariola viminea	+			+				+				-	Wide	3
Scolymus hispanicus	+		+	+								Medit.	Wide	3
Senecio vernalis	+		+									-	Wide	2
S. vulgaris	+		+									-	Out Tr.	2
Slybum marianum	+						+					-	Out Tr.	3
Solidago virgaurea					+							-	Wide	1
Sonchus asper ssp. glaucescens			+				+					-	Wide	3
Taraxacum cf. aznavouri									+				İstanbul	3
T. pseudobrachyglossum	+					+							Thracia	1
Tragopogon longirostris	+		+			+	+					-	Wide	2
Tussilago farfara	+							+				Euro-Sib.	Wide	4
Xanthium strumarium	+						+	+				-	Wide	4
Xeranthemum annuum	+		+				+	+				-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
CONVOLVULACEAE														
Calystegia sepium ssp. sepium	+							+				-	Wide	2
Convolvulus arvensis	+		+	+								-	Wide	4
CORNACEAE														
Cornus sanguinea ssp. australis					+							Euro-Sib.	Wide	3
CORYLLACEAE														
Carpinus orientalis ssp. orientalis					+							-	N, S Tr.	5
CRASSULACEAE														
Sedum caespitosum	+						+				+	Medit.	Wide	4
CRUCIFERAE														
Alyssum desortorum var. desortorum	+		+									-	Wide	4
A. strigosum ssp. strigosum	+		+			+						-	Wide	4
Boreava orientalis			+									-	Wide	1
Cakile maritima	+								+			-	Wide	3
Capsella bursa-pastoris	+		+			+						-	Wide	4
Cardamine hirsuta								+				-	Wide	3
Cardaria draba ssp. draba	+		+	+			+					-	Wide	4
Clypeola jonthlaspi	+										+	-	Wide	3
Diplotaxis tenuifolia									+			-	N Tr.	4
Erophila verna ssp. plur.	+					+	+				+	-	Wide	4
Eruca sativa			+									-	Wide	4
Hirshfeldia incana			+	+								-	Wide	4

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Malcolmia flexuosa	+								+			-	W. S Tr.	3
Myagrum perfoliatum			+									-	Wide	2
Nasturtium officinale	+							+				-	Wide	2
Raphanus raphanistrum	+		+									-	Wide	4
Rorippa amphibia								+				-	Wide	2
Sinapis arvensis	+		+	+								-	Wide	4
Sisymbrium altissimum	+			+								-	Wide	2
S. orientale	+			+				+				-	Wide	2
Thlaspi perfoliatum	+											-	Wide	4
Turritis glabra	+										+	-	Wide	2
CUCURBITACEAE														
Ecbalium elatorium				+								Medit.	Wide	3
DIPSACACEAE														
Cephalaria syriaca	+		+									-	NW, Mid. Tr.	2
C. transsylvanica	+		+			+						-	Wide	4
Dipsacus laciniatus	+					+		+				-	Wide	2
Knautia byzantina	+		+									End.	N Tr.	2
ERICACEAE														
Erica manipuliflora	+				+							E Medit.	Wide	3
EUPHORBIACEAE														
Chrizophora tinctoria	+		+									-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Euphorbia agraria			+									Euro-Sib.	NW, W Tr.	2
E. aleppica	+		+									-	Wide	3
E. exigua var. retusa									+			-	Out Tr.	3
E. helioscopia	+		+									-	Wide	4
E.seguieriana ssp. niciciana			+									-	NW, Mid. Tr.,	3
Mercurialis annua	+		+									-	Wide	4
FAGACEAE														
Quercus cerris var. austriaca					+							Euro-Sib.	NW, Mid. Tr	5
Q. infectoria ssp. infectoria					+							Euro-Sib.	N Tr	5
Q. petraea ssp. petraea					+							-	NW Tr.	5
Q. robur ssp. robur					+							Euro-Sib.	NW, Mid., S Tr.	3
GENTIANACEAE														
Centaurium erythraea ssp. turcicum	+		+									-	Wide	3
GERANIACEAE														
Erodium ciconium	+		+									-	Wide	3
E. malacoides	+		+			+						Medit.	Wide	3
Geranium dissectum	+		+			+						-	Wide	4
G. molle ssp. molle	+				+							-		3
G. pyrenaicum			-		+							-	Wide	3
G. rotundifolium	+							+				-	Wide	4
G. tuberosum ssp. tuberosum			+									-	Wide	4

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
GUTTIFERAE														
Hypericum montbretii	+							+				-	Wide	2
H.perfoliatum	+		+									-	Wide	2
H. perforatum	+				+							-	Wide	3
H. thasium											+	-	NW Tr.	1
HALORAGIDACEAE														
Myriophyllum spicatum	+									+		-	Wide	3
LABIATAE														
Acinos rotundifolius	+		+			+		+				-	Wide	4
Ballota nigra ssp. anatolica	+							+				İr.-Tur.	NW, Mid. Tr.	3
Clinopodium vulgare ssp. vulgare					+							-	Wide	3
Lamium amplexicaule	+		+									Euro-Sib..	Wide	4
L.purpureum var. purpureum					+							Euro-Sib..	W, Mid. Tr.	2
Lycopus europaeus	+							+				Euro-Sib..	Wide	3
Melissa officinalis ssp. altissima	+							+				E. Medit.	Out Tr.	3
Mentha pulegium	+							+				-	Out Tr.	2
M. spicata ssp. spicata	+							+				-	Wide	3
Nepeta italica	+				+							-	Wide	2
Origanum vulgare ssp. vulgare	+				+							Euro-Sib..	N Tr.	2
Prunella vulgaris	+				+							Euro-Sib..	Wide	3
Salvia bracteata	+		+									Ir.-Tur.	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
S. pinnata			+									Medit.	NW, W Tr.	2
S. viridis			+		+							Medit.	Wide	3
Stachys annua ssp. annua var annua			+			+						-	Wide	4
S. cretica ssp. smyrnaea	+				+							E Medit.	Wide	3
S. maritima	+								+			Medit.	NW Tr.	2
S. thirkei			+									Medit.	N Tr.	3
Teucrium chamaedrys ssp. chamaedrys	+				+						+	Euro-Sib.	Wide	2
T. polium	+										+	-	Wide	3
Thymus zygioides var. zygioides					+							E Medit.	W Tr.	2
Ziziphora capitata											+	Ir.-Tur.	Wide	3
LEGUMINOSAE														
Astragalus thracicus	+				+							-	Thracia	2
Chamaecytisus supinus					+							Euro-Sib.	N Tr.	1
Chondrilla juncea					+							Medit.	Out Tr.	1
Cicer montbretii								+				E Medit.	NW, W Tr.	1
Dorycnium graecum					+							Eux.	Wide	2
D. pentaphyllum ssp. herbaceum	+				+							-	Wide	3
Galega officinalis	+							+				Euro-Sib.	Wide	2
Lathyrus aphaca var. biflorus	+		+			+						-	Wide	3
L. cicera			+									-	Wide	3
L. laxiflorus ssp. laxiflorus					+							-	Out Tr.	2
Medicago marina	+								+			-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
M. minima var. minima	+		+			+						-	Wide	4
M. rigidula var. rigidula	+		+			+						-	Wide	4
Melilotus alba	+		+	+								-	Wide	3
M. indica	+							+				-	Wide	4
Onobrychis aequidentata	+			+		+						Medit.	Wide	4
Ononis spinosa ssp. spinosa	+			+								-	Wide	4
Psoralea butiminosa	+			+								Medit.	Out Tr.	3
Robinia psedoacacia		+												
Securigera securidaca								+				-	Wide	3
Trifolium angustifolium var. angustifolium	+					+						-	Wide	4
T. arvense var. arvense	+				+	+						-	Wide	3
T. campestre	+							+				-	Wide	4
T. dubium						+						-	N. Tr.	3
T. echinatum	+							+				E. Medit.	Wide	3
T. hirtum	+				+							Medit.	Wide	2
T. pratense var. pratense	+			+	+							-	Wide	3
T. resupinatum var. resupinatum			+	+		+						-	Wide	3
T. spumosum	+					+						Medit.	Wide	2
T. stellatum var. stellatum	+					+						-	Wide	4
T. vesicarium var. rumelicum					+	+						-	NW, S Tr.	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Trigonella monspeliaca	+		+		+	+						Medit.	Wide	4
Vicia cracca ssp. stenophylla	+		+									-	Wide	3
V. hybrida	+		+									-	Wide	3
V. narbonensis var. narbonensis			+									-	Wide	2
V. sativa ssp. sativa			+									-	Wide	3
V. tetrasperma			+									-	SE. Out Tr.	2
V. villosa ssp. villosa	+		+									-	Wide	3
LINACEAE														
Linum bienne	+					+						-	Wide	3
L. nodiflorum			+									-	Wide	3
LORANTHACEAE														
Viscum album ssp. album												-	Out Tr.	2
LYTHRACEAE														
Lythrum salicaria	+							+				Euro-Sib..	Wide	3
MALVACEAE														
Althaea cannabina								+				-	Wide	2
Malope malacoides			+									Medit.	Wide	2
Malva neglecta	+						+					-	Wide	2
M. sylvestris	+						+					-	Wide	3
OLEACEAE														
Fraxinus angustifolia ssp. oxycarpa					+							Euro-Sib..	N Tr.	2

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
F. ornus ssp. ornus	+				+							Euro-Sib..	NW, W Tr.	2
Jasminum fruticans	+				+							Medit.	Wide	4
Ligustrum vulgare	+				+							Euro-Sib..	N Tr.	3
Phillyrea latifolia	+				+							Medit.	Wide	1
ONAGRACEAE														
Epilobium hirsutum	+							+				-	Wide	3
OROBANCHACEAE														
Orobanche cernua			+									-	Wide	2
O. crenata			+									-	Wide	2
O. nana			+									-	Wide	2
O. ramosa			+									-	Wide	2
OXALIDACEAE														
Oxalis corniculata							+					-	Wide	2
PAPAVERACEAE														
Fumaria capreolate	+		+									-	S, W Tr.e	2
F. densiflora			+									-	Wide	3
F. officinalis												-	Wide	3
Glaucium corniculatum ssp. corniculatum	+			+								-	Wide	2
G. flavum									+			-	Wide	2
Hypecoum imberbe	+		+									-	Wide	3
Papaver rhoeas	+		+	+		+						-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
PHYTOLACCACEAE														
Phytolacca americana			+									-	Wide	1
PLANTAGINACEAE														
Plantago bellardii											+	E. Medit.	Out Tr.	2
P. coronopus ssp. coronopus	+			+								Euro-Sib..	Wide	2
P. lagopus	+			+		+						Medit.	Wide	3
Plantago major ssp. plur.	+					+						-	Wide	3
PLATANACEAE														
Platanus orientalis												-	Wide	5
PLUMBAGINACEAE														
Limonium gmelinii	+								+			Euro-Sib..	Wide	3
Plumbago europaea	+				+							Euro-Sib..	Wide	2
POLYGALACEAE														
Polygala vulgaris					+							Euro-Sib..	N Tr.	1
POLYGONACEAE														
Polygonum arenastrum	+			+								-	Wide	3
P. ariculare	+			+								-	Wide	3
P. convolvulus			+									-	Wide	3
P. maritimum	+								+			-	Wide	1
Rumex crispus	+							+				-	Wide	3
R. pulcher								+				-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
PRIMULACEAE														
Anagallis arvensis var. caerulea	+		+									-	Wide	4
Lysimachia atropurpurea			+		+							E. Medit.	Wide	2
Primula vulgaris ssp. sibthorpii					+							Öksin	N. Tr.	1
RANUNCULACEAE														
Adonis annua	+			+		+						-	Out Tr.	3
A. flammea			+									-	Wide	3
Anemone pavonina					+							-	NW Tr.	3
Ceratocephalus falcatus	+		+									-	Wide	4
Clematis vitalba					+							-	Out Tr.	2
Consolida orientalis			+									-	Wide	3
C. regalis ssp. paniculata var. paniculata	+		+									-	Wide	3
Delphinium peregrinum			+									-	W, S Tr.	3
Nigella damascena			+									-	NW Tr.	3
Ranunculus arvensis			+			+		+				-	Wide	3
R. neapolitanus								+				-	W, S Tr.	2
Thalictrum lucidum					+	+		+				-	Wide	3
RESEDACEAE														
Reseda lutea var. lutea	+			+								-	Wide	3
R. luteola				+								-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
RHAMNACEAE														
Paliurus spina-christi	+				+							-	Wide	3
ROSACEAE														
Crataegus monogyna ssp. plur.					+							-	Wide	2
Cydonia oblonga					+							-	Wide	1
Eriobotrya japonica		+										-	Wide	1
Geum urbanum					+							Euro-Sib..	Wide	3
Mespilus germanica					+							Öksin	N Tr.	1
Potentilla recta	+					+						-	Wide	3
P. reptans						+						-	Wide	3
Prunus spinosa ssp. dasiphylla						+						Euro-Sib..	Wide	2
Pyracantha coccinea					+							-	Wide	1
Pyrus bulgarica					+							-	Trakya	1
P. communis ssp. communis					+							-	Wide	1
Rosa canina					+							-	Wide	2
Rubus sanctus	+				+							-	Wide	3
Sanguisorba minor ssp. muricata	+					+						-	Wide	3
RUBIACEAE														
Asperula arvensis								+				Medit.	Wide	3
A. tenella						+						-	Wide	2
Crucianella angustifolia	+				+							Medit.	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Galium aparine	+				+							-	Out Tr.	3
G. palustre								+				Euro-Sib..	N. Tr.	2
G. verum ssp. verum	+				+							Euro-Sib..	Wide	3
SALICACEAE														
Salix alba								+				Euro-Sib..	Wide	3
SANTALACEAE	+													
Osyris alba					+							Medit.	Out Tr.	2
SCROPHULARIACEAE														
Bellardia trixago	+					+						-	Wide	3
Gratiola officinalis								+				Euro-Sib..	Wide	1
Kicksia spuria ssp. integrifolia	+		+									-	Wide	3
Linaria chalapensis var. chalapensis			+									E. Medit.	Wide	2
L. genistifolia var. genistifolia	+		+	+								Euro-Sib..	N Tr.	3
Scrophularia canina ssp. bicolor	+			+								E. Medit.	Wide	2
Verbascum phlomoides	+			+								Euro-Sib..	NW, NE Tr.	2
V. pinnatifidum									+			E. Medit.	NW Tr.	1
V. sinuatum var. sinuatum	+			+								Medit.	Wide	3
Veronica acinifolia			+	+								-	Wide	2
V. cymbalaria	+		+									Medit.	Wide	3
V. hederifolia	+		+									-	Wide	3
V. persica			+									-	Wide	2

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
V. triloba	+		+									-	Wide	3
V. verna					+							Euro-Sib..	Wide	2
SIMAROUBACEAE														
Ailanthus altissima	+	+												
SOLANACEAE														
Datura stramonium	+							+				-	Wide	2
Lycium europaeum			+									Medit.	Wide	2
UMBELLIFERAE														
Ammi visnaga			+									Medit.	Wide	3
Apium graveolens								+				-	Wide	3
Bupleurum euboeum									+			E. Medit.	W Tr	1
B. flavum							+					-	Wide	2
Caucalis platycarpos			+									-	Wide	2
Conium maculatum	+							+				-	Wide	3
Coriandrum sativum			+									-	Wide	3
Crithmum maritimum	+								+			-	Wide	2
Daucus carota	+			+			+	+				-	Wide	4
Echinophora tenuifolia ssp. sibthorpiana			+									Ir.-Tur.	Wide	3
Eryngium bithynicum	+						+					E. Medit.	Wide	3
E. campestre var. virens	+						+					-	Wide	3
E. maritimum	+								+			-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Falcaria vulgaris			+									-	Wide	2
Legoecia cuminoides	+					+						Medit.	Wide	3
Oenanthe silaifolia	+							+				-	Wide	3
Pastinaca sativa ssp. urens				+	+	+						-	Wide	2
Ridolfia segetum			+									-	Wide	2
Scandix australis ssp. grandiflora	+		+									-	Wide	3
S. pecten-veneris	+		+									-	Wide	3
Smyrnium creticum	+		+									-	W, S Tr.	2
Torilis arvensis ssp.arvensis	+		+									-	Wide	3
Turgenia latifolia			+									-	Wide	3
ULMACEAE														
Ulmus minor ssp. minor					+							-	N Tr.	3
URTICACEAE														
Urtica dioica	+					+						Euro-Sib..	Wide	3
VALERIANACEAE														
Valeriana dioscoridis					+							E. Medit.	Wide	3
Valerianella echinata											+	Medit.	Wide	3
VERBENACEAE														
Verbena officinalis	+							+				-	Wide	3
VIOLACEAE														
Viola sieheana					+							-	N Tr.	2

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
VITACEAE														
Vitis vinifera					+							-	Wide	2
ZYGOPHYLLACEAE														
Tribulus terrestris	+		+									-	Wide	3
MONOCOTYLEDONES														
ARACEAE														
Arum maculatum					+							-	W, N Tr.	2
Dracunculus vulgaris			+	+								E. Medit.	Wide	3
BUTOMACEAE														
Butomus umbellatus	+									+		Euro-Sib..	Wide	2
CYPERACEAE														
Bulboschonus maritimus var. maritimus	+							+				-	Wide	2
Carex divisa	+							+				-	Wide	2
C. flacca ssp. serrulata								+				Medit.	Wide	3
C. riparia								+				Euro-Sib..	Wide	3
Eleocharis mitracarpa								+				-	Wide	3
Schoenoplectus litoralis	+							+				-	Wide	3
DIOSCORACEAE														
Tamus communis ssp. cretica	+				+							-	W, S Tr.	1
GRAMINEAE														
Aegilops triuncialis ssp. triuncialis	+					+						-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Aeluropus littoralis	+								+			-	Wide	3
Agrostis stolonifera								+				Euro-Sib..	Wide	3
Ammophila arenaria ssp. arundinacea									+			Medit.	W Tr.	3
Apera spica-venti			+									Euro-Sib..	NW, Mid. Tr.	1
Avena barbata ssp. barbata	+							+				Medit.	Wide	4
Brachypodium sylvaticum					+							Euro-Sib..	Wide	3
Briza media	+				+							-	N Tr.	3
Bromus japonicus ssp. japonicus						+						-	Wide	4
B. tectorum	+							+				-	Wide	4
Catabrosa aquatica								+				-	Wide	3
Cynodon dactylon var. plur.			+									-	Wide	3
Cynosourus echinatus	+							+				Medit.	Out Tr.	3
Dactylis glomerata ssp. hispanica	+				+	+						-	Wide	3
Elymus elongatus ssp. elogatus									+			-	NW, S Tr.	1
E. elogatus ssp. turcicus								+				-	Wide	1
E. flaccidifolius								+				E Medit.	W Tr.	1
E. pycnanthus									+			Medit.	NW, SE Tr.	2
Festuca valesiaca					+	+						-	Wide	3
Holchus lanatus									+			Euro-Sib..	N, W Tr.	2
Hordeum bulbosum	+							+				-	Wide	3
H. murinum ssp. glaucum	+			+								-	Wide	3

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
Imperata cylindirica var. cylindirica									+			-	Out Tr.	3
Lolium multiflorum								+				-	Wide	2
L. perenne	+							+				Euro-Sib..	Wide	3
L. rigidum var. rigidum								+				-	Wide	2
Molineriella minuta									+			Medit.	NW, W Tr.	2
Parapholis incurva									+			-	Out. Tr.	2
P. pycnantha								+				-	N Tr.	2
Phacelurus digitatus								+				E Medit.	NW, S Tr.	2
Phleum subulatum ssp. subulatum						+						-	Wide	3
Phragmites australis	+							+		+		Euro-Sib..	Wide	5
Poa bulbosa					+	+						-	Wide	4
P. trivialis	+							+				-	Wide	3
Polypogon viridis								+				Euro-Sib..	Wide	3
Setaria viridis			+									-	Wide	4
Tragus racemosus									+			-	N, SW Tr.	2
Triticum baeoticum ssp. baeoticum				+								-	NW, Mid. Tr.	1
Vulpia fasciculata									+			Medit.	Wide	2
IRIDACEAE														
Gladiolus italicus			+		+							-	Wide	3
JUNCACEAE														
Juncus acutus	+								+			-	Out Tr.	5

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Nispi Bolluk
J. articulatus	+							+				Euro-Sib..	Wide	3
J. gerardii ssp. libanoticus								+				Ir.-Tur.	Wide	2
J. heldreichianus ssp. heldereichianus	+							+				E Medit.	W, S Tr.	2
J. themarsi								+				Medit.	NW Tr.	2
Luzula forsteri					+							Euro-Sib..	Wide	3
LILIACEAE														
Allium amethystinum			+	+	+							Medit.	Wide	2
A. atropurpureum			+				+					Euro-Sib..	NW Tr.e	2
A. guttatum ssp. sardoum					+							Medit.	Wide	2
Asparagus acutifolius	+				+							Medit.	NW, W, S Tr.	3
Muscari comosum	+				+							Medit.	Wide	3
M. neglectum	+				+							-	Wide	3
Ornithogalum pyrenaicum						+						-	Wide	3
O. umbellatum	+		+									-	Wide	3
Ruscus aculeatus var. angustifolia	+				+							-	NW, S Tr.	3
Scilla autumnalis	+							+				Medit.	Out Tr.	4
Smilax excelsa	+				+							Eux.	Wide	3
Tulipa orphanidea			+									E Medit.	N Tr.	2
ORCHIDACEAE														
Epipactis helleborine					+							-	Wide	3
Orchis laxiflora								+				Medit.	Out. Tr.	2

	Site	*	1	2	3	4	5	6	7	8	9	Flora Region	Spread in Turkey	Relative Abundance
O. morio ssp. morio					+							-	N Tr.	2
O. papilonacea var. rubra							+					Medit.	Out Tr.	2
O. tridentata					+							Medit.	Out Tr.	2
POTAMOGETONACEAE														
Groenlandia densa	+									+		Euro-Sib..	Wide	3
Potamogeton gramineus	+									+		-	N, Mid. Tr.	3
P. nodosus	+									+		-	Wide	2
P. pectinatus	+									+		-	Wide	2
TYPHACEAE														
Typha latifolia	+									+		-	NW, Mid Tr.	5