

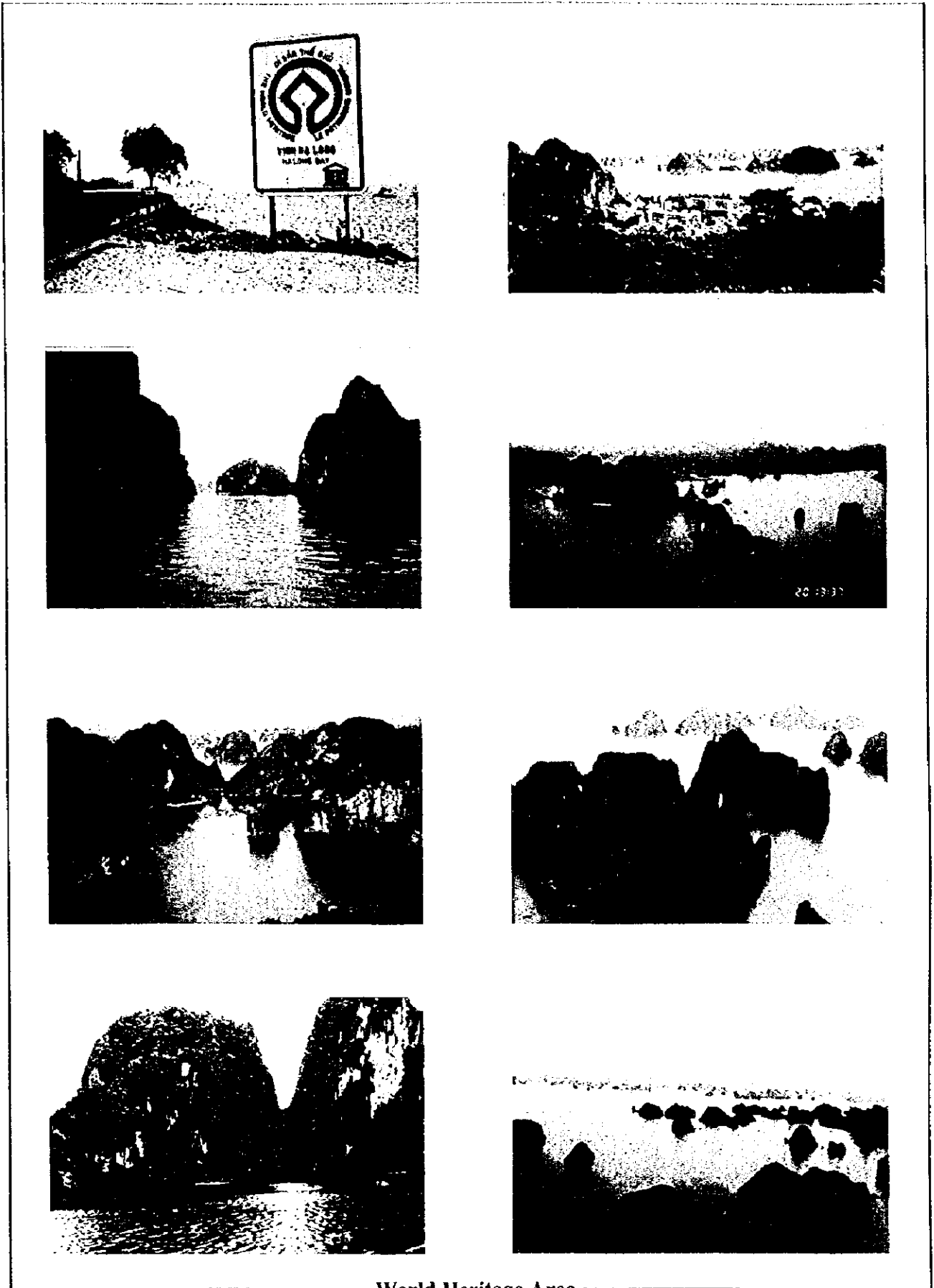
PART IV
PHOTOS

Part IV Photos

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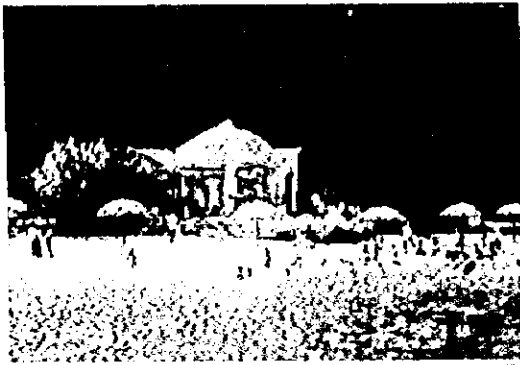
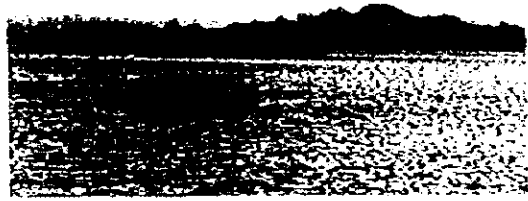
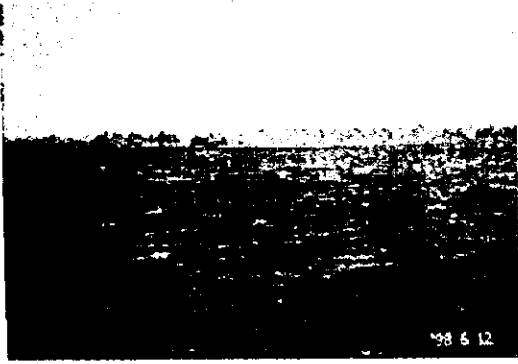
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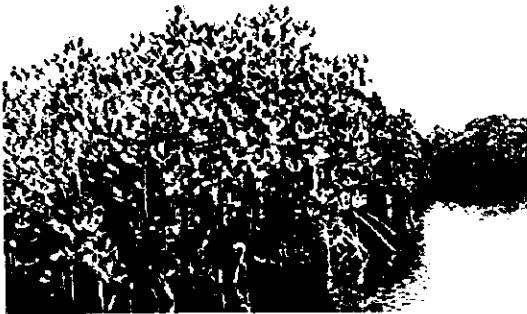
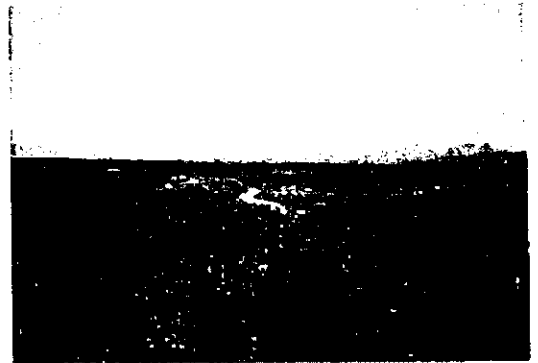
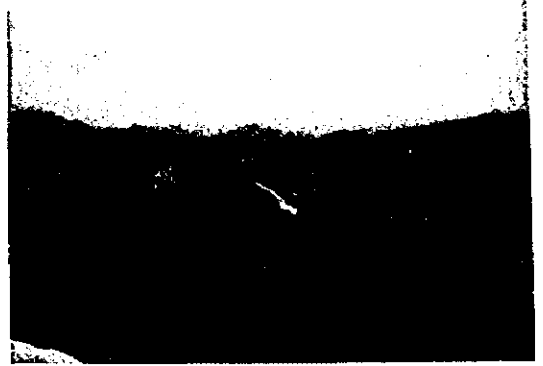
World Heritage Area

Photo 1 World Heritage Area (1)



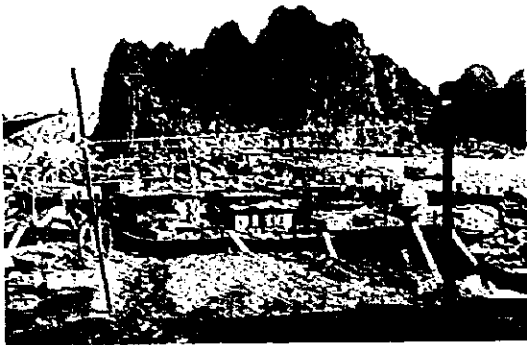
World Heritage Area

Photo 2 World Heritage Area (2)



Mangrove Swamps & Tidal Flats

Photo 3 Mangrove Swamps & Tidal Flats

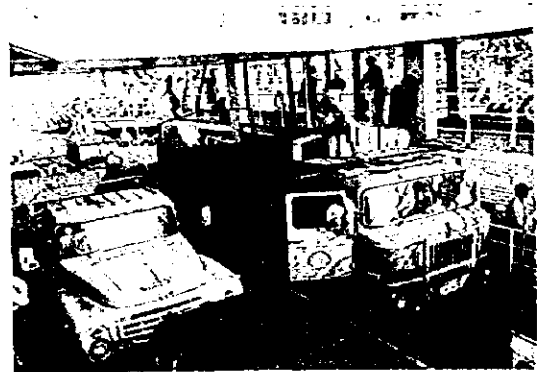
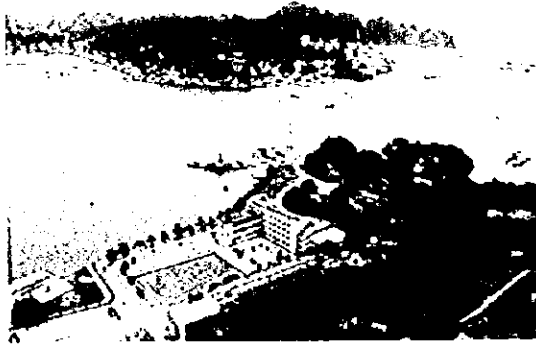


Residents on the Sea



Market

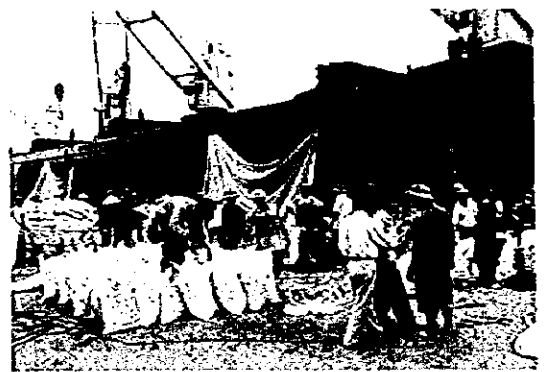
Photo 4 Residents on the Sea & Market



Cua Luc Strait and Ferry Transportation

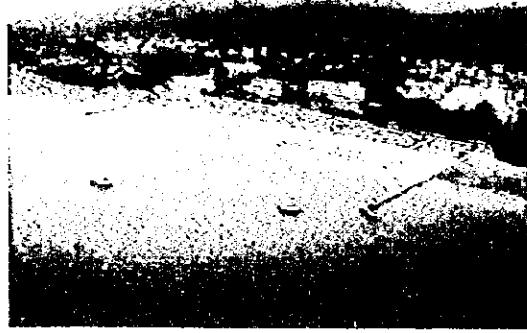


Large Cargo Ship Mooring on Ha Long Bay



Cai Lan Port

Photo 5 Cua Luc Strait & Cai Lan Port

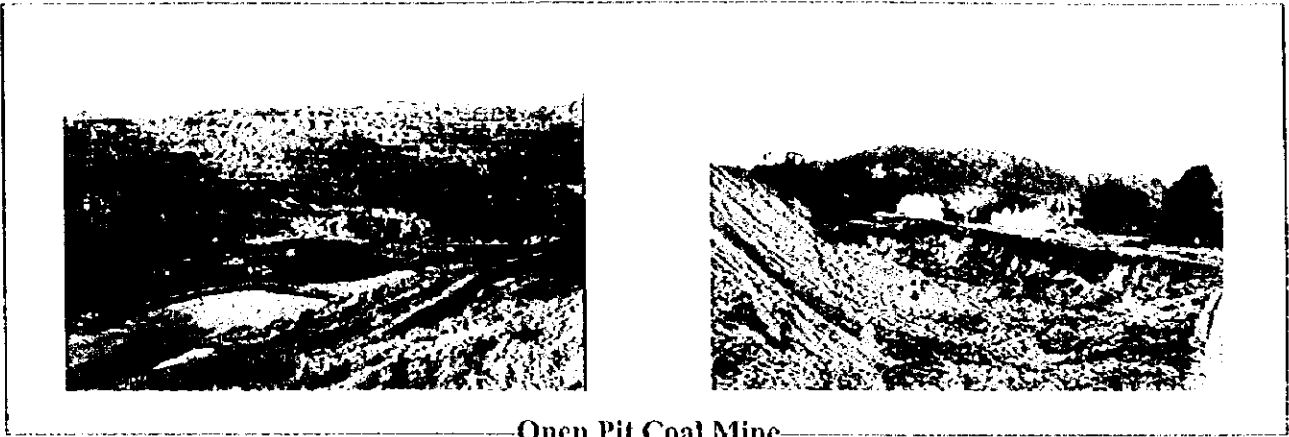


Bai Chay Beach and Tourism Development



Bai Chay Bay

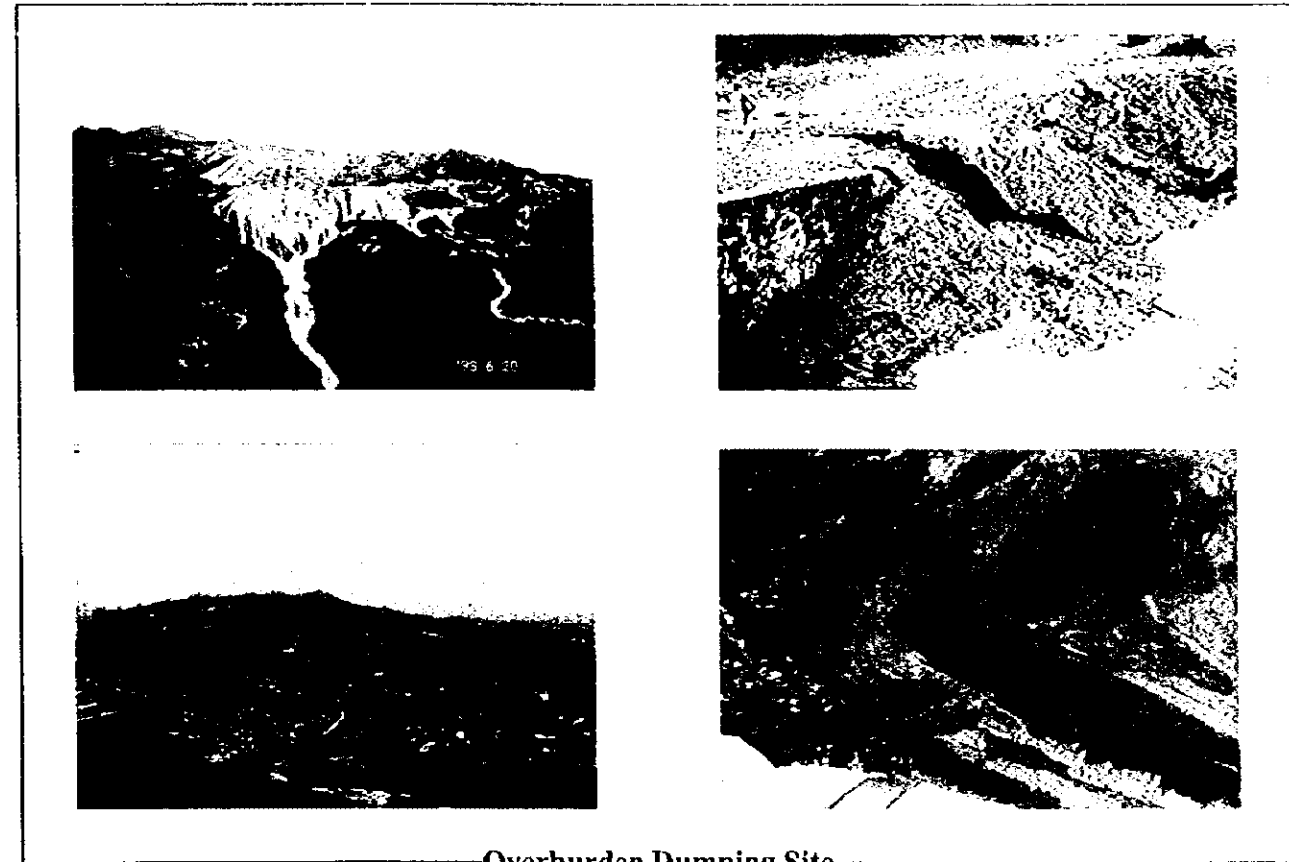
Photo 6 Bai Chay Area



Open Pit Coal Mine



Underground Coal Mine

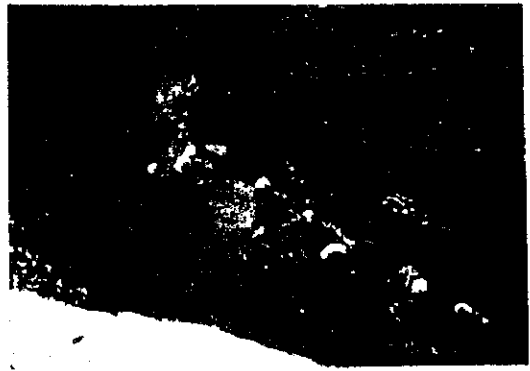


Overburden Dumping Site

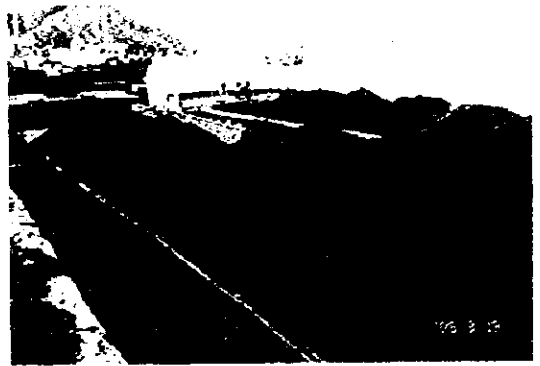
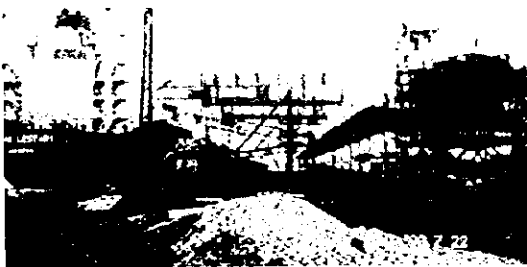
Photo 7 Coal Mining (1)



Coal Processing Plant

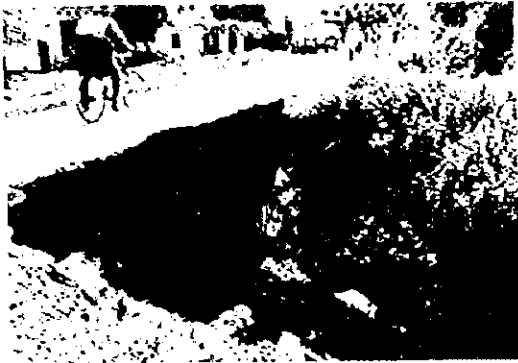
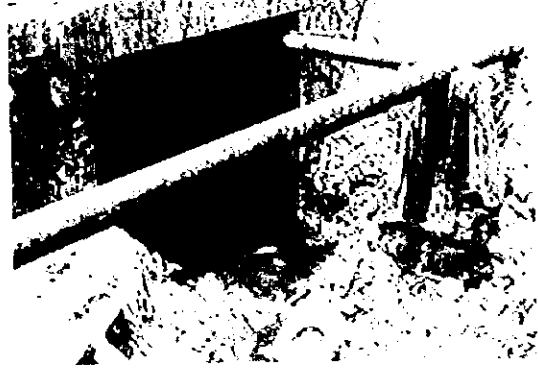


Overburden and Downstream

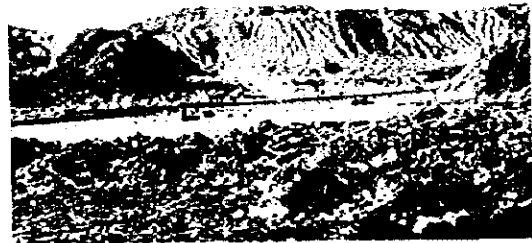
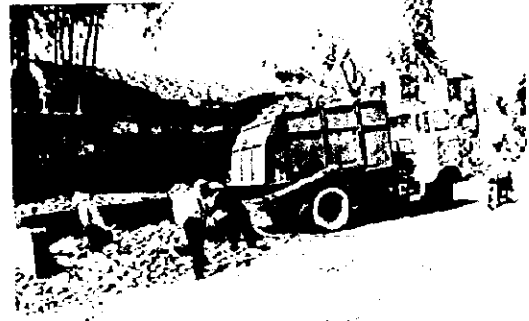


Coal Port

Photo 9 Coal Mining (3)



—Drainage (Domestic Wastewater)—

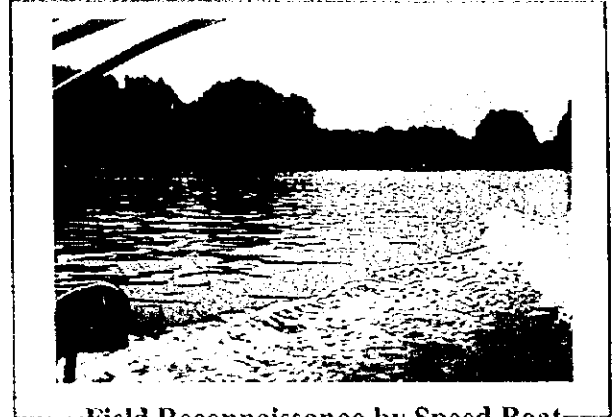


—Solid Wastes Collection and Dumping Site—

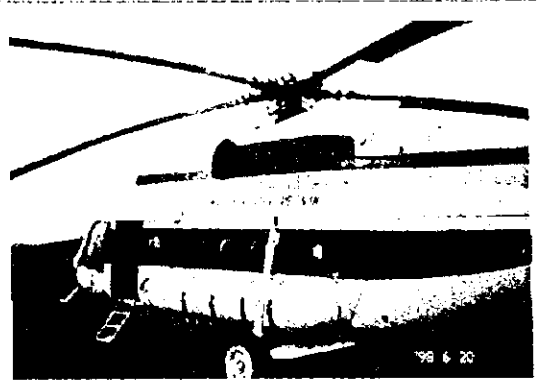
Photo 10 Drainage and Solid Wastes



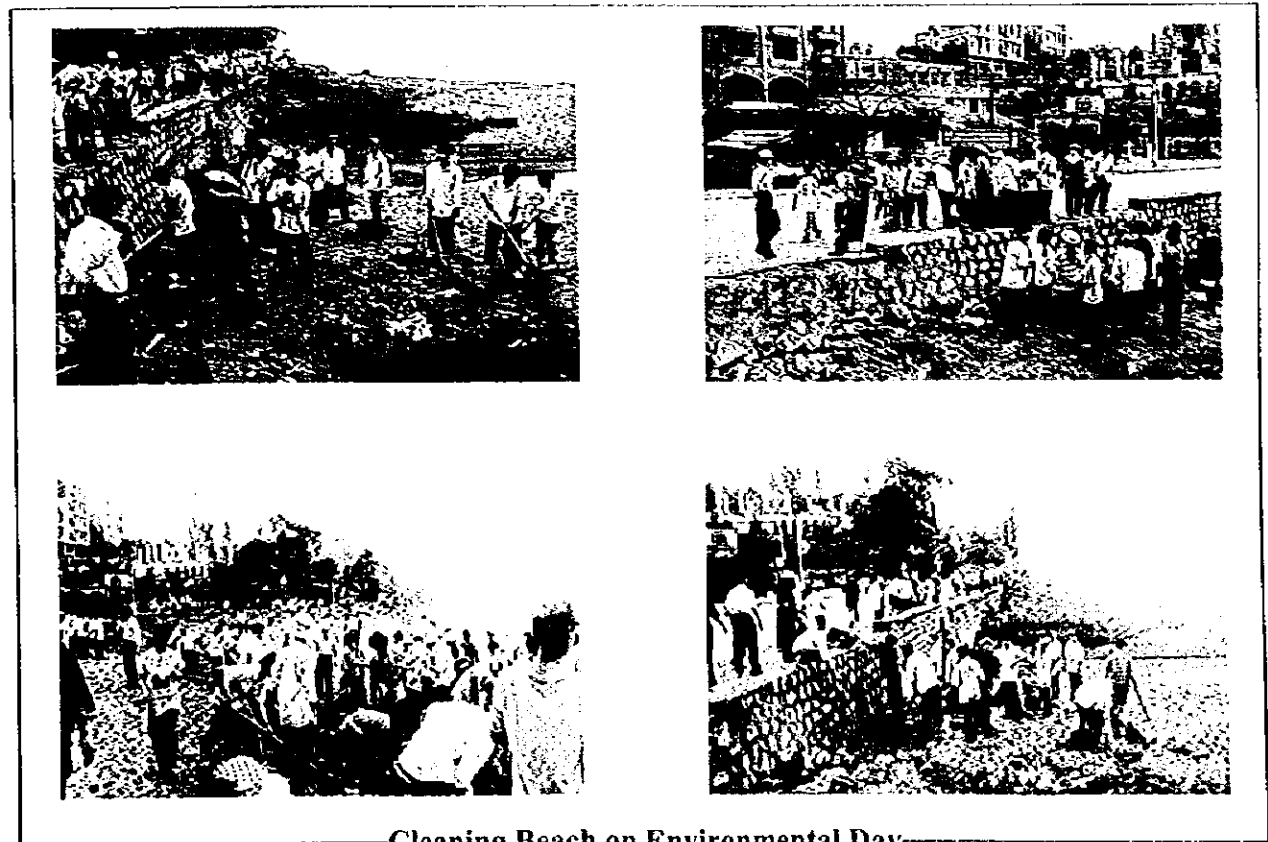
Field Reconnaissance at Coal Mining Site



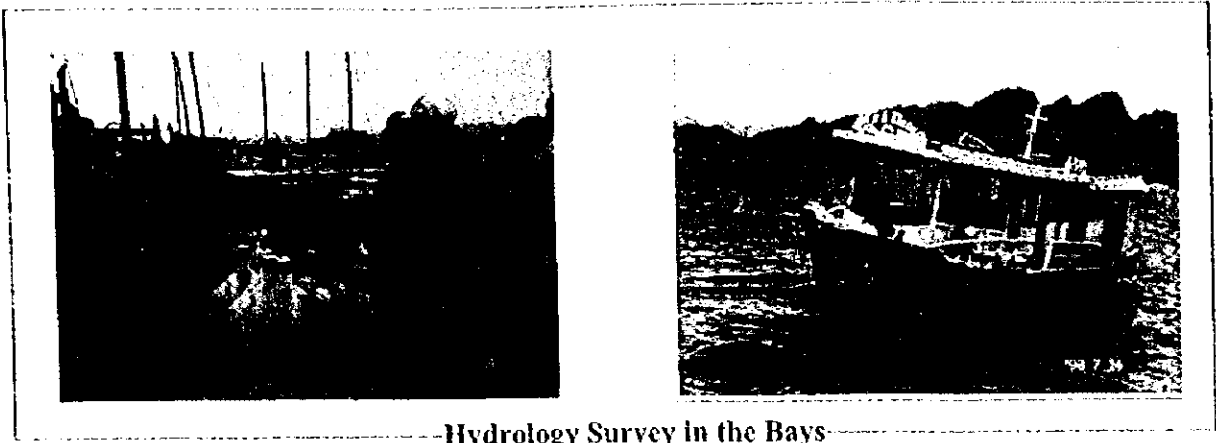
Field Reconnaissance by Speed Boat



Field Reconnaissance by Helicopter



Cleaning Beach on Environmental Day



Hydrology Survey in the Bays

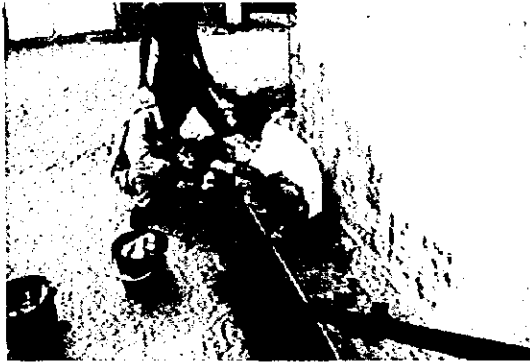
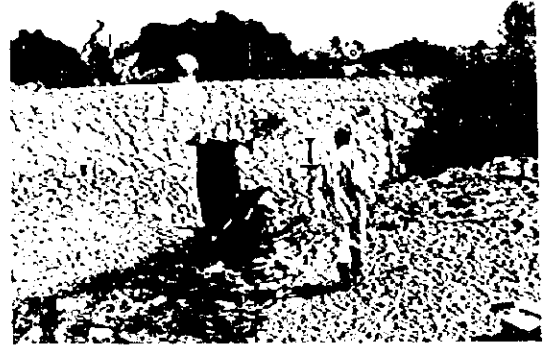


Water Quality Survey in the Rivers

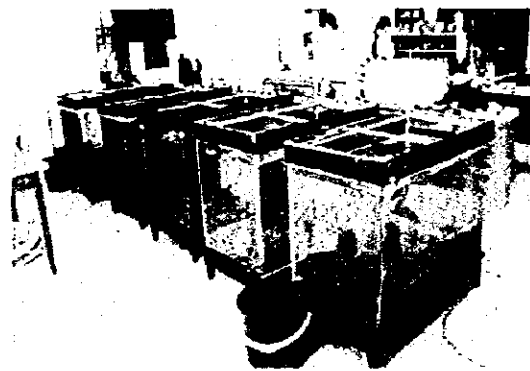
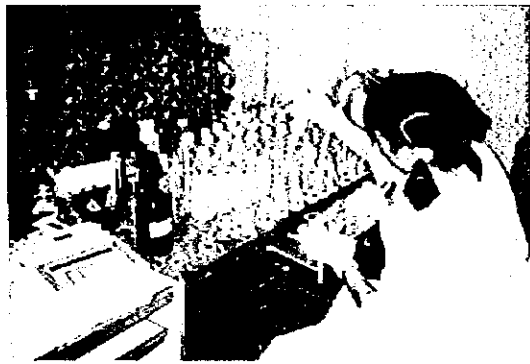


Water Quality Survey in the Bays

Photo 12 Field Survey (1)

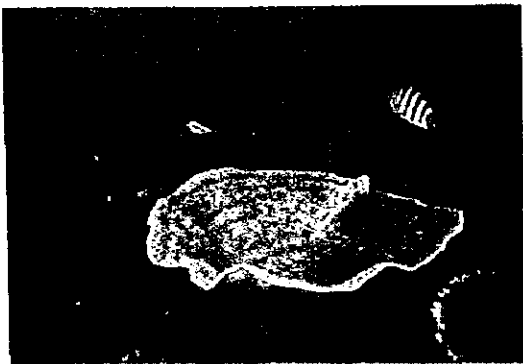


Water Quality Survey at Pollution Sources



Analysis and Test of Water Quality in Laboratory

Photo 13 Field Survey (2)



—Biological Industries Survey—

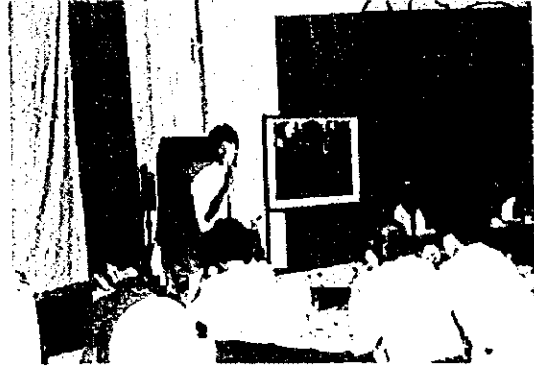
—Dust Survey—

Photo 14 Field Survey (3)

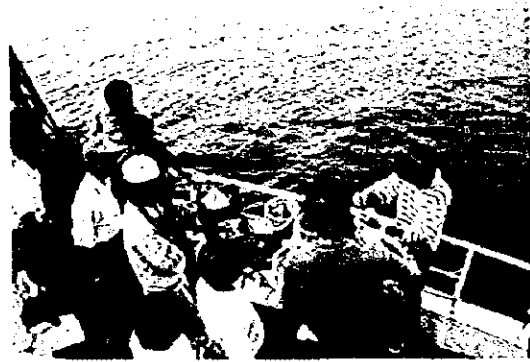


Questionnaire Survey

**Photo 15 Questionnaire Survey on
Willingness to Pay for Environmental Value**

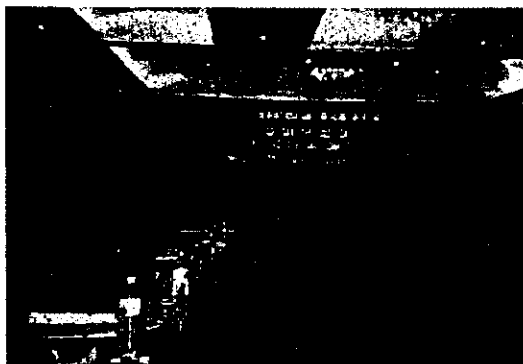
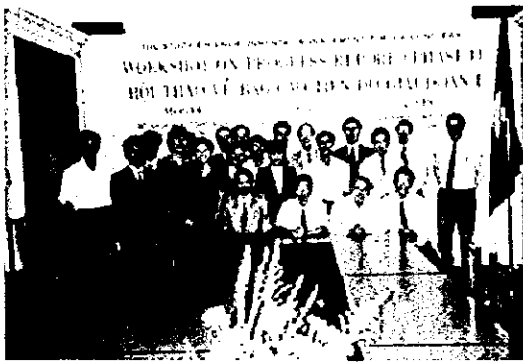
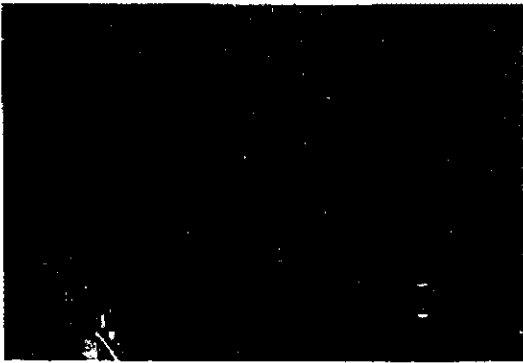


Mini Workshops



Training Programs

Photo 16 Mini Workshops & Training Programs



Steering Committee Meetings

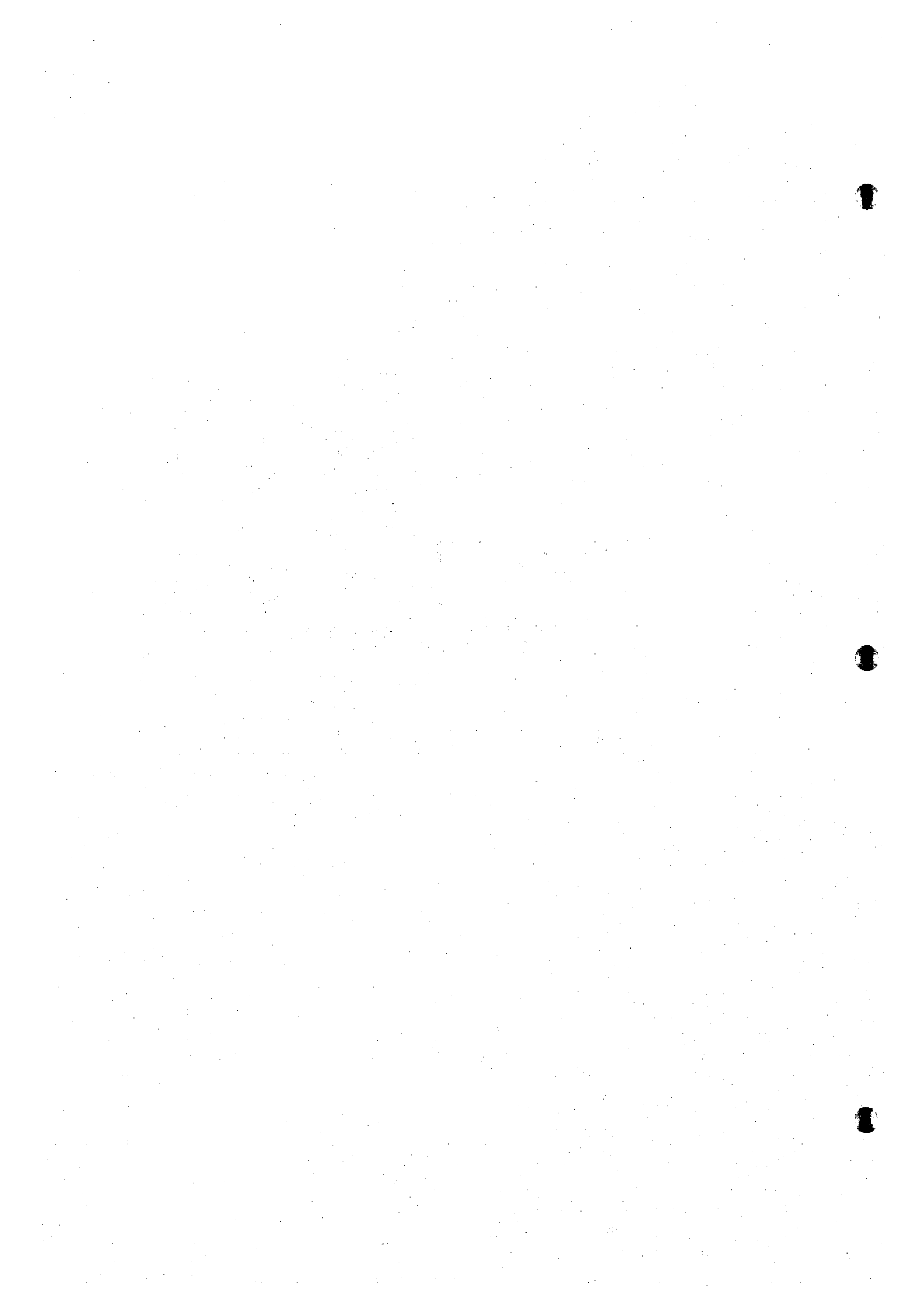
Photo 17 Steering Committee Meetings



Technology Transfer Seminar

Photo 18 Technology Transfer Seminar

APPENDIX
TORs OF FIELD SURVEY
AND
DUST SURVEY



TERMS OF REFERENCE
FOR
THE FIELD SURVEY
OF
THE STUDY ON ENVIRONMENT MANAGEMENT FOR
HA LONG BAY
IN THE SOCIALIST REPUBLIC OF VIETNAM

1. INTRODUCTION

Ha Long City is the largest city in Quang Ninh Province with approximately 140,000 of population and 122.5 km² of land area. Together with Hanoi City and Hai Phong City, it forms the North Focal Economic Area, or Triangle. Greater social and economic development of the area is anticipated. Ha Long Bay is located in the south of the rapidly growing Ha Long City and Cam Pha District, and is famous for the numerous islands and islets with peculiar geological characteristics. For its aesthetic seascape of these islands and islets, it is a major sightseeing spot in Vietnam, and was inscribed on the World Heritage List of UNESCO in 1994.

Ha Long Bay and its surrounding area are, thus, precious in terms of both natural environment and economic development. With the recent growth of the area, however, environmental destruction, such as water pollution and loss of natural environment, is getting serious. In particular, water pollution problems with domestic sewage, industrial wastewater, and mining wastewater are progressing rapidly in the Bai Chay and Cua Ong areas. With the anticipated growth of the industry and tourism, and accompanying increase in urban area, the environmental conditions of Ha Long Bay is expected to deteriorate rapidly in the future.

Therefore, the Study on Environmental Management Plan for Ha Long Bay (the Study) is needed to minimize the effects of proposed development on the valued natural features and to achieve environmentally sound socio-economic growth.

2. OBJECTIVES

The water body and natural environment in and around Ha Long Bay has been adversely affected by domestic and industrial effluent and waste, coal mining activities, fishery, irrigation, and forest and mangrove clearance. It is important to collect precise and current data to make appropriate environmental decisions. The tide conditions, water quality, bottom sediment, and biological surveys (the Survey) as a part of the Study will attempt to grasp the present environmental conditions in and around Ha Long Bay. It will bring forward the awareness of environmental issues, and then make understandings between the JICA Study Team and People's Committee of Quang Ninh Province (QNPC) to take better mitigation measures. The Survey will provide base level scientific data for establishing Environmental Management Plan for Ha Long Bay.

3. REQUIREMENTS

1) In principle, the methods and procedure of sampling, storing, transporting and analyzing are to be followed by "The Provisional Guidelines of NEA/MOSTE, 1997 : Vietnam Standards Methods (TCVN) for Marine Water Quality Sampling and Analysis, Surface Water Sampling and Analysis, and Air Quality Sampling and Analysis. The items which are not included these guidelines should be followed by Japanese Industrial Standards (JIS) or International Standards (ISO).

2) In the course of the Survey, supervise and technical instructions and advises for the sampling, field measurement and laboratory analysis shall be carried out by the JICA Study Team. The contractor shall follow these instructions and advises.

3) In line with the technical training of the counterpart personnel, sampling and field measurement will be carried out under the cooperation with the counterpart team members using equipment provided by the JICA Study Team. The contractor shall assist this technical training.

4) Necessary permissions and legal formalities related to the implementation of the Survey shall be taken by the contractor.

4. SURVEY AREA

The Survey area is Bai Chay Bay, Ha Long Bay, Bai Tu Long Bay (the Bays), and their hinterland such as Ha Long City and Cam Pha district.

Location of the field measurement and sampling points should be decided by means of a Global Positioning System (GPS). The exact location of the Survey points should be confirmed between the contractor and the JICA Study Team before commencement of the Survey.

5. SCOPE OF WORK

The contractor shall carry out the following Surveys.

5.1 Hydrology (Tidal current) Survey

1) Items

The tidal current direction and velocity should be measured by 2 layers (surface, bottom) simultaneously. Wind direction and velocity at the each Survey point should be measured by means of wind vane and anemometer at the time of inspections.

2) Points

The Survey points are off shore areas of Cua Luc strait, Cat Ba island, and Cua Ong area as shown in Figure 1. The points should be located apart from cays, islets, and reefs to avoid effects by them. The Survey should be implemented by two (2) layers ; two (2) m from the surface, two (2) m from the bottom.

3) Frequency

The Survey frequency is one (1) time. One Survey consists of continuous fifteen (15) days to cover the tidal range.

4) Method

- The tidal current measurement should be conducted by means of the current and direction meters being installed self-recording function. The data should be recorded every ten (10) minutes.
- The tidal current meters should be hung and left at each layer by using buoys and anchors to keep them at the exact depth ; two (2) m from the surface, two (2) m from the bottom, considering the tidal range.
- In order to ensure safety of the Survey, the buoy with a light or a flag as a sign should be connected with the meters set in the Bays. Necessary permissions and legal formalities shall be taken by the contractor.
- Inspection of the current and direction meters should be implemented throughout of the Survey.

5) Data arrangement

- Data taken by the current and direction meters should be arranged for harmonic analysis as shown in attachment-1.
- Velocity curve or holograph should be prepared based on the result of the measurement.
- The tidal level during the Survey period at the near observation stations should be collected.
- Methodology of the Survey and analysis should be identified and described in the reports.

5.2 Water Quality Survey

5.2.1 Bays

(1) Ambient Water Quality in the Bays

1) Items

The items to be measured and analyzed are tabulated in Table 1.

2) Points

The Survey points are in Bai Chay Bay, Ha Long Bay, and Bai Tu Long Bay (the Bays) as shown in Figure 2. The Survey should be implemented at twenty-seven (27) points by two (2) layers ; zero point five (0.5) m deep from surface, one (1) m above from the bottom.

3) Frequency

The Survey frequency is one (1) time. The Survey should be implemented during the tidal current Survey period.

4) Method

- Water samples should be taken by Van Don water sampler or the equivalent.
- Water temperature, salinity, pH, DO, TDS and transparency (by Secchi disk) should be measured at the sampling points. The other parameters should be analyzed at a laboratory.
- Depth of water, weather, wind direction and velocity (by wind vane and anemometer) , air temperature (by Assmann ventilated psychrometer or the equivalent), water color, existence of oil slicks or floating matters should be recorded at the time of sampling.

- Vertical distribution of water temperature and salinity at each sampling point should be measured by means of STD meter at the time of sampling. STD meter will be provided by the JICA Study Team.
- The samples to be brought into a laboratory should be stored in cool and dark conditions during the transportation.

5) Data arrangement

- Results of the Survey should be arranged into the tables with date and time of the Survey, tidal hour, and location maps.
- Methodology of field measurements and laboratory analysis should be identified and described in the reports.

(2) Pollution Mechanism in the Bays

1) Items

The test items to be implemented areas follows :

- Productivity test : Primary productivity rate by phytoplankton
- Decomposition test : Decomposition rate of organic matters
- Settlement test : Settling velocity/flux of organic particles such as detritus
- Elution test : Release rate from bottom sediment

2) Points

The Survey points are in Bai Chay Bay, Ha Long Bay, and Bai Tu Long Bay (the Bays) as shown in Figure 2. The Survey should be implemented at five (5) points.

3) Frequency

The Survey frequency is one (1) time.

4) Method

Following methods should be used for each test. The detailed methods of each test are described in attachment-2.

- Productivity test : Light and Dark (LD) bottle method *in situ*
- Decomposition test : Dark bottle method in laboratory
- Settlement test : Settlement sampler method *in situ*
- Elution test : Experimental water tank method in laboratory

Water temperature, salinity, pH, DO, TDS and transparency (by Secchi disk) should be measured at the sampling points. Vertical distribution of water temperature and salinity at each sampling point should be measured by means of STD meter at the time of sampling. STD meter will be provided by the JICA Study Team.

5) Data arrangement

- Results of the Survey should be arranged into the tables with date and time of the Survey, tidal hour, and location maps.
- Methodology of tests including field measurements and laboratory analysis should be identified and described in the reports.

5.2.2 Rivers

1) Items

The items to be measured and analyzed are tabulated in Table 1.

2) Points

The Survey points are in Mip, Trot, Man, Dien Von, Mong Duong rivers, and other streams (the Rivers) as shown in Figure 2. The Survey should be implemented at fifteen (15) points with one (1) layer, surface of the water.

3) Frequency

The Survey frequency is four (4) times consisting of two (2) times on rainy days and two (2) times fine or cloudy days.

4) Method

- Water samples should be taken from the main river course.
- Water temperature, salinity, pH, DO, and TDS should be measured at the sampling points. The other parameters should be analyzed at a laboratory.
- Weather, wind direction and velocity (by wind vane and anemometer), air temperature (by Assmann ventilated psychrometer or the equivalent), water color, existence of oil slicks or floating matters should be recorded at the time of sampling.
- Velocity of flow should be measured by a current meter (Price type or the equivalent) or a float. Area of flow section should be obtained by multiplying depth and width of the flow. The product of velocity of flow and area of flow section is the amount of water discharge (m^3/s).
- The samples to be brought into a laboratory should be stored in cool and dark conditions during the transportation.

5) Data arrangement

- Results of the Survey should be arranged into the tables with date and time of the Survey, tidal hour, and location maps.
- Methodology of field measurements and laboratory analysis should be identified and described in the reports.

5.2.3 Pollution sources

1) Items

The items to be measured and analyzed are tabulated in Table 1.

2) Points

The Survey points are in wastewater outlets (end-of-pipes) of selected industries including coal mining activities and leachate from solid waste disposal site, domestic wastewater drains. Details are as follows :

- Industrial wastewater : twenty (20) points (detailed locations shall be indicated by the JICA Study Team).
- Domestic wastewater : ten (10) points (3 in Bai Chay, 4 in Hong Gai, and 3 in Cua Ong areas, see Figure 3)

3) Frequency

The Survey frequencies are as follows :

- Industrial wastewater : one (1) time
- Domestic wastewater : four (4) times (morning:4-10, noon:10-16, evening:16-22, and night:22-4)

4) Method

- Water samples should be taken from the main of water course.
- Water temperature, salinity, pH, DO, and TDS should be measured at the sampling points. The other parameters should be analyzed at a laboratory.
- Weather, wind direction and velocity (by wind vane and anemometer), air temperature (by Assmann ventilated psychrometer or the equivalent), water color, smell, existence of oil slicks or floating matters should be recorded at the time of sampling.
- The water discharge (m³/s) should be measured at the time of sampling by measuring velocity of flow by a current meter or a float, by measuring weir, or by direct sampling.
- The samples to be brought into a laboratory should be stored in cool and dark conditions during the transportation.

5) Data arrangement

- Results of the Survey should be arranged into the tables with date and time of the Survey, and location maps.
- Methodology of field measurements and laboratory analysis should be identified and described in the reports.

5.3 Bottom Sediment Survey

1) Items

The items to be measured and analyzed are tabulated in Table 2.

2) Points

The Survey points are in the Bays as shown in Figure 4. The Survey should be implemented at ten (10) points. Samples should be taken from surface of the sea bed.

3) Frequency

The Survey frequency is one (1) time. The Survey should be carried out at the same time of the water quality survey.

4) Method

- Bottom sediment should be taken more than three times at each sampling points by means of Ekman sediment sampler or the equivalent. One bottom sediment sample should be a mixture of them.
- Temperature of sediment samples should be measured at the sampling points. Smell, quantity such as mud and sand, and color of sediment samples, and mixed matters such as coal fragment should be recorded at the time of sampling. The other parameters should be analyzed at a laboratory.
- The samples to be brought into a laboratory should be stored in polyethylene bags (or cases) with cool and dark conditions during the transportation.

5) Data arrangement

- Results of the Survey should be arranged into the tables with date and time of the Survey and location maps.
- Methodology of field measurements and laboratory analysis should be identified and described in the reports.

5.4 Biological Indicators

1) Items

Terrestrial vegetation, phytoplankton, zooplankton, benthos, fish and alga, coral reef, and mangrove as biological indicators should be surveyed. Details are as follows :

- Terrestrial vegetation : synoptic vegetation
- Mangrove : species, quality (stem size, height, density) distribution (locations and their extent)
- Phytoplankton : species composition, cell number of phytoplankton including microflagellates
- Zooplankton : species composition, settling volume, cell number
- Benthos : wet weight per area, individual number, species/taxonomic group composition
- Fish and alga : species, distribution (locations and their extent)
- Coral reef : species, quality (ratio of existing and extinction coral reef in a certain area), distribution (locations and their extent)

2) Survey area

The Survey areas are in the Bays and their catchment areas including the area facing the Bays in the Cat Ba Island. Details are as shown in Figures 5-7 and as follows :

- Terrestrial vegetation : whole catchment areas of the Bays including Cat Ba island
- Mangrove : catchment areas including intertidal zones
- Phytoplankton : ten (10) points with two (2) layers (surface, bottom)
- Zooplankton : ten (10) points
- Benthos : ten (10) points (same points as bottom sediments survey)
- Fish and alga : the Bays (fishery points and so on)
- Coral reef : the Bays

3) Frequency

The Survey frequency is one (1) time.

4) Method

The first step of biological indicators survey should be to undertake data collection including the previous surveys. Ecosystems, fauna and flora and their habitat types should be included. This data shall then be used to organize subsequent field reconnaissance, samplings, and hearing/inquirer surveys. The Survey should be organized to inventory biological indicators in the Survey area. The detailed Survey methods of each indicator are as follows :

- Terrestrial vegetation : field reconnaissance, inquiries/hearings to parties or person concerned (research institutes or agencies and their workers)
- Mangrove : ditto
- Phytoplankton : samples should be taken by plankton net and should be identified/analyzed at a laboratory.

- Zooplankton : samples should be taken by vertical haul of plankton net and identified/analyzed at a laboratory.
- Benthos : samples should be taken by Ekman bottom sediment sampler and identified/analyzed at a laboratory.
- Fish and alga : inquiries/hearings to fishermen and parties or person concerned (research institutes or agencies and their workers)
- Coral reef : field reconnaissance, and inquiries/hearings to fishermen, tourism industries and parties or person concerned (research institutes or agencies and their workers).

5) Data arrangement

- Results of the Survey should be arranged or compiled into the tables or figures with date and periods of the Survey. In particular, terrestrial vegetation, distributions of mangrove, alga, and coral reef should be drawn on the maps.
- Methodology of the Survey should be identified and described in the reports.
- Major and important areas or species (indicators) that signal the effects of degradation of ecosystem in and around of the Bays should be identified. In addition, common and dominants species should be taken into account.
- Endangered species, vulnerable species which are rare and/or low fecundity, and species to be subjected to economical valuables should be identified.

6. SURVEY PROGRAM

The contractor shall submit their detailed workplan, methodology, time schedule and cost estimation of the Survey as a technical proposal in English to the JICA Study Team. The overall Survey plan shall be approved by JICA, the JICA Study Team, and QNPC.

7. ORGANIZATION

The contractor shall organize the survey team consisting of team leader, experts of each sector such as hydrology, water quality and bottom sediment, and biological survey, and working staff. The following descriptions provide tasks and required background and qualifications of Team leader and each expert.

7.1 Team leader

1) General Tasks

The team leader shall carry out the following tasks.

- preparation of overall survey strategy and plan reflecting the JICA Study Team's objectives
- responsibility for overall supervision of the Survey and data analysis
- preparation of reports and explanation to the JICA Study Team

2) Required background and qualifications

Team leader should have college/university degree, in depth knowledge of his/her expertise, environmental survey and analysis, and be familiar with the general environmental condition

of the Survey area (at least fifteen (15) years experience). The candidate is to be an expert with writing and communications ability in English and experience in working with international experts.

7.2 Hydrology expert

1) General Tasks

The hydrology expert shall carry out the following tasks.

- preparation of program on tide conditions survey and necessary equipment
- implementation of tidal current measurement
- compilation of data and implementation of preliminary analysis of tidal current

2) Required background and qualifications

The candidate should have college/university degree, in depth knowledge of his/her expertise, hydrology (at least ten (10) years experience). He/she is expected to be familiar with the tide conditions in the Survey area. Good communication skill in English is required.

7.3 Water quality and bottom sediment survey experts

7.3.1 Survey expert for the Bays

1) General Tasks

The water quality and bottom sediment survey expert for the Bays shall carry out the following tasks.

- preparation of program on water quality and bottom sediment surveys, pollution mechanism tests, and necessary equipment for them
- implementation of the field survey, analysis of samples, and pollution mechanism tests
- compilation of data and implementation of preliminary analysis of water quality and bottom sediment

2) Required background and qualifications

The candidate should have college/university degree, in depth knowledge of his/her expertise, water quality and sediment surveys (at least ten (10) years experience). He/she is expected to be familiar with the water quality and sea bottom sediment conditions, and pollution mechanism in the Survey area., and to provide inputs to preliminary analysis required for. Good communication skill in English is required.

7.3.2 Survey expert for the Rivers

1) General Tasks

The water quality survey expert for the rivers shall carry out the following tasks.

- preparation of program on water quality survey in the Rivers and necessary equipment
- implementation of the field survey and analysis of samples
- compilation of data and implementation of preliminary analysis of water quality including water flow rate

2) Required background and qualifications

The candidate should have college/university degree, in depth knowledge of his/her expertise, water quality survey (at least ten (10) years experience). He/she is expected to be familiar with the water quality conditions in the Survey area., and to provide inputs to preliminary analysis required for. Good communication skill in English is required.

7.3.3 Survey expert for Pollution Sources

1) General Tasks

The water quality survey expert for Pollution sources shall carry out the following tasks.

- preparation of program on water quality survey and necessary equipment
- implementation of the field survey and analysis of samples
- compilation of data and implementation of preliminary analysis of water quality

2) Required background and qualifications

The candidate should have college/university degree, in depth knowledge of his/her expertise, water quality (at least ten (10) years experience). He/she is expected to be familiar with the water quality and sanitation conditions in the Survey area., and to provide inputs to preliminary analysis required for. Good communication skill in English is required.

7.4 Biological survey expert

1) General Tasks

The biological survey expert shall carry out the following tasks.

- preparation of program on biological survey and necessary equipment
- implementation of biological survey and identification/analysis of samples
- compilation of data and implementation of preliminary analysis of natural environment

2) Required background and qualifications

The candidate should have college/university degree, in depth knowledge of his/her expertise, biology/ecology (at least ten (10) years experience). He/she is expected to be familiar with the ecosystem in the Survey area. Good communication skill in English is required.

7.5 Working staff

Working staff shall carry out tasks required by the team leader and each expert. A background in environmental issues and good communication skill in English are required.

8. EQUIPMENT

1) The necessary sampling, measuring and analysis equipment, boats, and vehicles should be prepared by the contractor. Equipment which will be used for measuring and analysis must be calibrated according to their instruction manual.

2) All staff in charge of the sampling and field measurements on marine and river areas should wear a life-jacket. The life-jackets should be prepared by the contractor.

3) The equipment provided by the JICA Study Team such as STD meter should be returned to the JICA Study Team within 2 weeks after the completion of the Survey.

9. REPORTS

1) The contractor shall submit five (5) copies of the Progress Report before the 15th of July in English and five (5) copies of the Draft Final Report in English by the end of July, 1998. The Final Report, five (5) copies in English and five (5) copies in Vietnamese, must be submitted within one (1) week after receiving the comments from the JICA Study Team on the Draft Final Report, or not later than 15th of August, 1998.

2) All data should be submitted on diskettes in DOS text format.

3) Photograph showing the sampling points and field measurement scene should be taken and be attached in the Final Report.

10. SCHEDULE

The time schedule for the Survey is shown in Table 3.

Table 1 Water Quality (Bays, Rivers, Pollution sources)



Locations	Survey Items	Frequency	Points	Layers	Number of Samples	Methods
Bays	Temperature Salinity pH DO COD _{Mn} BOD ₅ TDS SS Turbidity NH ₄ -N NO ₂ -N NO ₃ -N T-N PO ₄ -P T-P Oil & grease	1	27	2	54	Samples should be analyzed in the fields and laboratory.
Rivers	-ditto- +Water Discharge +COD _r (except for Transparency, Fecal Coliform, Chl-a)	4*	15	1	60	-ditto- *2 times on rainy days 2 times on fine and cloudy days
Pollution sources (industrial wastewater)	-ditto- +Water Discharge +COD _r (except for Salinity, Fecal Coliform, Transparency, Chl-a)	1	20	1	20	-ditto-
Pollution sources (domestic wastewater)	Water flow Temperature pH COD _{Mn} COD _r BOD ₅ SS Coliform (Fecal Coliform)	4*	10	1	40	-ditto- *4 times mean samples are taken at morning, noon, evening, and night.

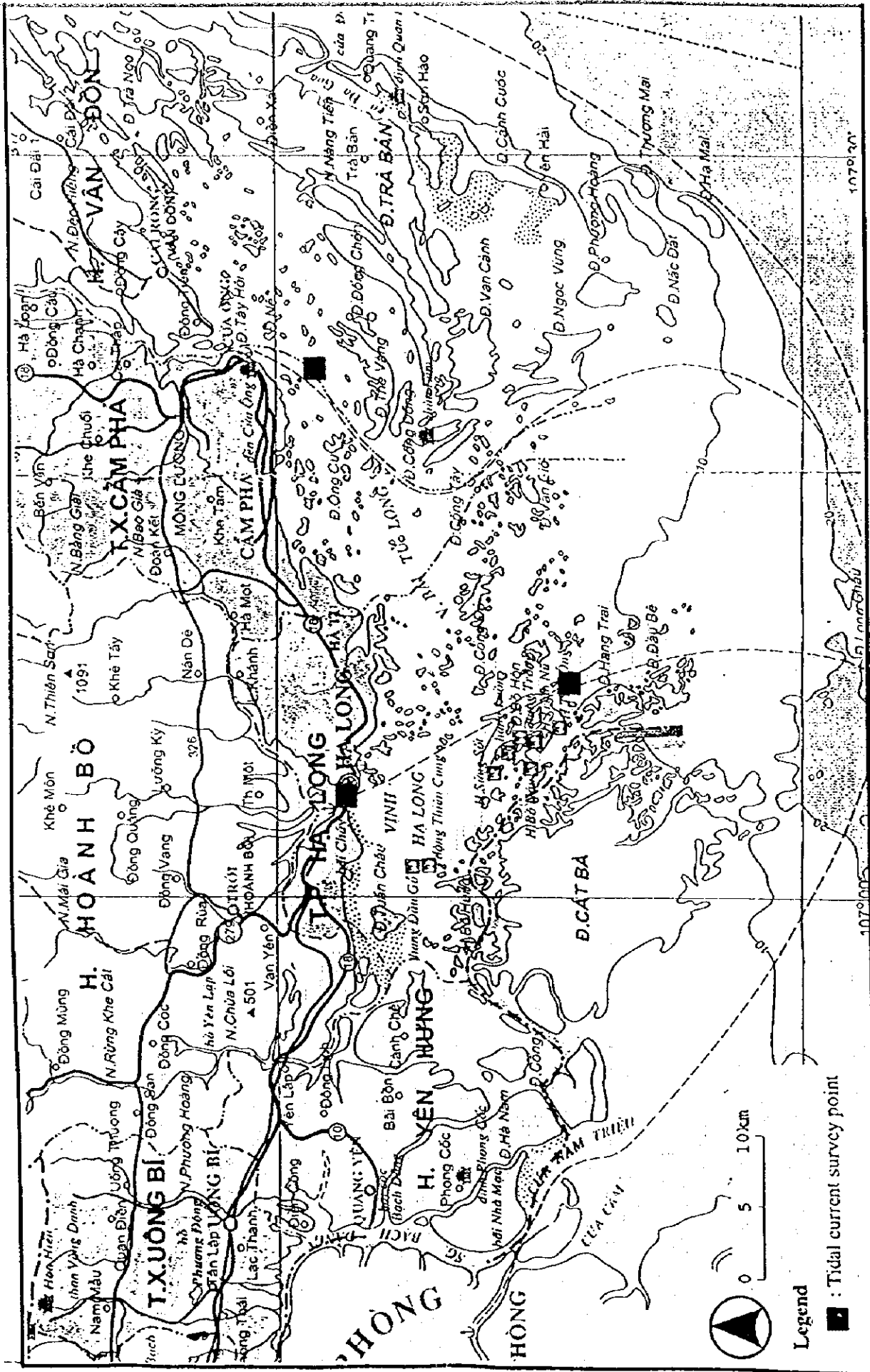
Table 2 Bottom Sediment

Survey Items	Frequency	Points	Layers	Number of Samples	Method
Temperature Smell Sediment quantity Color Mixed matters Size composition Water content pH COD _{sed} ORP Ignition loss	1	10	1	10	Samples will be taken by bottom sampler and analyzed at laboratory

Table 3 The Field Survey Schedule

Items	1998			
	June	July	August	September
I. Preparatory works (including data collection)				
II. Implementation of field survey				
1. Tide condition				
2. Water quality survey				
2.1 The Bays (ambient water quality)				
(pollution mechanism)				
2.2 The Rivers				
2.3 The pollution sources (domestic wastewater)				
(industrial wastewater)				
3. Bottom sediment survey				
4. Biological indicators survey				
4.1 Terrestrial vegetation				
4.2 Mangrove				
4.3 Phytoplankton				
4.4 Zooplankton				
4.5 Benthos				
4.6 Fish and alga				
4.7 Coral reef				
III. Data compilation and preliminary analysis				
IV. Report preparation				
Reports			△	△
			P/R	DF/R
				ER

Note:  works in the fields
 works in the laboratory or office



Tidal Current Survey Points

Figure 1

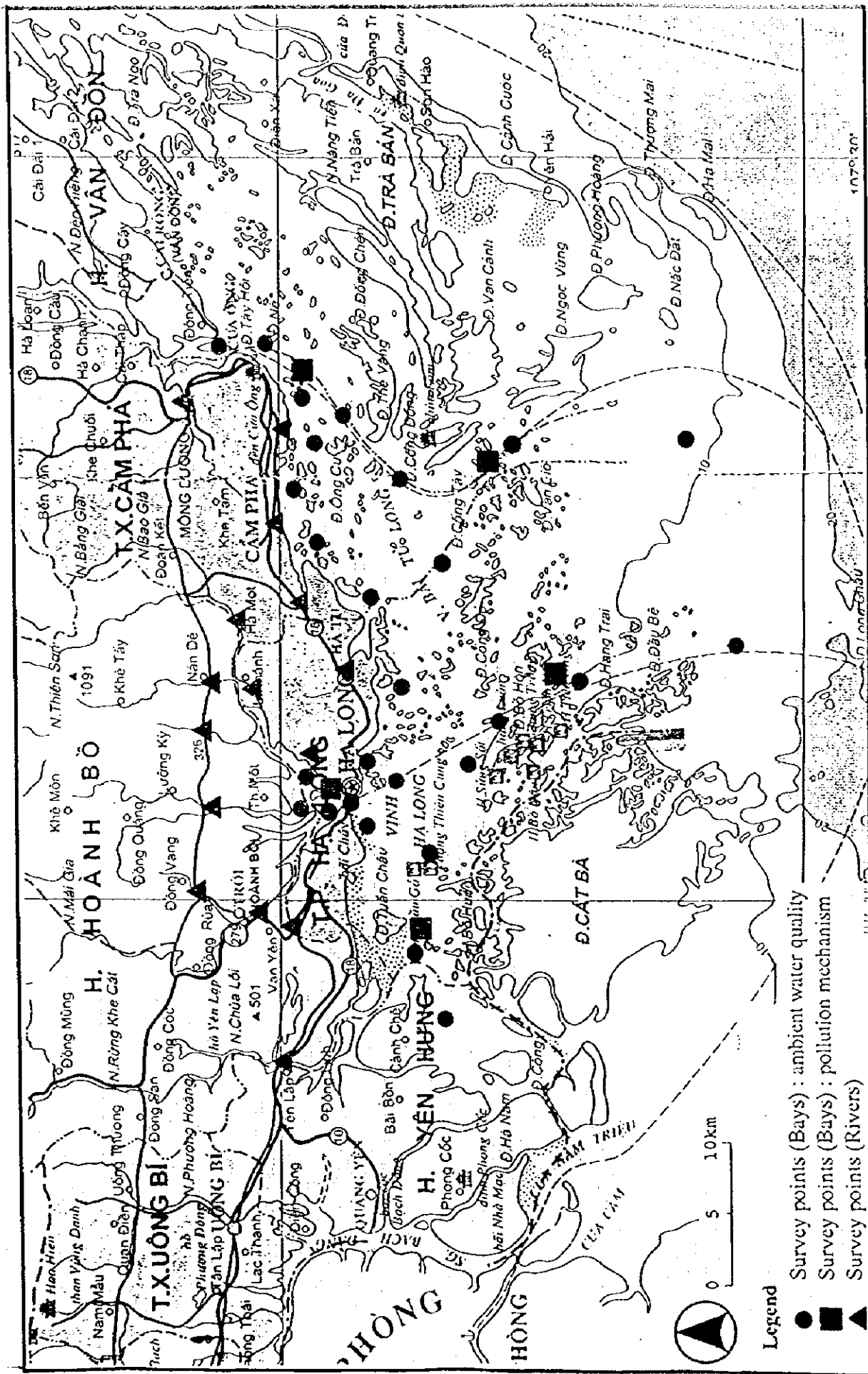


Figure 2 Water Quality Survey Points (Bays, Rivers)

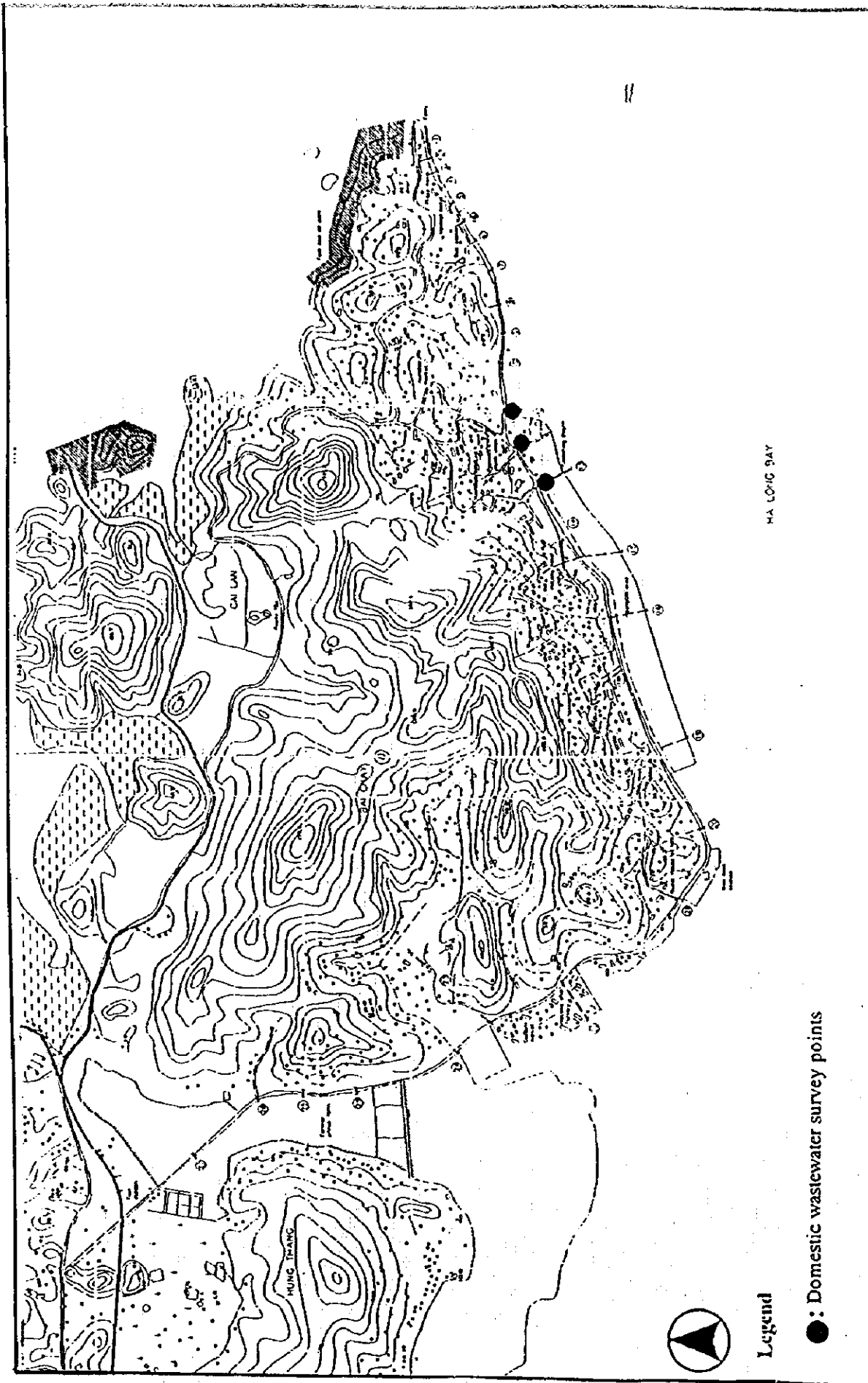
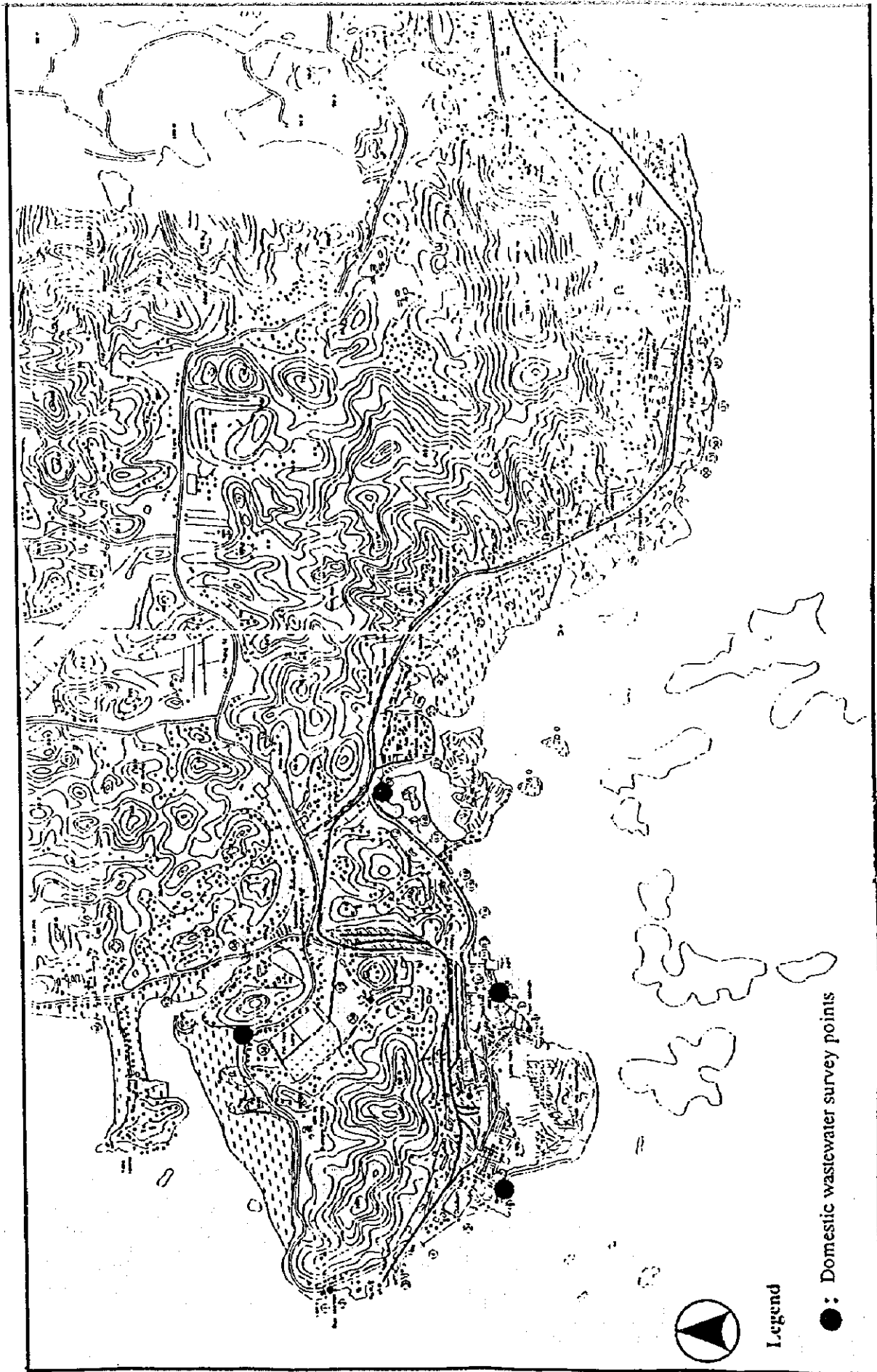


Figure 3 (1)
 Water Quality Survey Points (Pollution sources : domestic wastewater) : Bai Chay

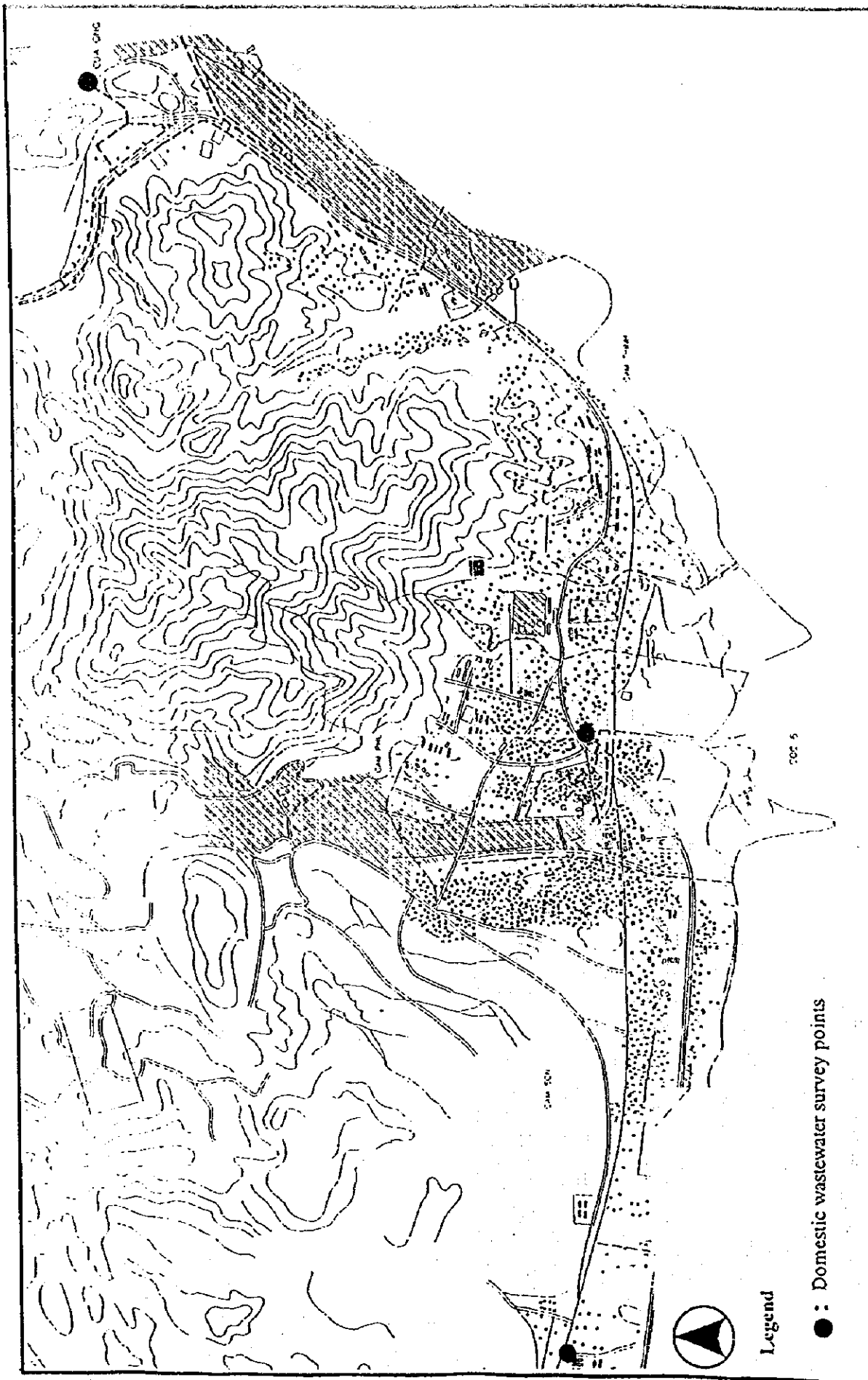


Water Quality Survey Points (Pollution sources :
domestic wastewater) : Hong Gai

Figure 3 (2)

Legend

● : Domestic wastewater survey points



Water Quality Survey Points (Pollution sources :
domestic wastewater) : Cua Ong

Figure 3 (3)

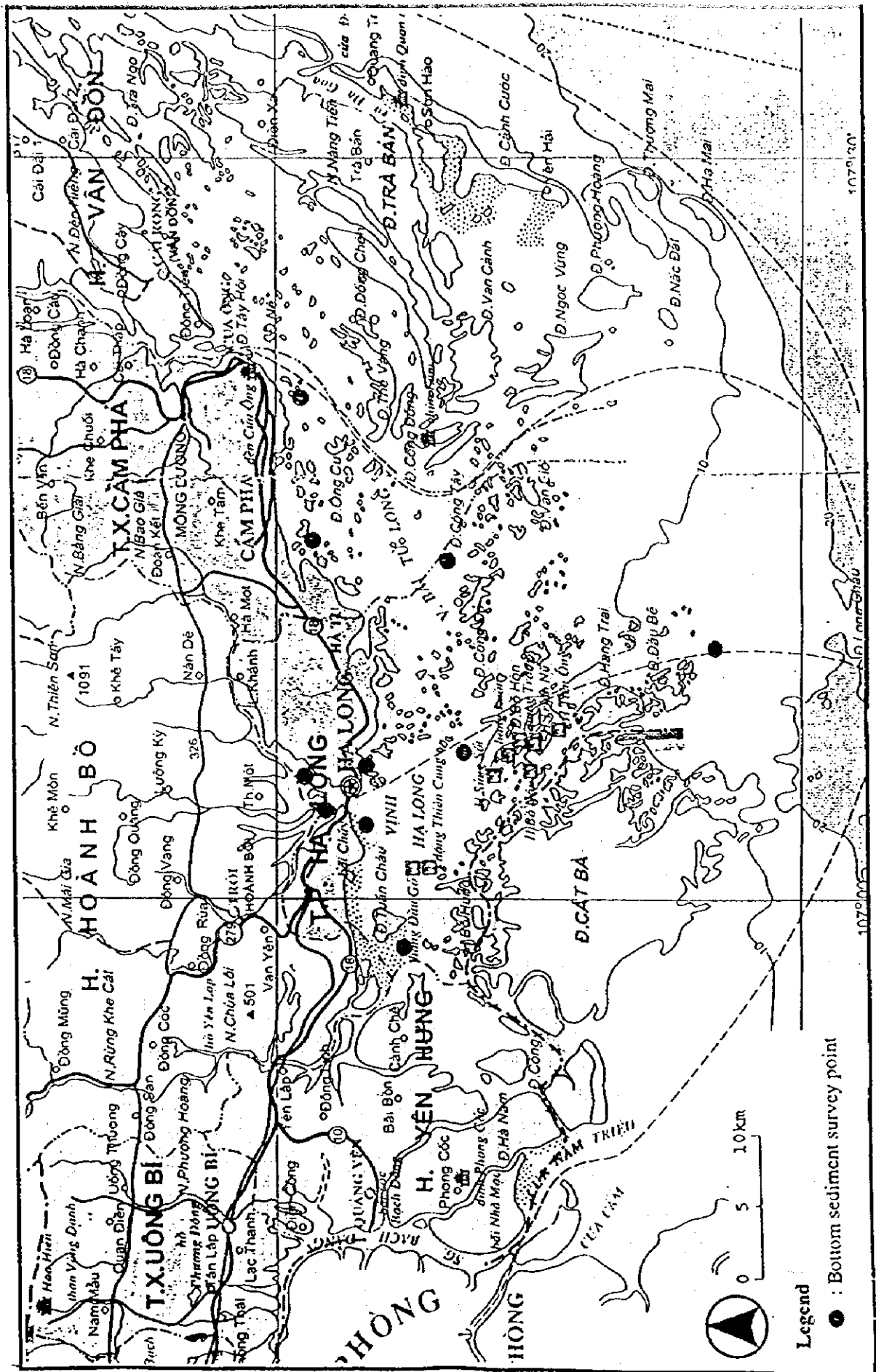


Figure 4 Bottom Sediment Survey Points

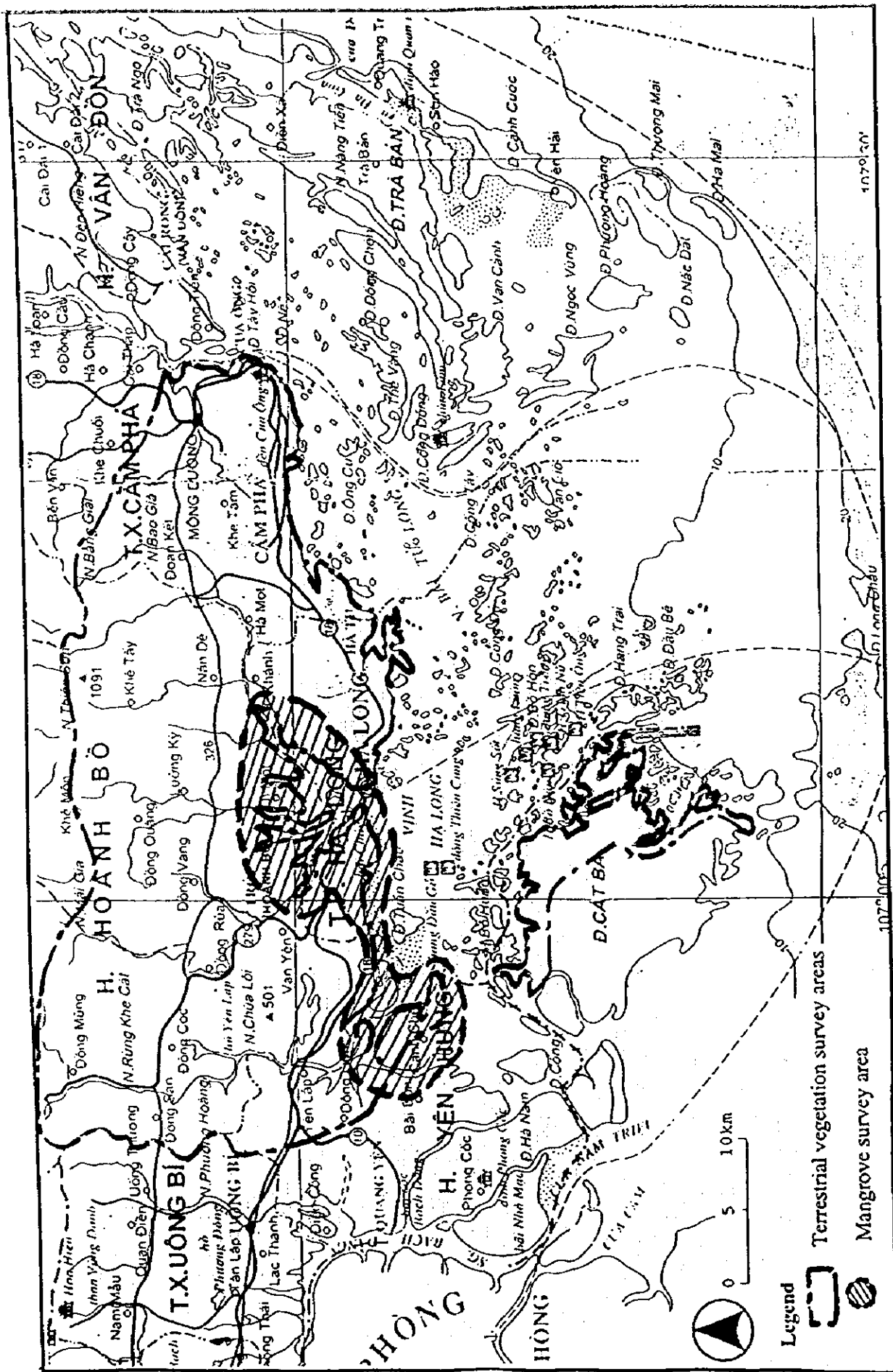


Figure 5 Biological Indicators Survey Areas (Terrestrial vegetation, mangrove)

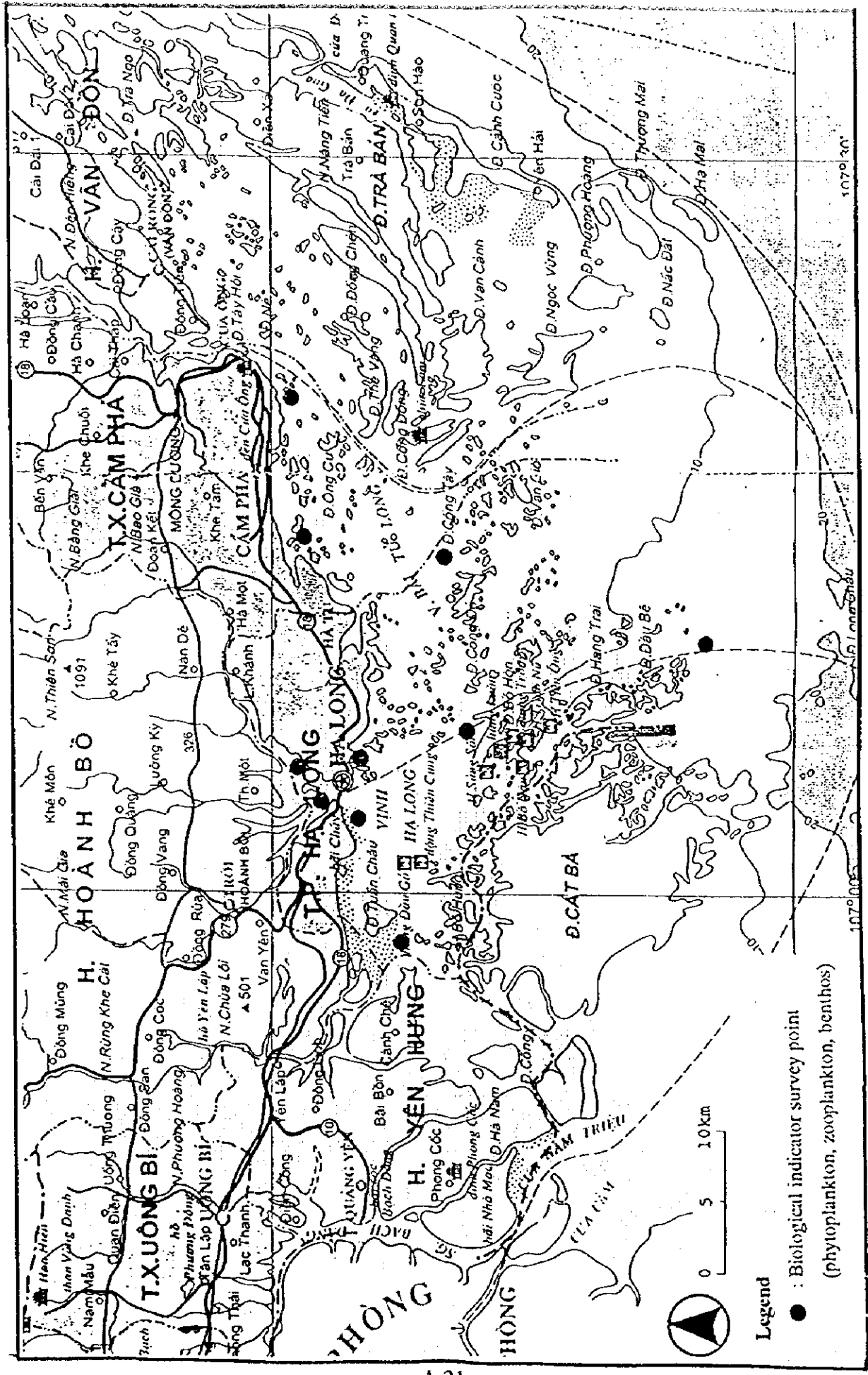


Figure 6
Biological Indicators Survey Points (Phytoplankton, zooplankton, benthos)

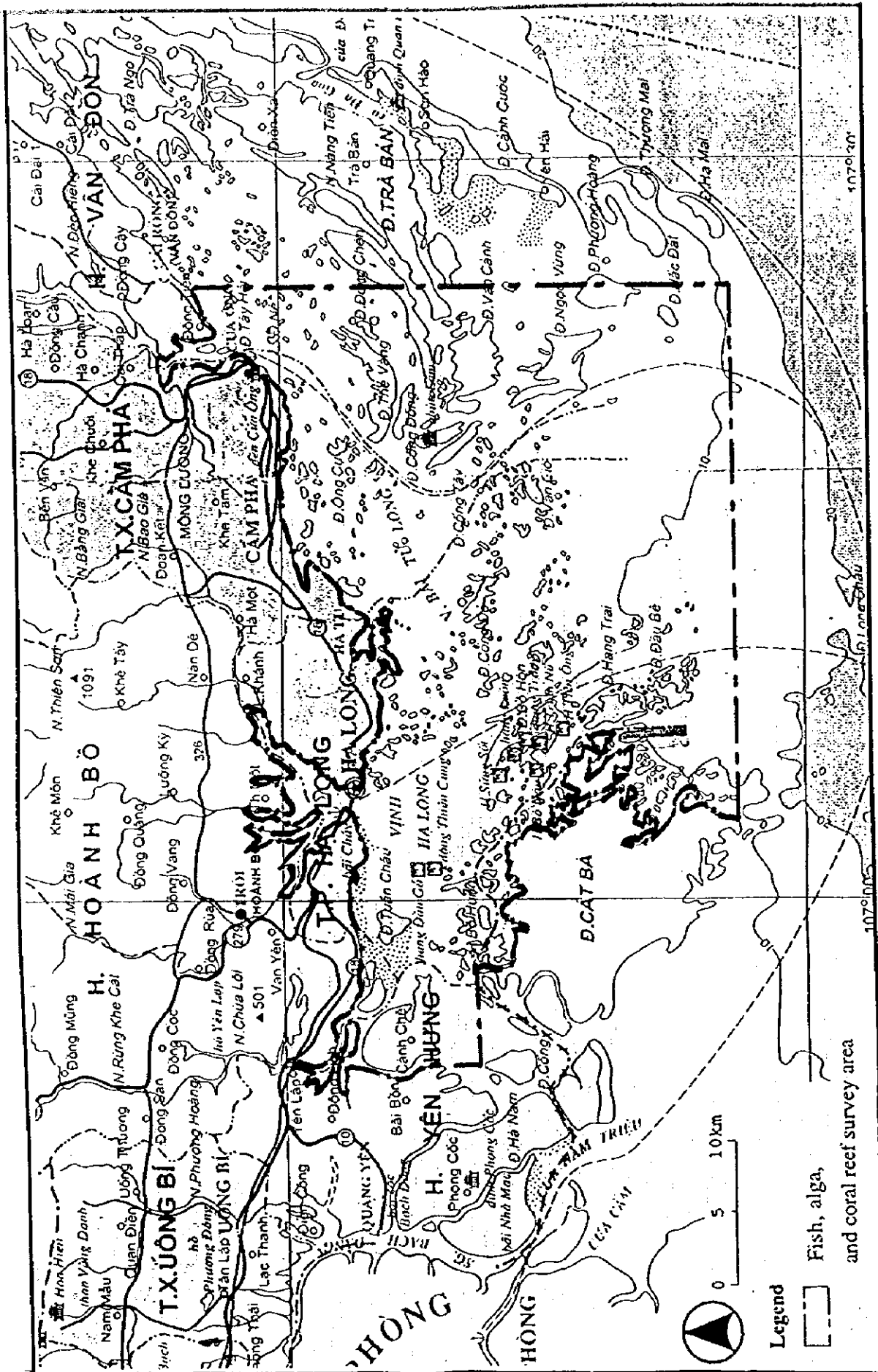


Figure 7 Biological Indicators Survey Areas (Fish and alga, coral reef)

Attachment-1 Arrangement of Tidal Current Data

Table A is the definition of the format of tidal current data for harmonic analysis by the JICA Study Team. The contractor should follow this definition for data arrangement of the results of the Survey. Table B is an example of arrangement of the tidal current data which followed the format.

Table A Format of Tidal Current Data for Harmonic Analysis

Row No.	Item	Length *	Column (fixed)	Note
1	Name of the area	a20	1 to 20	
	Name of the station	a5	21 to 25	
	Total depth (m)	f5	26 to 30	Depth of the station
	Measuring depth (m)	f5	31 to 35	Depth of the current meter
	Serial number of the equipment	i5	36 to 40	Serial number of the equipment for reference
	Sampling time interval (sec)	i5	41 to 45	
	Number of the sampled data	i5	46 to 50	Total number of the rows from row 3 to the end
	Magnetic declination (degree)	f5	51 to 55	Difference between geographic north and magnetic north
2	Year of the first sample	i5	1 to 5	
	Month of the first sample	i5	6 to 10	
	Day of the first sample	i5	11 to 15	
	Hour of the first sample	i5	16 to 20	0 to 23
	Minute of the first sample	i5	21 to 25	
	Longitude: degree	i5	26 to 30	Geographic location of the station
	Longitude: minute	i5	31 to 35	
	Longitude: second	i5	36 to 40	
	Latitude: degree	i5	41 to 45	
	Latitude: minute	i5	46 to 50	
Latitude: second	i5	51 to 55		
3	Serial number of the sampled data	i5	1 to 5	
	Blank	2	6 to 7	Blank for separation
	Month	i2	8 to 9	Time of the sampled data
	Day	i2	10 to 11	
	Hour	i2	12 to 13	
	Minute	i2	14 to 15	
	Reference number	f7	16 to 22	Only be used for Bergen type current meter
	Temperature (degree)	f7	23 to 29	Celsius
	Conductivity (mmho/m)	f7	30 to 36	(milli mho / meter)
	Salinity	f7	37 to 43	Practical Salinity
	Density (sigma-t)	f7	44 to 50	$= (\rho - 1) \times 1000 \text{ g/cm}^3$
	Direction of the current (degree)	f7	51 to 57	Clockwise from north
	Velocity (cm/s)	f7	58 to 64	
	East comp. of the velocity (cm/s)	f7	65 to 71	
North comp. of the velocity (cm/s)	f7	72 to 78		

* a: character, i: integer, f: real

Table B Example for Tidal Current Data Arrangement

TOKYO PORT			ST99 15.0		2.0 5187		10 2406		6.0	
1994	7	22	10	10	139	49	56	35	33	49
1	07221010	3382	27.43	39.44	23.85	14.22	335.78	11.01	-4.52	10.04
2	07221020	3382	27.43	39.54	23.92	14.26	322.16	10.40	-6.38	8.21
3	07221030	3382	27.40	39.55	23.94	14.29	347.12	18.08	-4.03	17.62
4	07221040	3382	27.75	39.74	23.89	14.15	351.92	13.20	-1.86	13.07
5	07221050	3382	27.83	39.80	23.89	14.12	337.17	11.07	-4.30	10.20
6	07221100	3382	27.93	39.69	23.77	14.00	330.45	11.36	-5.60	9.88
7	07221110	3382	27.93	39.68	23.76	13.99	326.09	14.35	-8.01	11.91
8	07221120	3382	27.98	39.77	23.80	14.01	349.56	13.96	-2.53	13.73
9	07221130	3382	28.17	40.05	23.88	14.01	336.74	24.16	-9.54	22.19
10	07221140	3382	28.25	40.33	24.03	14.09	333.68	23.26	-10.31	20.85
11	07221150	3382	28.23	40.18	23.94	14.03	346.33	23.94	-5.66	23.26
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Attachment-2 Methods of Pollution Mechanism Tests

1. Objectives

The pollutants that enter the Bays are subjected to various physical, chemical, and biological processes, such as advection, dispersion, primary production (internal production) which leads to eutrophication, degradation, sedimentation, and elution. When the organic pollution mechanism in the Bays is considered, material circulation in the Bays should be taken into consideration. In that case, productivity, decomposition, settlement, and elution rates of organic matters are necessary in addition to the inflow of organic matters directly or via rivers. The pollution mechanism tests consisting of productivity, decomposition, settlement, and elution tests (the Tests) will provide basic scientific data for water pollution mechanism study as well as for establishing water quality simulation model.

2. Tests items

The Tests to be implemented and items to be analyzed are as follows :

- Productivity test : Primary productivity rate by phytoplankton
- Decomposition test : Decomposition rate of organic matters
- Settlement test : Settling velocity/flux of organic particles such as detritus
- Elution test : Release rate from bottom sediment

3. Points

The Tests points are in Bai Chay Bay, Ha Long Bay, and Bai Tu Long Bay (the Bays) as shown in Figure 2. The Tests should be implemented at five (5) points.

4. Methods and equipment

The following methods should be used for each test. The detailed methods of each test are described below.

- Productivity test : Light and Dark (LD) bottle method *in situ*
- Decomposition test : Dark bottle method in laboratory
- Settlement test : Settlement sampler method *in situ*
- Elution test : Experimental water tank method in laboratory

4.1 Productivity test

(1) Method

- Light and Dark oxygen bottles should be used for the productivity test. Light oxygen bottles should be transparent ones. Dark oxygen bottles should be covered by aluminum foil or the equivalent to shut out the light.
- Water samples should be taken by Van Don water sampler or the equivalent by two (2) layers, at zero point five (0.5) m depth and one (1) m below from the Secchi disk reading depth.
- Three Light and Dark oxygen bottles should be filled up with water samples from

each depth, and then be submerged, hung and left at their original depths basically six (6) hours (see Figure A).

- Water temperature, pH, and DO of samples in each bottle should be measured before submergence and after six (6) hours (pulling them up).

(2) Equipment

Necessary equipment in the field is as follows ;

- Light oxygen bottles (250ml) : three (3) bottles/one (1) layer/point
- Dark oxygen bottles (250ml) : three (3) bottles/one (1) layer/point
- Thermometer, pH meter, DO meter, and Secchi disk : one (1) set
- Van Don water sampler : one (1) set
- Buoys, ropes (50 m) , two (2) bars (10m), weights (50 kg), wire (10m)/ point
- Boat : one (1) set

4.2 Decomposition test

(1) Methods

- Dark oxygen bottles should be used for the decomposition test. Dark oxygen bottles should be covered by an aluminum foil or the equivalent to shut out the light.
- Water samples should be taken by Van Don water sampler or the equivalent by two (2) layers, at zero point five (0.5) m depth and at one (1) m above from the bottom (at least one (1) m below from the Secchi disk reading depth).
- Seven (7) Dark oxygen bottles including reserves should be filled up with water samples from each layer, and then be brought into a laboratory and be kept basically at twenty five (25) degrees Centigrade.
- Water temperature, pH, DO, COD_{Mn}, T-N, NH₄-N, NO₂-N, NO₃-N, T-P, and PO₄-P of the samples should be measured immediately after sampling, and after one (1), three (3), seven (7), and fifteen (15) days.

(2) Equipment

Necessary equipment except for the field sampling and analytical apparatus is as follows ;

- Dark oxygen bottles (250ml) : seven (7) bottles/one (1) layer/point
- Thermostats or rooms with air conditioners to keep samples at twenty five (25) degrees Centigrade.

4.3 Settlement test

(1) Methods

- Settlement samplers should be used for the settlement test. A settlement sampler should be a cylindrical tube with internal diameter of zero point one (0.1) m and length of not less than zero point five (0.5) m or the equivalent.
- Settlement samplers should be hung and left at two (2) layers, one (1) m above

from the Secchi disk reading depth and one (1) m above from the bottom, basically twenty-four (24) hours (see Figure B). Three (3) samplers should be set at each layer.

- One test consists of five times samplings.
- Samples settled in the samplers should be brought into a laboratory in dark and cool conditions.
- SS as amount of settlements, COD_{Mn}, T-N, NH₄-N, NO₂-N, NO₃-N, T-P, PO₄-P, ignition loss of the samples should be measured.

(2) Equipment

Necessary equipment in the field is as follows ;

- Settlement samplers (D:0.1m, H:0.5m) : three (3) samplers/one (1) layer/point
- Buoys, ropes (50 m) , two (2) baskets, weights (50 kg), wire (10m)/ point
- Boat : one (1) set

4. 4 Elution test

(1) Methods

- Experimental water tank (the Tank) should be used for the elution test. The Tank should be a rectangle tank made of glass or acrylic resin with wide of zero point five (0.5) m, length of one (1) m, and depth of less than one (1) m or the equivalent. An aeration pump should be attached on the Tank (see Figure C).
- Bottom sediment samples should be taken by Ekman sediment sampler or the equivalent from the bottom bed. Water for the elution test should be taken by Van Don water sampler or the equivalent at one (1) m from the bottom of sampling points.
- Bottom sediment samples should be put on the bottom of the Tank gently with sediment depth of zero point one (0.1) m.
- The Tank should be filled up with water taken at one (1) m from the bottom of sampling points, and then be kept basically at twenty five (25) degrees Centigrade with aeration in a laboratory. DO should be maintained at certain value all the time.
- Water temperature, pH, DO, COD_{Mn}, T-N, NH₄-N, NO₂-N, NO₃-N, T-P, and PO₄-P of the water should be measured immediately after sampling, and after one (1), three (3), seven (7), and fifteen (15) days.

(2) Equipment

Necessary equipment except for the field sampling and analytical apparatus is as follows ;

- Experimental water tank (the Tank) : five (5) sets in total
- DO mater, aeration pump with flow rate counter : five (5) sets in total
- Thermostats or rooms with air conditioners to keep samples at twenty five (25) degrees Centigrade.

4.5 Field Measurements for the Tests

Water temperature, salinity, pH, DO, TDS and transparency (by Secchi disk) should be measured at the Tests points. Vertical distribution of water temperature and salinity at each sampling point should be measured by means of STD meter at the time of sampling. STD meter will be provided by the JICA Study Team.

5. Equipment

The necessary equipment for the Tests should be prepared by the Contractor.

6. Data arrangement

- Results of the Tests should be arranged into the tables with date and time of the survey, tidal hour, and location maps.
- Methodology of Tests laboratory analysis should be identified and described in the reports.

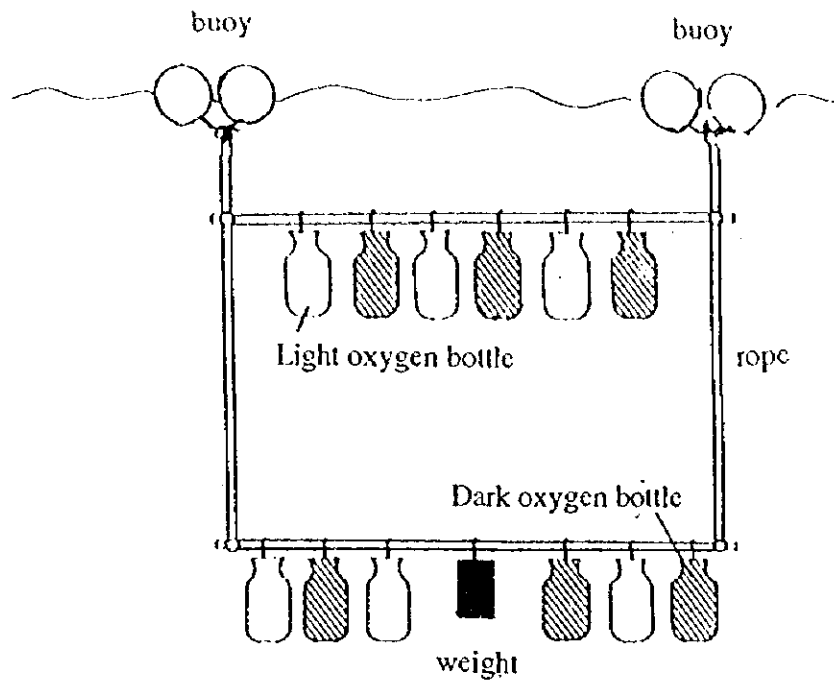


Figure-A Scheme for Productivity Test (Light and Dark bottles)

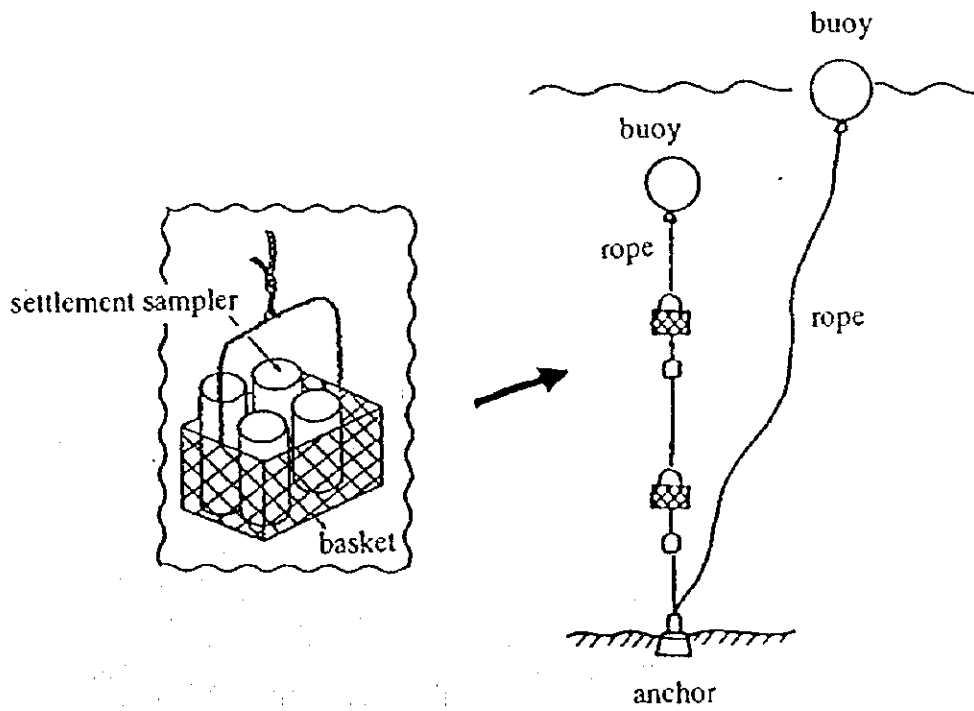


Figure-B Scheme for Settlement Test (Settlement Sampler)

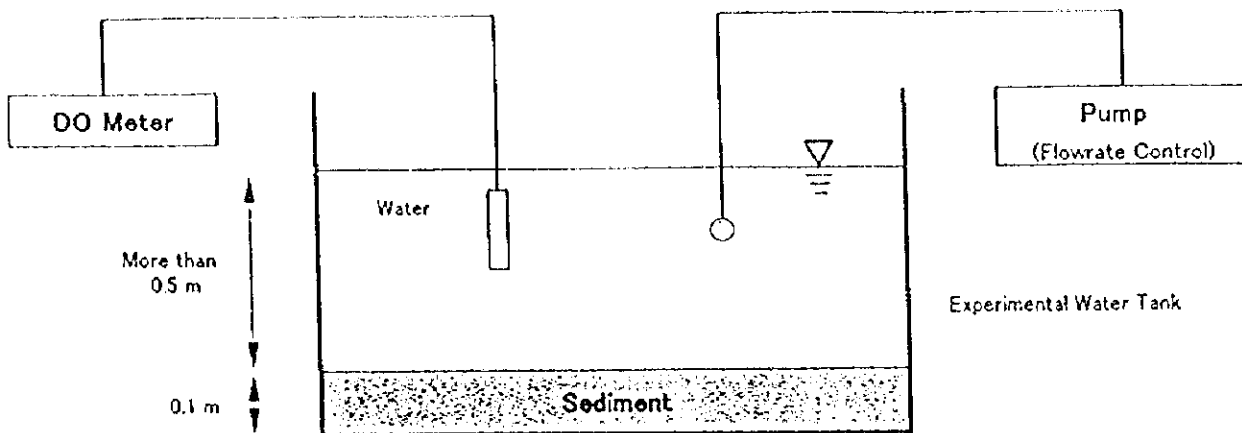


Figure-C Scheme for Elution Test (Experimental Water Tank)

**TERMS OF REFERENCE
FOR
THE DUST SURVEY
OF
THE STUDY ON ENVIRONMENT MANAGEMENT FOR
HA LONG BAY
IN THE SOCIALIST REPUBLIC OF VIETNAM**

1. INTRODUCTION

Ha Long City is the largest city in Quang Ninh Province with approximately 140,000 of population and 122.5 km² of land area. Together with Hanoi City and Hai Phong City, it forms the North Focal Economic Area, or Triangle. Greater social and economic development of the area is anticipated. Ha Long Bay is located in the south of the rapidly growing Ha Long City and Cam Pha District, and is famous for the numerous islands and islets with peculiar geological characteristics. For its aesthetic seascape of these islands and islets, it is a major sightseeing spot in Vietnam, and was inscribed on the World Heritage List of UNESCO in 1994.

Ha Long Bay and its surrounding area are, thus, precious in terms of both natural environment and economic development. With the recent growth of the area, however, environmental destruction, such as water pollution and loss of natural environment, is getting serious. In particular, water pollution problems with domestic sewage, industrial wastewater, and mining wastewater are progressing rapidly in the Bai Chay and Cua Ong areas. With the anticipated growth of the industry and tourism, and accompanying increase in urban area, the environmental conditions of Ha Long Bay is expected to deteriorate rapidly in the future.

Therefore, the Study on Environmental Management Plan for Ha Long Bay (the Study) is needed to minimize the effects of proposed development on the valued natural features and to achieve environmentally sound socio-economic growth.

2. OBJECTIVES

The water body in and around Ha Long Bay has been adversely affected by domestic and industrial effluent and waste, coal mining activities and so on. It is important to collect precise and current data to make appropriate environmental decisions. The tide conditions, water quality, bottom sediment, and biological indicators surveys (the Survey) as a part of the Study is being implemented to grasp the present environmental conditions in and around Ha Long Bay.

In the course of the Survey, necessity of dust survey has been grown up to grasp the water quality pollution mechanism. Normally, settled dust on the ground is flushed out by rain and flows into the Bays. Dust could be considered to be one of pollution sources.

It will bring forward the awareness of environmental issues, and then make understandings between the JICA Study Team and People's Committee of Quang Ninh Province (QNPC) to take better mitigation measures. The Survey will provide base level scientific data for establishing Environmental Management Plan for Ha Long Bay.

3. REQUIREMENTS

- 1) In principle, the methods and procedure of sampling, storing, transporting and analyzing are to be followed by "The Provisional Guidelines of NEA/MOSTE, 1997 : Vietnam Standards Methods (TCVN) for Air Quality Sampling and Analysis. The items which are not included these guidelines should be followed by Japanese Industrial Standards (JIS) or International Standards (ISO).
- 2) In the course of the Survey, supervise and technical instructions and advises for the sampling, field measurement and laboratory analysis shall be carried out by the JICA Study Team. The contractor shall follow these instructions and advises.
- 3) In line with the technical training of the counterpart personnel, sampling and field measurement will be carried out under the cooperation with the counterpart team members using equipment provided by the JICA Study Team. The contractor shall assist this technical training.
- 4) Necessary permissions and legal formalities related to the implementation of the Survey shall be taken by the contractor.

4. SURVEY AREA

The Survey area is Ha Long City and Cam Pha district. Location of the sampling points should be decided and confirmed between the contractor and the JICA Study Team before commencement of the Survey.

5. SCOPE OF WORK

The contractor shall carry out the following Dust survey.

1) Items

The quantity of settled dust should be measured with wind direction and velocity at each survey point.

2) Points

The Survey should be implemented at five (5) points. The Survey points are in Bai Chay, Hong Gai, and Cua Ong areas as shown in Figure 1.

3) Frequency and method

The survey frequency is two (2) times. One Survey consists of continuous fifteen (15) days.

4) Method

-Dust should be collected by dust jar or the equivalent.

- Wind direction and velocity at the each Survey point should be measured by means of wind vane and anemometer.
- Quantity of settled dust should be measured by an electric balance or the equivalent at a laboratory.
- Rain stood in the dust jars should be filtered. And then impurities filtered off should be measured as a settled dust.
- Inspection of the dust jars should be carried out throughout the Survey.

5) Data arrangement

- Results of the Survey should be arranged into the tables with date and periods of the Survey and location maps.
- Major sources of dust around the Survey points should be identified and described in the report.
- Methodology of measurement should be identified and described in the report.

6. SURVEY PROGRAM

The contractor shall submit their detailed workplan, methodology, time schedule and cost estimation of the Survey as a technical proposal in English to the JICA Study Team. The overall Survey plan shall be approved by JICA, the JICA Study Team, and QNPC.

7. ORGANIZATION

The contractor shall organize the survey team consisting of team leader, dust survey expert, and working staff. The following descriptions provide tasks and required background and qualifications of team leader and expert.

7.1 Team leader

1) General Tasks

The team leader shall carry out the following tasks.

- preparation of overall survey strategy and plan reflecting the JICA Study Team's objectives
- responsibility for overall supervision of the Survey and data analysis
- preparation of reports and explanation to the JICA Study Team

2) Required background and qualifications

Team leader should have college/university degree, in depth knowledge of his/her expertise, environmental survey and analysis, and be familiar with the general environmental condition of the Survey area (at least fifteen (15) years experience). The candidate is to be an expert with writing and communications ability in English and experience in working with international experts.

7.2 Dust survey expert

1) General Tasks

The dust survey expert shall carry out the following tasks.

- preparation of program on dust survey and necessary equipment
- implementation of dust survey and analysis of samples
- compilation of data and implementation of preliminary analysis of dust

2) Required background and qualifications

The candidate should have college/university degree, in depth knowledge of his/her expertise, dust survey (at least ten (10) years experience). He/she is expected to be familiar with the dust conditions in the Survey area. Good communication skill in English is required.

7.3 Working staff

Working staff shall carry out tasks required by the team leader and each expert. A background in environmental issues and good communication skill in English are required.

8. EQUIPMENT

The necessary sampling, measuring and analysis equipment, and vehicles should be prepared by the contractor. Equipment which will be used for measuring and analysis must be calibrated according to their instruction manual.

9. REPORTS

1) The contractor shall submit five (5) copies of the Progress Report before 31st of July in English and five (5) copies of the Draft Final Report in English by 15th of August, 1998. The Final Report, five (5) copies in English and five (5) copies in Vietnamese, must be submitted within one (1) week after receiving the comments from the JICA Study Team on the Draft Final Report, or not later than 31st of August, 1998.

2) All data should be submitted on diskettes in DOS text format.

3) Photograph showing the sampling points and field measurement scene should be taken and be attached in the Final Report.

10. SCHEDULE

The time schedule for the Survey is shown in Table 1.

Table 1 The Dust Survey Schedule

Items	1998		
	July	August	September
I. Preparatory works (including data collection)	▨		
II. Implementation of field survey (Dust survey)	▨		
III. Data compilation and preliminary analysis	▤	▤	
IV. Report preparation	▤		
Reports	△	△	△
	P.R	D.F.R	F.R

Note : ▨ works in the fields
 ▤ works in the laboratory or office

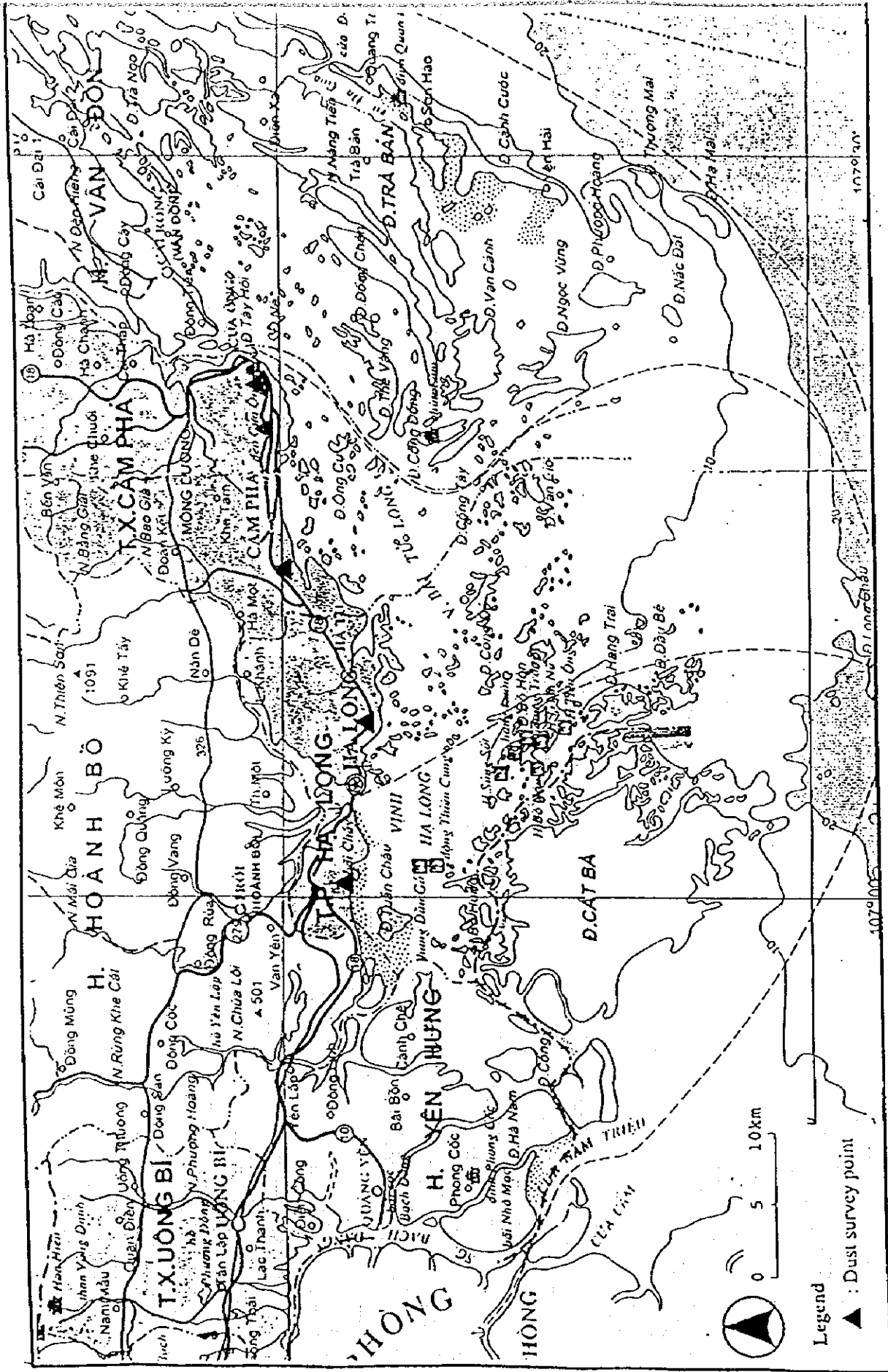


Figure 1 Dust Survey Points





JICA