

CHAPTER 6 ENVIRONMENTAL MEASURES TO ATTAIN CRITERIA

6.1 Sanitation Measures

6.1.1 Domestic Wastewater

Domestic wastewater is a significant source of the pollution load in the Ha Long bay area and its management is therefore an important component of the EMP. The extent of coverage of collection systems and the standard of treatment required for domestic wastewater discharges needs to be determined to meet the target conservation criteria for the receiving waters. Conventional secondary treatment (Level 1 treatment) is generally suitable for discharges to Ha Long bay and Bai Tu Long bay, but advanced treatment including nutrient removal (Level 2 treatment) is necessary for discharges to Bai Chay bay. The recommended strategies for the domestic wastewater management plan include:

- 1) Flush toilets should be provided in all tourism and commercial developments. They are also recommended for high density residential development.
- 2) Dry sanitation methods or septic tanks draining to soakaways are generally suitable in low density and rural areas.
- 3) Separate piped sewer systems should be provided in major new development.
- 4) Small bore sewer systems will be suitable for existing development if the systems are properly managed and controlled.
- 5) Oxidation ditches are generally recommended for conventional wastewater treatment. Sequencing batch reactors are suitable if the area of land available is very limited.
- 6) Oxidation ditches with side stream phosphorus removal are recommended for advanced treatment.

Two options have been considered for the domestic wastewater plan for west Ha Long city, one with treatment plants at both Don Dien and Dong Dang, and the other with a single plant at Don Dien. At Don Dien, which is west of the World Heritage buffer area, Level 1 treatment is adequate but at Dong Dang, which is on Bai Chay bay, Level 2 treatment is required. The total population that should be served in west Ha Long city by 2010 is 120,000.

Separate treatment plants near Deo Sen and Bach Dang are recommended for the northern and southern areas of Hong Gai, respectively. The population to be served by the Deo Sen plant has been derived in conjunction with the industrial wastewater management plan to meet the target conservation criteria and varies between 164,000 and 184,000 depending on the industrial wastewater load discharged. The population to be served at the compact Bach Dang plant is 60,000.

The provision of sewage collection and treatment facilities for central Hong Gai should be regarded as an urgent measure in the EMP. The recommended urgent measures program includes construction of parts of the main collection systems in northern and southern Hong Gai together with the first stages of the Deo Sen and Bach Dang treatment plants (to serve populations of 40,000 and 30,000 respectively). The costs of these works are discussed in Section 6.5.

A coastal interceptor system to a single treatment plant located to the west of the town is recommended to serve Cam Pha. The first stage plant should have capacity to serve a population of 45,000. The total estimated cost of the system in Cam Pha is about US\$ 7.5 million including O&M cost from 2000 to 2010.

6.1.2 Domestic Solid Wastes

The first stage program for the solid waste component of the Ha Long City Water Supply and Sanitation Project (HWSSP) includes the equipment and sanitary landfill capacity for the collection coverage for Ha Long city and Cam Pha to be increased to 65% and 50%, respectively, by 2005. The landfill capacity is to be provided at Ha Khau for the Bai Chay area, Deo Sen for the Hong Gai area, and Quang Hanh for Cam Pha.

The domestic solid wastes management under the EMP should generally follow the same principles as HWSSP. However, the target for the EMP should be to improve collection coverage to 85% in Ha Long city and 80% in Cam Pha by 2010 so as not to have an increase in untreated solid wastes. This requires an extension of HWSSP project both in terms of equipment and disposal facilities. The sanitary landfill sites to be constructed under the first stage program of

HWSSP has adequate capacity for disposal of municipal solid waste up to 2008. The methods considered to deal with the additional disposal quantities beyond 2008 include additional landfill capacity, incineration, and composting. Additional landfill capacity is the most cost effective solution and a 450,000 m³ extension should be provided at the Quang Hanh site. Hospital clinical waste should be handled separately and incinerated at a central facility for the EMP area. The recommended capacity for the clinical waste incinerator is 10 ton per day.

An education and advertising campaign to improve public environmental awareness should be undertaken and also the existing anti-littering bylaws should be enforced.

The total estimated cost for the domestic solid waste management plan is about US\$ 13.8 million including O&M cost from 2000 to 2010.

6.1.3 Industrial Wastewater Management

All new factories should pre-treat their wastewater to comply with the Vietnam Standard TCVN – 1995 for industrial wastewater discharges to Class B waters. The standard of any further treatment required for industrial wastewater discharges must be determined to meet the target conservation criteria for the receiving waters.

Industrial parks should have collection sewer systems so that the combined discharges from factories can receive further treatment or be transferred to a suitable discharge location. Discharges from industries in existing development have to be connected to the domestic sewerage system after any necessary pre-treatment.

Three options for the industrial wastewater plan for the Cai Lan Industrial park and four for the Hoanh Bo Industrial park have been developed. The options include: treatment of wastewater at the industrial parks to the Vietnam Standard for Class A waters for discharge to Bai Chay bay, transfer of industrial wastewater flows for discharge to Ha Long bay at Don Dien, and treatment of industrial wastewater in combination with domestic wastewater to Level 1 at Don Dien or to

Level 2 at Dong Dang. Required costs for these option are discussed in Section 6.5.

A collection system and industrial wastewater treatment plant should be provided for the local major industries at Lang Bang to treat the wastewater to the standard for Class A waters prior to discharge to Bai Chai bay. The total estimated cost of Lang Bang system is about US\$ 1.6 million including O&M cost from 2000 to 2010.

6.1.4 Industrial Solid Wastes Management

Investment is needed to collect and satisfactorily dispose of the projected 2010 industrial solid waste and hazardous waste quantities of 34,500 and 3,450 ton per year, respectively. Regulation of the handling and disposal of hazardous waste in the EMP area is required and an assessment procedure for hazardous waste should be put in place.

Collection and transportation of industrial solid wastes should be carried out either by industry itself, or private contractors, or by the public sector at commercial rates. Minimization of industrial solid waste generation, maximization of recycling and recovery, and co-siting of compatible industries should all be encouraged.

The recommended method for disposal of non-hazardous industrial solid waste is landfilling. An additional landfill capacity of approximately 100,000 m³ is required for disposal of wastes up to 2010. The landfills could be publicly or privately operated but a system for control and licensing of private sites is required. Various methods are required for the disposal of hazardous waste including incineration, special landfill facilities, and long term containment. Thus, the construction of a 15 ton per day hazardous waste incinerator is justified.

The total estimated cost of the industrial solid wastes management plan is about US\$ 4.7 million including O&M cost from 2000 to 2010.

6.2 Environmental Measures for Mining

6.2.1 Environmental Targets for Coal Mining Industries

Environmental targets for mining industries were set to satisfy the environmental laws and regulations, basin-specific environmental conservation criteria, and long-term rehabilitation requirement. The main targets are summarized as follows:

- 1) To control pollution from non-specific sources and to promote rehabilitation, the size of the denuded area in the mining area should be below 4,874 ha in 2010. This is roughly the same as the existing size of denuded area. Specific target values were set for all basins.
- 2) The discharge from point sources should meet the Industrial Effluent Standard, TCVN 5945-1995.

6.2.2 Environmental Programs and Projects

The environmental targets should be achieved through an array of environmental measures. They are broadly classified into “structural measures” and “non-structural measures”. Structural measures include mine land rehabilitation projects, projects to control point sources (mine wastewater and processing plants), and a dredging project. Non-structural measures include institutional/regulatory measures, cleaner production/waste minimization, environmental monitoring, and other soft measures. In total, 12 environmental measures were proposed. They are summarized as follows.

Summary of Proposed Measures and Estimated Costs (Year 2000-2010)

No.	Project	Description	Cost	
			(US\$ × 10 ⁶)	%
1	Environmental Plans	Development of environmental plan for the entire region and each mine	0.9	2.6
2	Pilot Project on Rehabilitation	Pilot project to establish rehabilitation technologies	1.8	5.2
3	Measure for Mine Wastewater	Installation of 50 wastewater treatment facilities	2.2	6.3
4	Measures for Processing Plants	Improvement of drainage system to intercept runoff	1.7	4.9
5	South Deo Nai Dumping Site	Rehabilitation and landslide prevention of a large dumping site	3.4	9.8
6	Mong Duong River Basin	Basin-wise rehabilitation of mining sites through combination of revegetation, drainage improvement, and dust control	4.4	12.6
7	Dien Vong River Basin		4.2	11.9
8	Ha Tu River Basin		1.8	5.2
9	Hong Gai North Basin		0.5	1.5
10	Cam Pha West Basin		0.1	0.4
11	Cua Ong Basin	Routine and emergency dredging of affected area, such as rivers and irrigation systems.	0.5	1.5
12	Dredging		13.3	38.1
Total			34.8	100

Note: Before adjustment of discount rate, O&M costs after 2010 not included.

These projects are expected to reduce 1.73 million tons/year of erosion and 34×10^3 tons of SS/year in 2010 compared with the case that no environmental measures were taken. The total cost of the measures is estimated at US\$ 35 million for the period of 2000-2010. The largest cost is needed for the dredging project. Due to the large sizes of basins, Mong Duong River Basin Rehabilitation Project and Dien Vong River Basin Rehabilitation Project will cost more than the measures for other basins. The measures for point sources such as the Environmental Measures for Mine Wastewater and the Environmental Measures for Processing Plants, cost US\$ 4.0 million or 11% of the total cost.

6.3 Environmental Measures for Tourism

6.3.1 Environmental Targets for Tourism

Considering the existing environmental regulations, existing levels of environmental measures, and the anticipated increase in tourism activities, the following targets were selected.

Environmental Targets for Tourism

Category	Target
Planning	Development of Tourism Management Plan
Solid Wastes	Essentially 100% collection and disposal of solid waste from tourism boats & islands
Wastewater	Essentially 100% collection and disposal of wastewater from tourism boats & islands
Natural Resource Protection	Doubling patrolling capacity

6.3.2 Environmental Program and Projects

The following four measures were proposed. The project to improve sanitation conditions on tourism boats and islands should be implemented in two phases so that the project can deal with the growing demand for sanitation control in a flexible manner.

Proposed Measures and Estimated Costs (Year 2000-2010)

No.	Project	Description	Cost	
			US\$ × 10 ⁶	%
1	Environmental Planning for Tourism	Development of Environmental Plans for Tourism	0.1	2.6
2	Improvement of Sanitation Condition – Phase 1	Improvement of sanitation conditions on tourism boats & islands by providing solid wastes/wastewater collection services, and construction of toilets (Phase 1).	1.5	39.5
3	Improvement of Sanitation Condition – Phase 2	Second phase of sanitation project for tourism boats and islands (Phase 2).	1.2	31.6
4	Reinforcement of Patrolling Capability	Reinforcement of patrolling with 6 boats and 30 staff members by 2010	1.0	26.3
Total			3.8	100

Note: Before adjustment of discount rate, O&M costs after 2010 not included.

6.4 Environmental Measures for Environmental Resources

6.4.1 Environmental Measures for Natural Environment

(1) Target Management Items and Strategies

Forests, tidal flats, mangrove swamps, seaweed beds and coral reefs are selected as the target items for natural environment management considering their important roles in maintaining natural ecosystem in the EMP area. In order to manage these natural resources, the following three strategies were proposed:

- Conservation of existing resources,

- Rehabilitation of deteriorated resources, and
- Reinforcement of ongoing management activities.

(2) Projects and Programs

1) Reforestation in bare areas

In the EMP area, there is about 800 ha of bare areas at present, and additionally 2,000 ha of bare land will be formed by land use changes by 2010. Among the bare areas, the Troi river basin has relatively large bare areas at present, and Man river basin, the Dien Vong river basin, and the Mong Duong basin are predicted to have large bare areas in the future. Therefore, those areas should have priority of reforestation. To achieve the target conservation criteria, 2,700 ha should be covered by trees or greened by 2010.

2) Rehabilitation of mangrove swamps

Reforestation project should be carried out in the area where large areas of mangroves have been lost by reclamation, such as Cua On, Cam Pha, and Hung Thang. In order to achieve the target conservation criteria, mangrove swamps rehabilitation by mangrove planting of 1,320 ha should be carried out by 2010. The proposed Tidal Flat Management Unit (TFMU) is expected to be in charge of the mangrove swamps rehabilitation.

3) Fishing activity management program

This program is mainly to reinforce ongoing management activities by Department of Fisheries (DOF), by means of i) Reinforcement of patrolling capability of fishing activities, ii) Promotion of environmental education to fishermen, and iii) Collection and analysis of fishermen's data (Fishermen data survey).

(3) Cost Estimation

Total estimated cost for environmental measures for natural resources from 2000 to 2010 is about US\$ 2.6 million.

6.4.2 Environmental Measures for Landscape

(1) Target Management Items and Strategies

In the EMP area, the landscape of the World Heritage area should be given the highest priority to be managed for absolute protection. The value of landscape of the World Heritage area depends on the landscape elements and they should be considered as the target items of landscape management. In order to attain the target, the following three strategies were proposed:

- Enforcement for ongoing management activities,
- Formulation of landscape management guideline, and
- Restriction of anchored area and route of cargo ships

(2) Projects and Programs

1) Preparation of management guideline for landscape

The landscape guideline for landscape is to be prepared for not only agencies concerned but also for the private sector such as shipping companies and tourism. The guideline is to be used for reinforcement of management capability of landscape element. Although the main target of landscape management is the World Heritage area, the proposed guideline includes notes and directions from an aesthetic viewpoint in AMZ and DZ. The future development projects should follow this guideline in view of shape, coloring of buildings, and greening.

2) Reinforcement of patrolling capability for shipping activities

Major impact that may affect the natural impression in the World Heritage area is anchored and sailing cargo ships. Popular tourism spots are mainly distributed in the west of the World Heritage area. This area is close to the anchored area near Hon Net Floating Port (HNFP). HNFP is scheduled to be moved to the east area of the bays. Thus, the number of anchored ships near the popular tourism area and sailing boats deviating from the defined courses should be controlled strictly.

(3) Cost Estimation

Total estimated cost for environmental measures for landscape from 2000 to 2010 is about US\$ 0.1 million.

6.5 Study on Alternative Selection

6.5.1 Setting Alternatives

(1) Target

In previous sections, possible environmental measures were considered by each pollution source to achieve the proposed conservation criteria in 2010. Each component of the measures was validated from a viewpoint of technical soundness and social acceptance. Alternatives of component of the measures were also analyzed in the sector studies. Among them, however, it is necessary to analyze alternatives by combining the environmental measures of domestic wastewater and industrial wastewater. Because generated pollution loads from them were concentrated on Bai Chay bay, applicable combination of the measures for domestic and industrial wastewater should be required to manage them effectively and efficiently. Thus, the optimum environmental measures of domestic and industrial wastewater were selected by the following process:

- Identification of areas, items, components for alternative setting,
- Preparation of alternatives considering technical feasibility,
- Estimation of investment cost of each alternative, and
- Selection of the optimum measures by the least cost method.

(2) Area

The most complex problem is the management of water quality in Bai Chay bay, which is surrounded by existing and planned major domestic and industrial pollution sources. To solve this problem, the wastewater management strategies for the surrounding area had to be optimized as well. Hence the alternative measures for domestic and industrial wastewater management in Binh Houg

estuary, Bai Chay coastal, and Hong Gai coastal areas were examined. In the case of Cam Pha, the environmental impacts of industries exclusive of coal mining are minor. Therefore, alternative measures for wastewater management were not examined.

(3) Allowable Pollution Loads

Alternatives are to be drawn up to attain the allowable pollution loads into Bai Chay bay. Total allowable pollution loads set for the Bai Chay bay from domestic and industries are 1,300 kg/day in BOD, 2,200 kg/day in COD, 1,200 kg/day in T-N, and 160 kg/day in T-P.

(4) Components of Alternatives

The following domestic and industrial wastewater treatment plants (WWTPs) including collection systems and pumping stations are selected as the components for alternative setting. Based on the combinations of these components such as discharge points of treated wastewater, and/or whether or not industrial wastewater is connected with the sewerage system, necessary sewerage population and facilities like pumping stations are changed.

Components of Alternatives

Category	Facility
Domestic wastewater	1. Dong Dang WWTP
	2. Don Dien WWTP
	3. Deo Sen WWTP
Industrial wastewater	1. Hoanh Bo Industrial WWTP
	2. Cai Lan Industrial WWTP

Note: WWTP means wastewater treatment plant.

6.5.2 Description of Alternatives

The alternatives were drawn up on the basis of discharge points of the treated wastewater from industrial parks: whether they are to be discharged into Bai Chay bay, Binh Huong estuary, or to be connected with sewerage systems. These considerations led to five alternatives. In addition, the option of developing Dong Dang wastewater treatment plant (WWTP) was also considered. If the Dong Dang

WWTP is not developed, the domestic wastewater is to be conveyed to Don Dien WWTP. Accordingly, ten possible alternatives were drawn up as follows:

Description of Alternatives

WWTP	Dischar. Point	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Alt.1.1	Alt.1.2	Alt.2.1	Alt.2.2	Alt.3.1	Alt.3.2	Alt.4.1	Alt.4.2	Alt.5.1	Alt.5.2
Dong Dang	BC	○	×	○	×	○	×	○	×	○	×
Don Dien	BH	○	○	○	○	○	○	○	○	○	○
Deo Sen	BC	○	○	○	○	○	○	○	○	○	○
Hoanh Bo	BC	○	○	○	○	×	×	×	×	×	×
	BH	×	×	×	×	○	○	×	×	×	×
	SS	×	×	×	×	×	×	○	○	○	○
Cai Lan	BC	○	○	×	×	×	×	○	○	×	×
	BH	×	×	○	○	○	○	×	×	×	×
	SS	×	×	×	×	×	×	×	×	○	○

Note : BC; Bai Chay bay, BH; Binh Huong estuary, SS; Sewerage system
○ : applicable, × : not applicable

6.5.3 Evaluation

Indicative cost estimation of each alternative was carried out for evaluation of the proposed alternatives. The estimated cost including those of construction, operation, and maintenance as incremental costs are shown below. Alternative 3.2 was identified as the least-cost alternative.

Comparison of Alternatives

(Unit: US\$ × 10 ⁶)			
Alternatives	Domestic WWTP	Industrial WWTP	Total
Alt.1.1	85	15	100
Alt.1.2	84	15	99
Alt.2.1	85	14	99
Alt.2.2	84	14	98
Alt.3.1	82	13	95
Alt.3.2	79	13	92
Alt.4.1	92	10	102
Alt.4.2	88	14	102
Alt.5.1	91	13	104
Alt.5.2	88	13	101

Notes : 1) Sewerage costs does not include those of 1st stage of HWSSP.
2) Sewerage costs include those of sewerage systems of Bach Dang.
3) In case of industrial wastewater to be treated to class B, cost for that is not included.
4) Industrial wastewater treatment costs include those of Lang Bang.
5) Shaded line means selected alternative.

6.5.4 Prediction of Water Quality by the Selected Plan

The model was run again replaced with selected plan to predict its effect as shown in Figure 6.5.1. The reduction effects of the pollution loads inside Bai Chay bay

are remarkable for SS and COD especially near the mouth of Troi river. On the other hand, local increases of the concentrations are found near the new discharge point in the western side of the causeway for SS and COD. Compared with the simulated water quality and the conservation criteria, the simulated water quality by the selected plan met the conservation criteria.

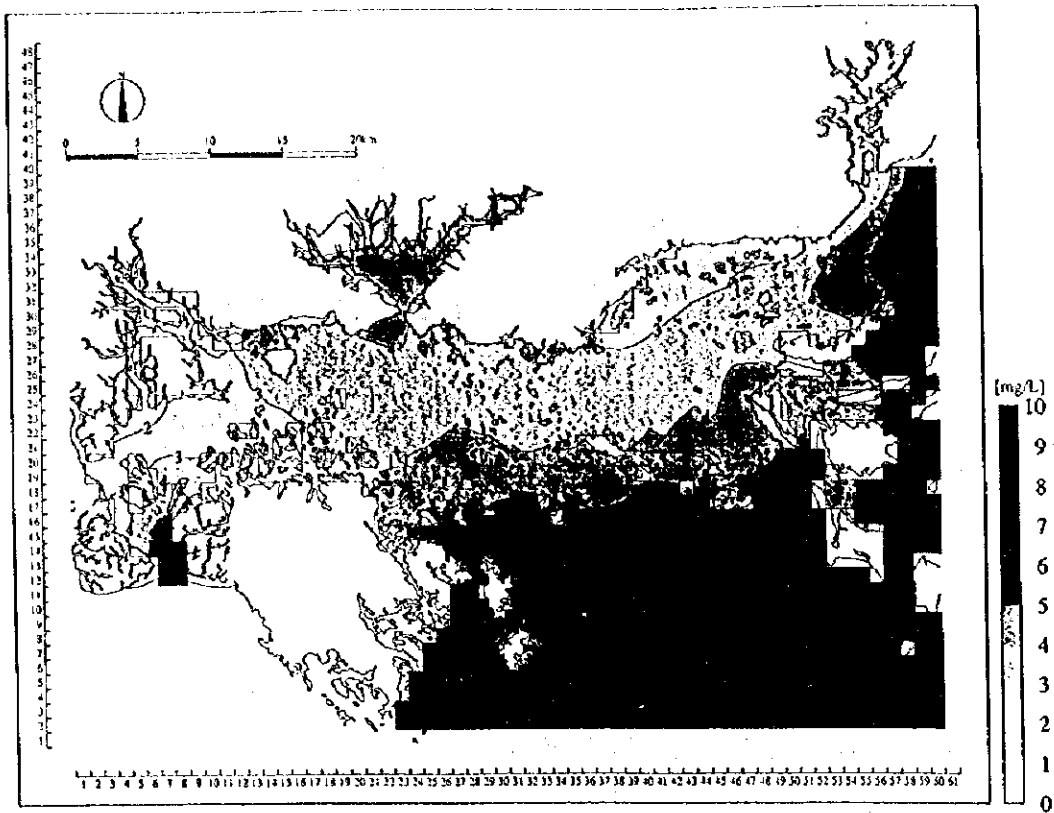


Figure 6.5.1(1) Predicted Concentrations of COD of the Upper Layer by the Selected Plan

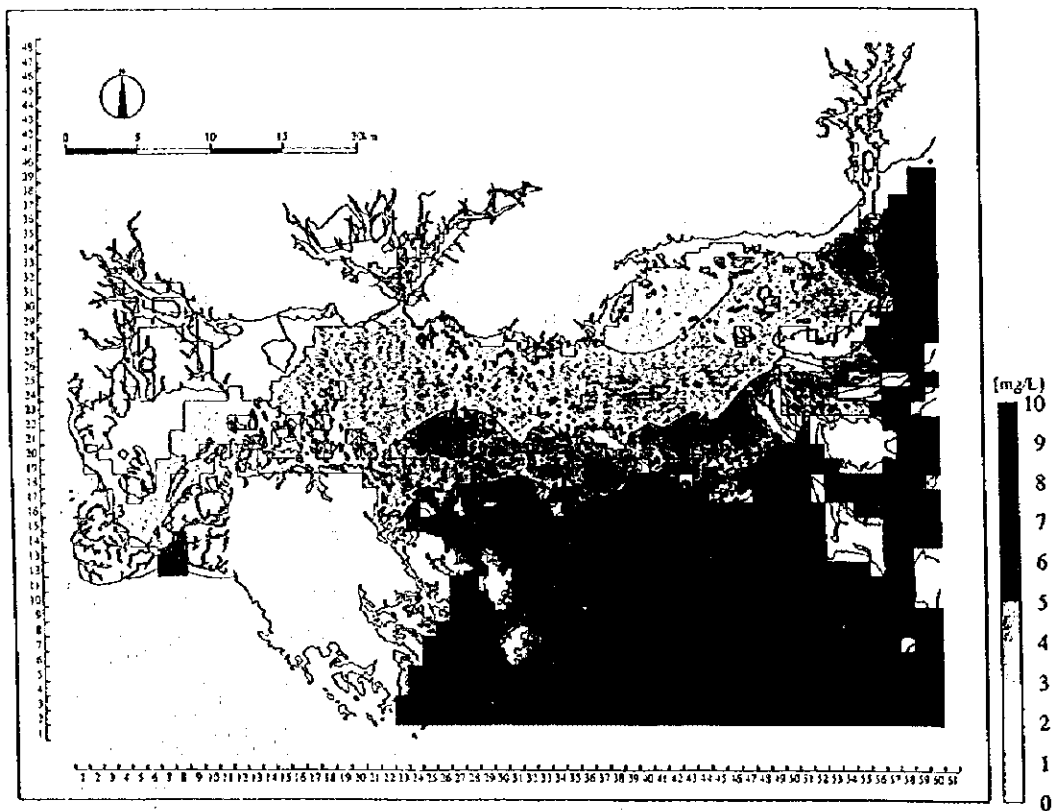


Figure 6.5.1(2) Predicted Concentrations of COD of the Lower Layer by the Selected Plan

CHAPTER 7 ENVIRONMENTAL MONITORING

7.1 Environmental Monitoring Plan

7.1.1 Water Quality Monitoring

Monitoring locations should take the environmental zones into account. Locations of the strategically designed monitoring sites are shown in Figure 7.1.1.

The equipment and skilled personnel to conduct the environmental monitoring is essential. Considering current monitoring capability of DOSTE, the development schedule of the monitoring system should be divided into three terms, i.e. short-term for the period 2000 to 2002, transition-term for 2003 to 2006, and the long-term after 2007.

In the bays, monitoring frequency is four times a year to monitor seasonal changes. For the representative sites, however, the monitoring should be carried out on a monthly basis to grasp detailed seasonal change. Monitoring frequency for the rivers' sites is four times a year in principle.

Monitoring Items for Short-term Program

Items		Sampling Layer	
		Marine Sites	River Sites
Field measurement	Depth, Weather, Air temperature, Wind direction and velocity, Color of water	(at sites)	(at sites)
Discharge	Current direction and velocity	0.5 m, B - 1m	Main river course
Water quality	Transparency	all layer	-
	Water temperature, Salinity	every 0.5 m to 1 m above the bottom (B - 1 m)	Main river course
	pH, DO, Turbidity	0.5 m, B - 1 m	- ditto -
	COD, BOD	0.5 m, B - 1 m	- ditto -

Note: B - 1 m means 1 m above the bottom.

Settled dust is considered to be a part of the origin of land runoff of SS. In order to grasp effects of measures for dust, monitoring of the amount of settled dust to be sampled by a dust jar is proposed. Monitoring frequency is four times a year. Five monitoring sites are selected as shown in Figure 7.1.1.

Monitoring Items for the Transition-term and the Long-term Program

Items		Sampling Layer	
		Marine Sites	River Sites
Field measurement	Depth, Weather, Air temperature, Wind direction and velocity, Color of water	(at sites)	(at sites)
Discharge	Current direction and velocity	0.5 m, B - 1 m	Main river course
Water quality	Transparency	all layer	-
	Water temperature, Salinity	every 0.5 m to 1m above the bottom (B - 1 m)	Main river course
	pH, DO, Turbidity, SS	0.5 m, B - 1 m	- ditto -
	COD, BOD, NH ₄ -N, NO ₂ -N, NO ₃ -N, T-N, PO ₄ -P, T-P, Chlorophyll-a	- ditto -	- ditto -
	Coliform bacteria	- ditto -	- ditto -
	Heavy metals (Pb, Zn, Cu, Cd, As, Fe), Oil	- ditto -	- ditto -
Sediment quality	Grain size composition	bottom	-
	Water content, ORP, COD, IL, TOC, T-S, T-N, T-P	- ditto -	-
	Heavy metals (Pb, Zn, Cu, Cd, As, Fe)	- ditto -	-

Note: B - 1 m means 1 m above the bottom.

7.1.2 Environmental Resources Monitoring

(1) Natural Environment

The environmental monitoring for natural environment consists of three surveys, namely, Vegetation survey, Wetland survey, and Marine Biological survey. Monitoring items and methodology of each survey are summarized as follows.

Items and Methodology of the Natural Environment Monitoring

Survey		Monitoring Items	Methodology	Frequency
Vegetation	Forests Targets	Forest coverage	Analysis of satellite images - Ground truth	every 2 years
Wetland	Tidal Flats and Mangrove Swamps	Distribution of tidal flats and mangrove swamps, Species composition and biomass of mangrove swamps and zoobenthos	Field Survey - Aerial observation - Belt transect - Sampling & analysis	every 5 years
Marine Biology	Coral Reefs	Distribution, Species composition of corals, living coral coverage	Field Survey - Belt transect - Sampling & analysis	every 5 years
	Fish and Shellfish	Species composition and biomass of fish and shellfish	Field Survey - Catchment with gill net and trawl net	every 5 years
	Plankton (Phytoplankton, Zooplankton)	Species composition and biomass of plankton	Field Survey- - Water sampling - Sampling with net	every 5 years
	Benthos	Species composition and biomass of zoobenthos	Field Survey - Sampling with grab	every 5 years

(2) Landscape

The landscape in the EMP area is strongly characterized by the World Heritage area, which has unique landscape of aesthetic value. In order to manage landscape in the EMP area, it is proposed to carry out a landscape monitoring program. This monitoring program consists of two surveys, the landscape element survey and the landscape value survey. Monitoring items and methodology of each survey are summarized below.

Items and Methodology of the Landscape Monitoring

Survey	Monitoring Items	Methodology	Frequency
Landscape Element	Shape and surface of islands, Color and clearness of seawater, View of natural resources, Natural scenery	Field reconnaissance	every month
Landscape Value	Change of value of the World Heritage area	Questionnaire Survey	every 5 years

7.2 Environmental Inspection Plan

The proposed environmental inspection aims at guiding every pollution source toward environmentally friendly performance to achieve successful implementation of the EMP. It is necessary to prepare a framework for inspection system which defines the responsible and implementing bodies and methodology.

Though inspection activities have been operated by some authorities severally, their individual results have not worked to lead the province to an environmental conservation target due to lack of a comprehensive system. Thus, the EMP requires the linkage or integration of the environmental monitoring and inspection. The main targets of the inspection include specific pollution sources consisting of pollution sources on land such as factories, coal mines and relating facilities, markets, hospitals, hotels, and those on the sea such as ships and floating gas stations.

7.3 Institutional Frame and Cost Estimation

7.3.1 Organization for Environmental Monitoring

The proposed Environmental Research and Monitoring Unit (ERMU) is expected to perform environmental research and monitoring activities in the EMP area. EMD in DOSTE will ultimately be responsible for the environmental administration including execution of environmental monitoring plan. Research activities are to be joint activities between proposed ERMU and local research institutes. DOSTE should coordinate its efforts with the other management agencies and institutes that contribute to ERMU. Agencies, institutes, and groups that may contribute to the activities of ERMU are the Ha Long Bay Management Board (HLMB), the Haiphong Institute of Oceanology (HIO), the Center for Marine Environment Survey, Research & Consultation (CMESRC), the Department of Transportation (DOT), the Department of Agriculture and Rural Development (DARD), and NGOs.

7.3.2 Organization for Environmental Inspection

The responsible agency for the inspection of pollution sources on land area is expected to be the Inspection Division (ID) in DOSTE, in close collaboration with proposed Industrial Pollution Control Unit (IPCU) and ERMU. It is rational to carry out inspection of pollution sources on the sea utilizing the existing organizations as implementation agencies, such as HLMB, Port Authority, and Board of Tourist Ferry Dock, which have conducted inspection for their respective

responsibilities, because working within the existing government framework can avoid difficulties likely encountered if some new organization had the direct operation of inspection.

7.3.3 Required Cost for Environmental Monitoring and Inspection

The estimated costs for environmental monitoring and inspection from 2000 to 2010 are about US\$ 787,000 and US\$ 115,000, respectively.

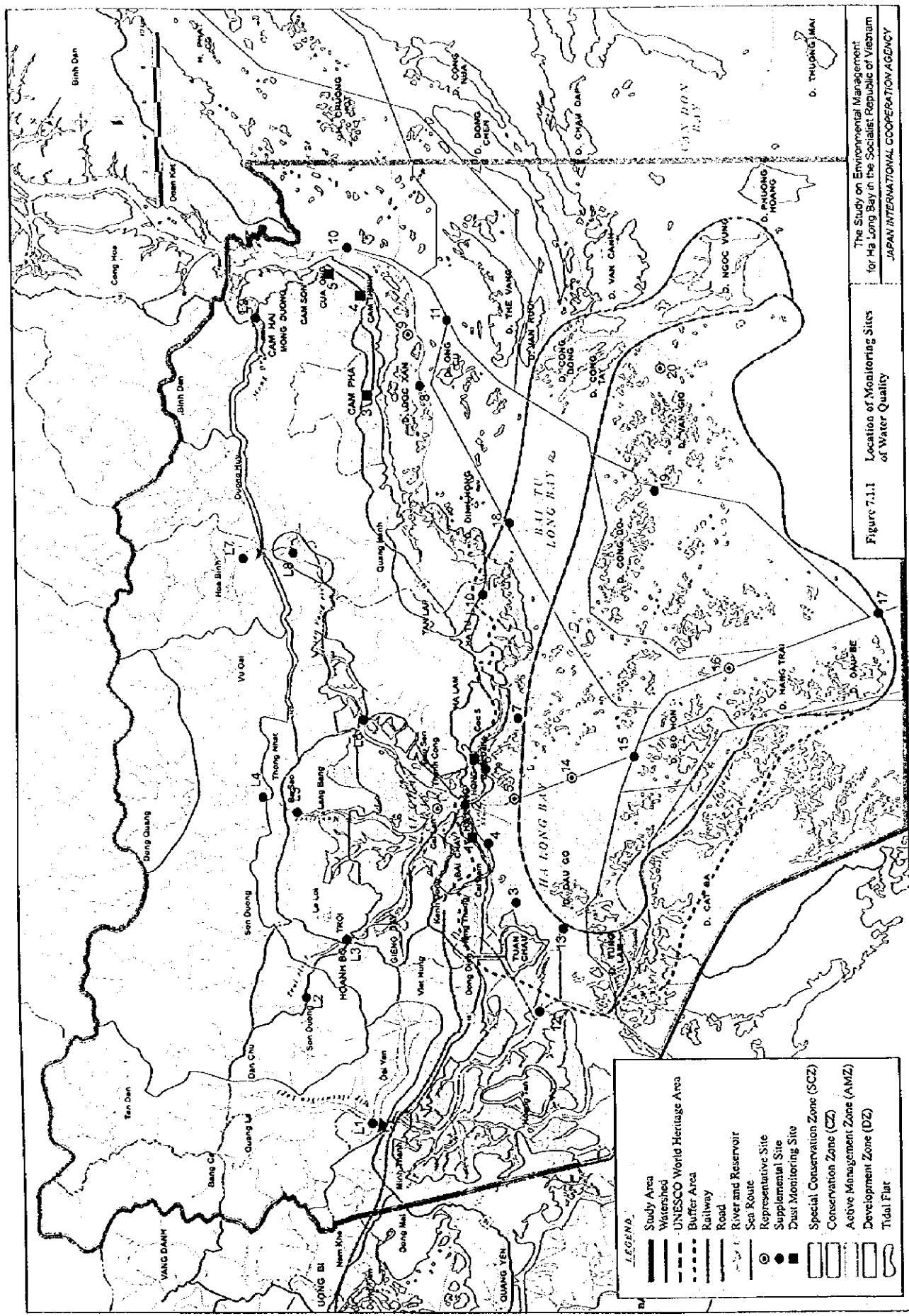


Figure 7.1.1 Location of Monitoring Sites of Water Quality

Note: Bottom sediment is monitored at representative sites.

CHAPTER 8 LEGAL AND INSTITUTIONAL FRAMEWORK

8.1 Organizational Structure

The proposed organisation structure for implementation of the EMP emphasizes the multi-sector nature of environmental management including the appropriate agencies to ensure conservation and protection of natural resources, environmental and land use planning, control of pollution and waste, and environmental management functions.

Up to the year 2010, it is best to work within the existing government framework. A committee for implementation of the EMP must be created under the overall direction of QNPC. Most of the agencies will retain their existing responsibilities. New organizational units will be created to allow the agencies to better fulfil their responsibilities. This approach has the advantage that it is relatively easy to implement and does not require many changes to the existing institutional framework. Its flexibility will allow the agencies to help each other as major needs arise.

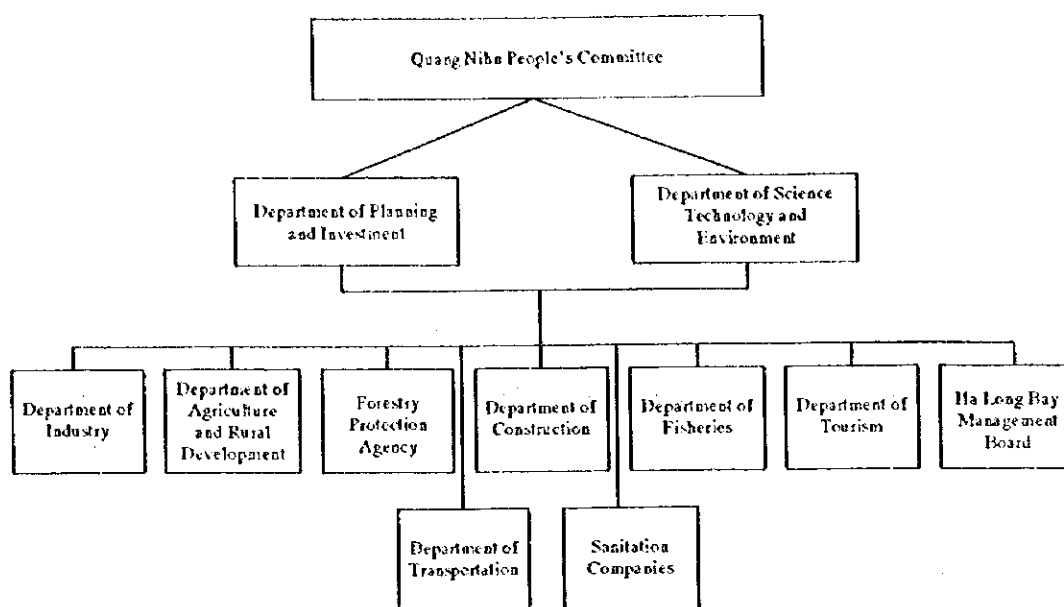
However, it may be difficult to achieve the high level of cooperation and coordination amongst agencies that will be required. It perpetuates a fragmented decision making structure that disperses environmental management responsibilities among many agencies. No one management agency will have a complete perspective on the EMP. No one agency will have enough authority to make the difficult decisions to resolve conflicts between development priorities and environmental protection goals. Therefore, it is recommended to establish a single environmental management authority in order to ensure effective implementation of the EMP after 2010.

8.1.1 Establishment of the Implementation Committee for the EMP

The QNPC should promulgate a decision or instruction to define the legal mandate for establishment of the Implementation Committee (IC) and the implementation arrangements for the EMP. The proposed organisation chart for IC is presented below. The IC should be chaired by the Chairman of QNPC, with

co-deputy chairmen from the Department of Planning and Investment (DPI) and DOSTE. The DPI and DOSTE should be the lead agencies, and act as the secretariat for IC to conduct the following administrative activities:

- a) preparation of annual plans and budgets,
- b) preparation of annual reports on the EMP activities, and
- c) making meeting arrangements and taking minutes of meetings.



Organization of Implementation Committee

8.1.2 New Organizational Units

Effective implementation of the EMP will require formal creation and strengthening of three new organisational units in DOSTE and the Department of Agriculture and Rural Development (DARD), namely, the Environmental Research and Monitoring Unit (ERMU), the Industrial Pollution Control Unit (IPCU), and the Tidal Flats Protection Unit (TFPU).

8.1.3 Allocation of Responsibilities and Institutional Changes

The allocation of responsibilities of the concerned agencies for effective implementation of the EMP are summarized in Tables 8.1.1. In addition to the creation and funding of ERMU, IPCU, and TFPU as well as capacity building of

the Inspection Division of DOSTE, Inspection Units of provincial departments of national ministries and HLMB, the following key institutional changes are proposed:

- Incorporation of the EMP into the Development Master Plan of Ha Long City for 1994-2010,
- Regulation of land use in tidal flats, and
- Establishment of a policy and a national program for collection of pollution charges

8.2 Involvement of Stakeholders and Dissemination of Environmental Information

The successful implementation of the EMP requires the cooperation of many stakeholders including industry, government agencies, and the people of Quang Ninh province. Both government regulators and the various stakeholders have to work together to achieve the goals of the environmental management plan. The main stakeholders are a) Mining industry, b) Existing and proposed industrial facilities, c) Planned industrial zones, d) Ports and shipping, e) Tourism industry, f) Coastal communities, g) Fishing community, and h) Mass organizations.

The leadership in Vietnam is dissatisfied with progress on the implementation of environmental awareness programs. Promotion of environmental awareness by key agencies is needed:

- to improve the awareness of the need for environmental protection by the party and authorities at all levels in Quang Ninh province,
- to integrate the awareness of environment into socioeconomic activities in order to lay the ground for sustainable development in the industrialisation and urbanisation process, and
- to disseminate environmental information for the community to improve the awareness of environmental protection and introduce environmental education in the school.

Considering the importance of the public awareness on environmental protection, it is recommended to establish a visitor center in the study area. The proposed visitor center mainly consists of display and observation corner, exhibit and study corner, video theater, library, and experimental tidal flat, and its location could be in the existing reclaimed land of Hung Tang.

8.3 Authorization and Operational System of the EMP

8.3.1 Justification and Authorization

The implementation of the EMP requires commitments and undertakings at both the national and provincial level. These include:

- implementation of pollution charge system at the national level by MOSTE and the Ministry of Finance,
- approval of increases in the full time staffing levels within DOSTE and other agencies by the Government Committee on organization and personnel,
- approvals and funding to be given at the national level to allow the implementation of proposed the EMP programs for national level agencies,
- approval by MPI of any official development assistance programs provided by donor agencies, and
- support from MOSTE to provide equipment and training to support environmental monitoring and inspection activities.
- creation of the Implementation Committee of the EMP by a directive or instruction by QNPC,
- creation and funding of ERMU, IPCU, and TFPU,
- regulations on land use in tidal flats promulgated by QNPC,
- capacity building in the provincial level agencies that is done without donor assistance,
- raising of environmental awareness amongst communities and mass organizations, and
- implementation of natural resource programs to protect ecological resources.

8.3.2 Operational System

For the actual implementation of the EMP, the following operational system should be established:

- appropriate discharge standards for all facilities,
- compliance agreements to gradually reach discharge standards,
- penalties and fines,
- pollution charges, and
- linking EIA requirements to inspection activities and compliance monitoring.

8.4 Cost Estimation for Institutional Strengthening of the EMP

The estimated cost for major institutional activities including the required staff numbers, training programs, facilities and equipment required for the EMP is about US\$ 5.5 million up to 2010 including the proposed visitor center.

Table 8.1.1 Proposed Allocation of Responsibility under the IC

Environmental Management Function	Primary Agency Currently Responsible	Agency Responsible Under IC
1) Policy, strategy, planning, and direction	• NEA • QNPC	No change
2) Environmental standards and conservation criteria	• NEA	• <i>Conservation criteria set by QNPC, DOSTE, and HLMB</i>
3) Environmental monitoring and laboratory analysis	• NEA • EMD of DOSTE	• <i>ERMU</i>
4) State of Environment Reporting	• EMD of DOSTE	• <i>ERMU</i>
5) Environmental protection research and development	• National Research Institutions	• <i>ERMU</i>
6) Environmental impact assessment	• NEA • EMD of DOSTE	No Change
7) Complaints and dispute resolution	• Inspection Division of DOSTE	No Change
8) Inspection	• Inspection Division of DOSTE • Inspection Division of Provincial Departments of National Agencies	No Change
9) Education, training, and environmental awareness	• EMD of DOSTE • Information Division of DOSTE	• EMD of DOSTE • Information Division of DOSTE • <i>ERMU</i>
10) Licensing	• Industry Licensing Division of DOSTE	No Change
11) Pollution control	• Industrial Facilities • NEA • Other Sectoral Ministries • DOSTE	• Industrial Facilities • VINACOAL • <i>IPCU</i>
12) Supervision and collection of pollution charges	• NEA • Ministry of Finance	• <i>DOSTE</i> • <i>Department of Finance</i>
13) Solid and hazardous waste management	• Ha Long City and Cam Pha Sanitation Companies (solid wastes) • NEA (hazardous wastes) • DOSTE (hazardous wastes)	No Change
14) Protected area management	• Ha Long Bay Management Board (World Heritage Site) • Forest Protection Agency of Department of Agricultural and Rural Development	No Change
15) Tidal flats and mangrove protection	• Forest Protection Agency of Department of Agricultural and Rural Development	• <i>TFPU</i>

Note: New or changed responsibilities are highlighted in bold italics.

CHAPTER 9 EVALUATION AND DEVELOPMENT PROGRAM OF THE MASTER PLAN

9.1 Environmental Measures

The conservation criteria for the EMP should be achieved through an array of environmental measures. Total estimated incremental costs of the EMP are about US\$ 168 million from 2000 to 2010. The proposed environmental measures and estimated costs are as shown in Table 9.1.1 and summarized below.

Proposed Environmental Measures

(Unit: US\$ x 10⁶)

Category		Number of Projects/ programs	Investment Costs	O&M Costs			Total
				2000- 2010	2011- 2050	Sub- total	
1. Sanitation	Domestic Wastewater Management	4	79.4	7.3	65.5	72.8	152.2
	Industrial Wastewater Management	3	12.6	2.3	19.0	21.3	33.9
	Domestic Solid Wastes Management	3	10.0	3.8	31.9	35.7	45.7
	Industrial Solid Wastes Management	3	3.1	1.6	16.9	18.5	21.6
	Subtotal	13	105.1	15.0	133.3	148.3	253.4
2. Measures for Mining		7	29.0	5.8	18.9	24.7	53.7
3. Measures for Tourism		4	1.5	2.3	3.0	5.3	6.8
4. Measures for Environmental Resources		4	2.4	0.3	1.8	2.1	4.5
5. Environmental Monitoring		2	0.4	0.5	3.8	4.3	4.7
6. Institutional Development		2	3.0	2.5	2.0	4.5	7.5
Total		32	141.4	26.4	162.8	189.2	330.6

Note: O&M costs during 2011 to 2050 is estimated based on that of 2010.

It should be noted that there will be O&M costs after the target year 2010 to implement the EMP continuously.

9.2 Economic and Financial Evaluation

9.2.1 Questionnaire Survey for Environmental Value of Ha Long Bay

This survey aims at collection of enough data and information on Willingness To Pay (WTP) for environmental conservation of the Ha Long bay area of both tourists and local residents. These collected data and information significantly contributed to benefit calculation of conserved aesthetic and recreational amenity of Ha Long bay in addition to consideration on potential financial sources for the EMP implementation.

As shown in the next table, about 75% of tourists (both foreign and Vietnamese) and over 80% of local residents in Quang Ninh province were identified to have some WTP to conserve the Ha Long Bay's environment. Foreign tourist, Vietnamese tourist, and Quang Ninh people expressed total WTP of around US\$ 3.1, 0.3, and 0.1/person/year on average, respectively.

Average WTP of Tourists and Local Residents for the EMP

Items	Units	Foreign Tourists	Vietnamese Tourists	Residents in QNP
(1) Average WTP for non-use value	US\$/person/year	1.8	0.3	0.1
(2) Average WTP for use value	US\$/person/year	3.6	0.2	0.3
(3) Average WTP in total	US\$/person/year	3.1	0.3	0.1
(4) Total Ratio expressing WTP either for non-use or use value	%	75	74	83

9.2.2 Environmental Benefit

The results of benefit calculation summarized in the next table are on an annual basis of 2010 which is the target year of the EMP. The annual benefits is estimated to be approximately US\$ 14 million (VND 190 billion) in 1998 price, which is equivalent to 12% of the 1995 total GDP of the study area (about US\$ 120 million or VND 1,570 billion). Environmental benefits generated through conserved water quality account for nearly 63%, followed by benefit from conserved aesthetic and recreational amenity (around 16%). This result is in compliance with the EMP's direction of putting the most importance on water quality management.

Summary of Effects and Benefits of the EMP in 2010

Benefit Items	Physical Effects	Economic Benefits (US\$ ×10 ⁶ /year)
1. Conserved Water Quality	- Abated BOD and SS - Incremental mangrove - Reduction of water-related patients and deaths	9,112
2. Conserved Aesthetic & Recreational Amenity	- Conserved use and non-use values to tourists and residents	2,342
3. Conserved Fishery Resources	- Recovery of mangrove area - Prevention of reduced fishery production	771
4. Improved Forestry Resources	- Tree planting for mining - Natural reforestation	87
5. Others	- Increase of adequate water supply - Conserved air quality - Strengthened erosion & flood control capacity	2,086
Total		14,396

A cost-benefit analysis was carried by inputting the estimated benefits in addition to costs for the proposed measures under the EMP. The Economic Internal Rate of Return (EIRR) was calculated to be 7.1%, which is more than the discount rate recommended by the Japanese government at least. It can be justified that the EMP implementation is economically feasible and acceptable from a social viewpoint of the study area, because intangible benefits of the EMP such as scientific, ecological, and educational values have not been counted in the cost-benefit analysis.

9.2.3 Financial Evaluation

Under the national and local socioeconomic and financial background, the following three principles were basically set out for considering how to recover the costs necessary for the EMP implementation.

- Extra financial source for EMP should be developed,
- Public and private polluters of the Ha Long bay area should pay to recover their pollutant loads (Polluter Pays Principle, PPP), and
- Users of or beneficiaries from the Ha Long bay should contribute based on their payable capacity (User Pays Principle, UPP).

Considering the potential financial sources and procurement methods to collect and manage money necessary for the measures included in the EMP, a combination of these is proposed as the financial plan. Most of the initial investment rely on the international donors' soft loan because of their large size of necessary investment, while O&M costs are covered by environmental and wastewater fees from local residents and tourists as users of Ha Long Bay's environment. On the other hand, the major costs related to the coal mining environment is supposed to be charged to VINACOAL while the industrial part of the costs for wastewater & solid waste management is planned to be charged to the industrial sectors concerned in line with the PPP concept. And costs for the proposed software works, such as planning, surveys, training and equipment, are suitable to grant assistance from possible donors.

The next table is a summary of the financial plan by EMP measure and type of financial arrangement. Under this financial plan, over 55% of the total cost for EMP accruing between 2000 and 2050 is proposed to be financed domestically without donors' financial assistance. But, approximately 11% and 33% of the cost are expected to be covered by means of foreign donors' grant and soft-loan, respectively.

As for the domestic financing component for the EMP, the average annual expenditure amounts to about US\$ 3.7 million (= US\$ 186.9 million/51 years). Compared with the total GDP of Quang Ninh province of US\$ 270 million (equivalent to VND 3,000 billion) in 1996, this annual domestic expenditure accounts for 1.4% of the provincial GDP. Referring to the fact that OECD countries have spent 1 ~ 2% of their GDP as expenditures for environmental management, the proposed ratio of domestic financing is reasonable and essential to conserve even the local environment of the Ha Long bay.

Summary of Financial Plan

Measures under EMP	Total Cost by Financial Arrangement (US\$ mil.)				Major Method of Cost Recovery for Soft-loan and Domestic Financing
	Grant (%)	Soft-loan (%)	Domestic-Financing (%)	Total (%)	
1. Wastewater Management	23.8 (13)	68.2 (37)	94.5 (50)	186.1 (100)	-Environmental/wastewater fees -Charge to industries
2. Solid Wastes Management	0 (0)	13.1 (19)	54.2 (81)	67.3 (100)	-Environmental/wastewater fees -Charge to industries
3. Measures for Mining	2.5 (5)	26.5 (49)	24.7 (46)	53.7 (10)	-Charge to VINACOAL
4. Measures for Tourism	1.5 (22)	0 (0)	5.3 (78)	6.8 (100)	-Environmental fees - Visitor center entrance fees
5. Measures for Environmental Resources	2.5 (54)	0 (0)	2.0 (46)	4.5 (100)	-Environmental fees - Visitor center entrance fees
6. Environmental Monitoring	0.4 (9)	0 (0)	4.3 (91)	4.7 (100)	-Environmental fees - Visitor center entrance fees
7. Institutional Development	5.2 (68)	0 (0)	2.3 (32)	7.5 (100)	-Environmental fees - Visitor center entrance fees
Total	35.9 (11)	107.8 (33)	186.9 (56)	330.6 (100)	---

The revenues consist of environmental fees, wastewater fees, charges to industrial sectors, charges to VINACOAL, and visitor center entrance fees. The total revenue (about US\$ 350 million) between 2000 and 2050 overwhelms the total

cost before discounting. Its Financial Internal Rate of Return (FIRR) results in 0.54 %. All the measures and projects proposed under the EMP are for environmental conservation hardly generating monetary profits, and implemented by non-profit public agencies. Therefore, from viewpoint of the public implementing agencies, the EMP is considered financially feasible, as its FIRR is over 0 % at least.

In accordance with the financial plan, the cost recovery schedules for the measures of the EMP are formulated. The schedules include interest, repayment, and O&M costs, all of which amount to the total cash outflow to be recovered. Grant portion is excluded from the cash outflow.

Comparing these cash outflows in the cost recovery schedules with the potential revenues, the revenues through 2000 to 2050 is enough to cover the cash outflow as a whole, summing up to a surplus balance. Therefore, the proposed financial plan is appropriate to realize a sound financial management for the EMP.

9.3 Development Program of the Master Plan

9.3.1 Implementation Schedules

(1) Phased Plan of the EMP

A total of 32 projects and programs (the Projects) were proposed as a long list of the required measures under the EMP. To implement the Projects systematically and steadily, a phased implementation schedule is required. Considering necessary time of capacity building for the implementation of the Projects and the consistency and linkage with the planned socioeconomic development, a plan with three phases was proposed as follows:

- Phase I : commencement period of the Projects with a high priority and other urgent ones (year 2000 to 2002).
- Phase II : commencement period of the Projects which need preparation time for capacity building, and which proposed mainly against the development projects scheduled to be implemented at the middle term of HLMP (year 2003 to 2006).

- Phase III : commencement period of the Projects proposed mainly against the development projects scheduled to be implemented at the later term of HLMP (year 2007 to 2010).

(2) Implementation Schedules

Corresponding to these phases, the implementation schedules of the Projects were developed. The developed implementation schedules of the Projects are shown in Table 9.3.1. In these schedules, the stage classification such as design, equipment procurement, construction, training, and O&M were incorporated as shown in the patterned bar charts in the table.

It must be noted that the restoration of the sound environment after degradation is always much more costly than the prevention. Therefore, the commencement of the Projects on schedule is strongly recommended.

9.3.2 Investment Program

The yearly costs of each project of the EMP were calculated, and then an investment program was developed. The developed investment schedule of the EMP is shown in Table 9.3.2, including their O&M costs during 2000 to 2010. The total investment costs from 2000 to 2010, consisting of those for design, construction, and equipment procurement, will be about US\$ 141.4 million, and about US\$ 12.9 million per year on average. As the target year of 2010, the annual O&M cost will be about US\$ 5.0 million.

9.3.3 Priorities of Projects and Programs

Some of the Projects need to be commenced more urgently and certainly in order to achieve the goals set in the EMP. Thus, priorities of the Projects for actual implementation of the EMP were examined. The urgency (urgency points), effectiveness (effectiveness points), and location (location points) of each project and program has each given a score out of three.

The Projects were largely divided into three groups: high, medium, and low priorities according to their scores. The results of scoring and allocated priorities are shown in Table 9.3.3. The Projects scored higher were selected as priority projects and programs. The priority projects and programs are listed below.

Selected Priority Projects and Programs

No. *	Priority Projects and Programs
3	Bac Dang Wastewater Treatment Plant Construction Project
15	Pilot Rehabilitation Project on Coal Mining Area
22	Tourism Area Sanitation Improvement Project (Phase 1)
26	Mangrove Swamps Rehabilitation Project
29	Environmental Monitoring Program
32	Visitor Center Construction Project

Note: * Project Nos. in the EMP

Table 9.1.1 Proposed Environmental Measures and Estimated Costs of the EMP up to 2010

Category		Projects and Programs	Costs (million US\$)
I. Sanitation			
1.1 Domestic Wastewater Management	1	Don Dien WWTP including collection system in Dong Dang area	31.2
	2	Deo Sen WWTP	36.9
	3	Bach Dang WWTP	11.1
	4	Cam Pha WWTP	7.5
		Subtotal	86.7
1.2 Industrial Wastewater Management	5	Cai Lan Industrial WWTP (collection and convey system)	13.2
	6	Hloanh Bo Industrial WWTP (collection and convey system)	
	7	Lang Bang Industrial WWTP	1.7
		Subtotal	14.9
1.3 Domestic Solid Wastes Management	8	Procurement of solid wastes collection vehicles and equipment	8.3
	9	Extension of Quang Hanh landfill site	4.3
	10	Clinical solid wastes incinerators	1.2
		Subtotal	13.8
1.4 Industrial Solids Wastes Management	11	Procurement of solid wastes collection vehicles and equipment	1.7
	12	Extension of landfill sites	1.0
	13	Hazardous solid wastes incinerators	2.0
		Subtotal	4.7
		Total	120.7
2. Measures for Mining	14	Development of environmental plans for mining	0.9
	15	Pilot project on rehabilitation	1.8
	16	Measures for mine wastewater	2.2
	17	Measures for coal processing plants	1.7
	18	South Deo Nai dumping site rehabilitation	3.4
	19	Rehabilitation of river basins (Mong Duong, Dien Vong, Ha Tu, Hong Gai, Cam Pha, and Cua Ong)	11.5
	20	Dredging	13.3
		Total	34.8
3. Measures for Tourism	21	Development of environmental plans for tourism	0.1
	22	Improvement of sanitation condition-Phase 1	1.5
	23	Improvement of sanitation condition-Phase 2	1.2
	24	Reinforcement of patrolling capability	1.0
		Total	3.8
4. Measures for Environmental Resources	25	Reforestation in bare areas	1.5
	26	Rehabilitation of mangrove swamps	1.0
	27	Fishing activity management program	0.1
	28	Measures for landscape	0.1
		Total	2.7
5. Environmental Monitoring	29	Environmental monitoring (water quality, environmental resources)	0.8
	30	Environmental inspection	0.1
		Total	0.9
6. Institutional Development	31	Reinforcement of environmental management capability (staff, training programs, procurement of equipment)	2.5
	32	Establishment of Visitor Center	3.0
		Total	5.5
		Grand total	167.8

Note: 1) WWTPs include accompanied collection systems including pump stations and local collector sewers in densely populated areas.

2) Costs include those of O&M during 2000-2010.

Table 9.3.1 Implementation Schedules for Projects and Programs of the EMP

Category	Type	No.	Name of Projects/Programs	Phase I			Phase II				Phase III			
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sanitation Measures	Domestic Wastewater Management	1	Don Dien WWTP											
			Dong Dang Area (wastewater collection and convey system)											
		2	Deo Sen WWTP											
		3	Bach Dang WWTP											
	Industrial Wastewater Management	4	Cam Pha WWTP											
		5	Cai Lan WWTP (wastewater collection and convey system)											
		6	Hoanh Bo WWTP (wastewater collection and convey system)											
	Domestic Solid Wastes Management	7	Tang Bang WWTP											
		8	Procurement of Solid Wastes Collection Vehicles and Equipment											
		9	Extension of Quang Hanh Landfill Site											
	Industrial Solid Wastes Management	10	Clinical Solid Wastes Incinerator											
		11	Procurement of Solid Wastes Collection Vehicles and Equipment											
		12	Extension of Landfill Sites											
Measures for Mining		13	Hazard Solid Wastes Incinerator											
		14	Development of Environmental Plan for Mining											
		15	Pilot Project on Environmental Rehabilitation											
		16	Environmental Measures for Mine Wastewater											
		17	Environmental Measures for Coal Processing Plants											
		18	South Deo Nai Dumping Site Rehabilitation											
Measures for Tourism		19	Environmental Rehabilitation of River Basins											
		20	Dredging											
		21	Development of Environmental Plan for Tourism											
		22	Improvement of Sanitation Condition Phase 1											
Measures for Environmental Resources		23	Improvement of Sanitation Condition Phase 2											
		24	Reinforcement of Patrolling Capability for Tourism Activities											
		25	Reforestation in Bare Area											
		26	Rehabilitation of Mangrove Swamps											
Environmental Monitoring		27	Fishing Activity Management Program											
		28	Measures for Landscape (Landscape Management Guideline) (Reinforcement of Patrolling Capability for Shipping Activities)											
		29	Environmental Monitoring (water quality and environmental resources)											
Institutional Development		30	Environmental Inspection											
		31	Reinforcement of Environmental Management Capability											
		32	Establishment of Visitor Center											

Note: 1) Design, Construction, Equipment Procurement, Operation and Maintenance (O&M) or Training
 2) means priority project.

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Table 9.3.2 Investment Schedules for Projects and Programs of the EMP

Unit: US\$ x 10³

Unit: US\$'000																	
Category	Type	No.	Name of Projects/Programs	Stage	Phase I				Phase II				Phase III				Total
					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
Sanitation Measures	Domestic Wastewater Management	1	Don Dien WWTP	Design & Construction O&M			2,000	3,500	3,500				2,482	3,000	250	14,482	
			Dong Dang Area (wastewater collection and convey system)	Design & Construction O&M				2,500	3,600	3,945	4,000	200	238	250	250	13,338	
		2	Deo Sen WWTP	Design & Construction O&M			3,000	5,600	5,600			200	200	419	419	1,298	
		3	Bach Dang WWTP	Design & Construction O&M	1,000	1,800	1,800			400	400	6,000	6,583	7,000	580	33,783	
		4	Cam Pha WWTP	Design & Construction O&M				90	90	90	1,000	2,294	2,294	90	200	3,120	
			Subtotal	Design & Construction O&M	1,000	1,800	6,800	11,600	14,700	6,245	7,552	8,294	11,359	10,000	158	158	79,350
					0	0	0	90	90	780	780	1,138	1,176	1,637	1,637	7,329	8,604
	Industrial Wastewater Management	5	Cai Lan WWTP (wastewater collection and convey system)	Design & Construction O&M	1,200	1,602		80	80	80		80		1,200	1,602	160	1,004
		6	Huynh Bo WWTP (wastewater collection and convey system)	Design & Construction O&M						1,200	1,602				1,200	1,602	5,604
		7	Lang Bang WWTP	Design & Construction O&M							600	805		251	251	251	1,405
			Subtotal	Design & Construction O&M	1,200	1,602	80	80	80	1,800	2,407	1,200	1,602	1,200	1,602	160	12,613
	Domestic Solid Wastes Management	8	Procurement of Solid Wastes Collection Vehicles and Equipment	Equipment Procurement O&M				801	801	801	801	801	801	801	801	801	6,408
		9	Extension of Quang Luoi Landfill Site	Design & Construction O&M				1,000	1,723	165	192	224	262	306	357	417	1,923
		10	Clinical Solid Wastes Incinerator	Design & Construction O&M		407	500			29	32	35	38	39	39	39	907
			Subtotal	Design & Construction O&M	0	407	500	1,801	2,524	801	801	801	801	801	801	801	10,038
	Industrial Solid Wastes Management	11	Procurement of Solid Wastes Collection Vehicles and Equipment	Equipment Procurement O&M				196	196	18	23	31	41	55	81	120	1,192
		12	Extension of Landfill Sites	Design & Construction O&M		270	300			17	22	29	39	52	76	112	498
		13	Hazard Solid Wastes Incinerator	Design & Construction O&M				450	911			51	65	83	106	146	1,361
			Subtotal	Design & Construction O&M	0	270	300	646	1,107	51	65	83	106	146	173	231	624
Measures for Mining	14	Development of Environmental Plan for Mining	Design	202	374	259										921	
	15	Pilot Project on Environmental Rehabilitation	Design & Construction O&M	675	727	261	38	40	44	44						1,663	
	16	Environmental Measures for Mine Wastewater	Design & Construction O&M				58	360	720	720			90	90	90	1,858	
	17	Environmental Measures for Coal Processing Plants	Design & Construction O&M		58	58	53	55			236	238	250	250	250	224	
	18	South Deo Nai Dumping Site Rehabilitation	Design & Construction O&M		144	2,736	62	62	62	62	62	62	62	62	62	2,880	
	19	Environmental Rehabilitation of River Basins	Design & Construction O&M		173	173	997	1,034	1,028	958	861	878	1,130	976	8,228	496	
	20	Deciding	Design & Construction O&M	1,315	1,315	1,315	133	171	311	381	439	528	668	711	3,292	13,265	
		Subtotal	Design & Construction O&M	2,192	2,791	4,802	2,423	2,764	3,063	2,832	1,936	1,973	2,305	2,651	2,651	29,039	
				0	0	0	233	273	643	725	851	930	1,010	1,113	1,113	5,728	
																75	
Measures for Tourism	21	Development of Environmental Plan for Tourism	Design	50												0	
	22	Improvement of Sanitation Condition-Phase 1	Design & Procurement O&M	29	241	241		125	125	125	125	125	125	125	125	511	
	23	Improvement of Sanitation Condition-Phase 2	Design & Construction O&M				14	176	224	257		168	168	168	168	1,000	
	24	Reinforcement of Patrolling Capability for Tourism Activities	Design & Procurement O&M			67	60	73	85	98		110	124	136	149	671	
		Subtotal	Design & Construction O&M	79	241	308	14	268	224	314	332	357	399	466	511	1,955	
Measures for Environmental Resources	25	Reforestation in Bare Areas	Construction O&M		122	124	125	125	125	125	125	125	125	125	125	1,381	
	26	Rehabilitation of Mangrove Swamps	Design & Construction O&M	92	81	81	5	6	10	10	12	13	14	16	18	86	
	27	Fishing Activity Management Program	Equipment Procurement O&M		32	6	8	8	8	8	8	8	8	8	8	916	
	28	Measures for Landscape (Landscape Management Guideline)	Design		50		10	10	11	12	13	16	17	18	18	105	
		(Reinforcement of Patrolling Capability for Shipping Activities)	Equipment Procurement O&M				32	4	5	5	5	5	5	5	5	32	
		Subtotal	Design & Construction O&M	92	285	205	245	266	266	236	268	231	231	211	211	2,436	
				0	6	6	23	26	33	34	37	41	43	46	46	295	
																60	
Environmental Monitoring	29	Environmental Monitoring (water quality and environmental resources)	Equipment Procurement Monitoring	30			79	24	108	90	23	42	25	87	331		
	30	Environmental Inspection	Equipment Procurement Inspection	30			24	37	64	40	30				60		
		Subtotal	Design & Construction O&M	60	0	0	79	24	168	90	30	0	0	0	0	391	
Institutional Development	31	Reinforcement of Environmental Management Capability	Equipment Procurement Training	134	572	452	22	391	11	412	10	10	10	10	10	2,671	
	32	Establishment of Visitor Center	Design & Construction O&M	300	235	2,236	40	40	40	40	40	40	40	40	40	360	
		Subtotal	Design & Construction O&M	334	235	2,236	62	431	51	452	50	50	50	50	50	2,610	
Total		Design & Construction + Equipment Procurement		4,957	7,631	15,151	16,828	21,533	12,521	14,232	12,929	16,378	14,437	4,761	141,325		
		O&M + Training		435	593	614	765	1,515	2,361	2,930	3,991	3,937	4,663	5,019	26,438		
		Grand total (Design & Construction + Equipment Procurement + O&M + Training)		5,392	8,224	15,765	17,593	23,049	14,882	17,162	16,923	20,315	19,100	9,780	167,763		

Notes: 0 means priority projects.



Table 9.3.3 Selection of Priority Projects and Programs

Type	No.	Project/Program Name	Urgency (1)	Effectiveness (2)	Location (3)	Total Score (1)+(2)+(3)	Priority
Domestic wastewater	1	Don Dien WWIP	2	3	2	7	Medium
	2	Deo Sen WWIP	2	3	2	7	Medium
	③	Bach Dang WWIP	3	3	2	8	High
	4	Cam Pha Area WWIP	1	1	1	3	Low
Industrial wastewater	5	Cai Lan WWIP	2	3	1	6	Medium
	6	Hoanh Bo WWIP	1	3	1	5	Medium
	7	Lang Bang WWIP	1	1	1	3	Low
Domestic solid wastes	8	Collection Equipment	1	2	2	5	Medium
	9	Quang Hanh Landfill Extension	1	2	2	5	Medium
	10	Clinical Wastes Incinerator	1	1	1	3	Low
Industrial solid wastes	11	Collection Equipment	1	2	1	4	Low
	12	Extension of Landfill Sites	1	2	1	4	Low
	13	Hazard. Wastes Incinerator	1	1	1	3	Low
Mining	14	Environmental Plan	1	1	1	3	Low
	①⑤	Pilot Project on Rehabilitation	3	3	2	8	High
	16	Mine Wastewater	3	2	2	7	Medium
	17	Processing Plants	3	2	2	7	Medium
	18	South Deo Nai Dumping Site	3	2	2	7	Medium
	19	Rehabilitation of River Basins	2	3	2	7	Medium
	20	Dredging	1	2	1	4	Low
Tourism	21	Environ. Manage. Plan	1	3	-	4	Low
	②③	Improvement Sanitation-Phase 1	3	2	3	8	High
	23	Improvement Sanitation-Phase 2	1	2	3	6	Medium
	24	Reinforce. Patrolling Capability	1	1	3	5	Medium
Environmental Resources	25	Reforestation in Bare Area	2	2	2	6	Medium
	②⑥	Rehabilitation of Mangrove	2	3	3	8	High
	27	Fishing Activity Management	1	1	3	5	Medium
	28	Measures for Landscape	1	1	3	5	Medium
Monitoring	②⑨	Environ. Monitoring	3	3	3	9	High
	30	Environ. Inspection	2	2	3	7	Medium
Institutional Development	31	Reinforce. Manage. Capability	2	3	1	6	Medium
	③①	Establishment of Visitor Center	3	3	2	8	High

Note: (1) Urgency point: projects and programs to be commenced urgently scored 3, rather urgently 2, little urgently 1.
 (2) Effectiveness point: projects and programs have relatively high effectiveness are scored 3, medium 2, and small 1.
 (3) Location point: projects and programs in SCZ and its vicinity are scored 3, neighborhood 2, distant place 1.
 Projects and programs with more than eight points were selected high priority projects and programs.



CHAPTER 10 RECOMMENDATIONS

10.1 Recommendations

10.1.1 Recommendations on Execution of the EMP

The EMP is prepared for provincial environmental management of the Ha Long bay area. This means that QNPC has the primary responsibility for implementation of the EMP. Although a lot of difficulties will confront to QNPC, it should be noted that an actual challenge could break current problems of environmental management. In order to pave the way for execution of the EMP, the following points are strongly recommended to be set up by QNPC.

- (1) To Incorporate the EMP into the Development Master Plan of Ha Long City (HLMP)

By executing the proposed projects and programs in the EMP, the conservation criteria can be attained under HLMP toward target year 2010. It is important that development projects of HLMP should follow the proposed land use guidelines in the EMP. Considering the importance of environmental management in the Ha Long bay area, the involvement of the EMP in HLMP is an effective way to:

- state QNPC's commitment on implementation of the EMP,
- authorize the right and power related to the EMP,
- make EMP a common knowledge among the departments in QNPC,
- keep EMP in mind among officers in daily decision making,
- receive supports from national level ministries and institutions as an advisory committee, and
- ensure allocation of budget from QNPC.

It is also recommended that, after 2010, immoderate development in and around Bai Chay bay, and disordered land reclamation should be avoided. Invitation of environmentally friendly industry is also recommended in the future.

(2) To Establish the Implementation Committee (IC) of the EMP

This is the first actual step to be taken by QNPC. IC should be a core organization for implementation of the EMP. The purposes of this action are to:

- announce the top down decision to QNPC staff,
- unify the ultimate responsible body,
- identify official agencies and stakeholders to be involved,
- demarcate roles and responsibilities among bodies concerned,
- clarify a procedure of planning, coordination, execution, inspection, monitoring, evaluation, and revision of the EMP, and
- accumulate experience and information to establish the Quang Ninh Environmental Management Authority (QNEMA).

(3) To Put High Priority on Conservation of Tidal Flats

The tidal flats play very important roles in the EMP area from environmental viewpoint, such as conservation of flora and fauna as well as natural ecosystem. The tidal flats have been targeted for reclamation for urban and industrial development without enough recognition of their functions. Therefore, QNPC should put high priority on conservation of tidal flats aiming to:

- protect tidal flats from encroachment and reclamation,
- demarcate roles and responsibilities between FPA and DARD under IC,
- reflect tidal flats protection in land use planning,
- enhance purification capacity of tidal flats by reforestation of mangrove trees, and
- maintain the natural conditions of the coast line to preserve biodiversity and landscape.

(4) To Cooperate with State Owned Enterprises (SOE)

Since the proposed EMP is mainly prepared under the leadership of QNPC, there could be some limitations to incorporate intentions of SOE such as VINACOAL mainly due to the different management level from provincial to national. An

agreement of cooperation between QNPC and SOE is required for effective environmental management in the EMP area. Its major aims are to:

- clarify implication of SOE to the EMP,
- demarcate roles and responsibilities between IC and SOE,
- reflect the EMP in SOE's environmental management plans,
- submit SOE's environmental management plans and monitoring data to IC periodically,
- allow inspections and report the results to those governing ministries, and
- provide basic data for database preparation.

(5) To Control Pollution Loads from Ships

The proposed EMP suggests that the pollution loads derived from ships during transshipment may impact on the environment in the Ha Long bay area. Although it is difficult to tackle them qualitatively, the following measures are strongly recommended:

- enforcement of inspection and patrol of shipping activities,
- holding bilge water for next port-call of cargo ships,
- offshore recycling of ballast water of tankers,
- control by MARPOL Protocol of 1978 (MARPOL 73/78) and the Guidelines of Baltic Marine Environment Protection Commission (HELCOM),
- proceeding the modernization of ships and ports facilities, and
- proper allocation of ports including floating ones and B12 oil port.

(6) To Reinforce Actual Activities of the EMP

Actual activities will bring difference from the present conditions, and give positive incentives to staff and stakeholders. It is important to continue actual activities of the EMP especially environmental monitoring even if it is small scale at first, because the continuation contributes to:

- motivate accountability of staff and stakeholders,
- understand environmental conditions in the field as much quantitatively as possible,
- develop technical tools to be applied and strengthen enforcement capability,

- learn lessons from actual practices,
- train staff for future trainers,
- identify and formulate necessary projects and programs to be implemented in the EMP,
- disseminate experiences in the world as a model in Vietnam, and
- promote international cooperation.

(7) To Tackle Environmental Impacts Brought from the Outside of the EMP Area

In the course of the Study, the environmental impacts brought from outside of the EMP area were identified. The origin of the impacts is considered to be the discharged fresh water from the Thai Binh and Bach Dang rivers. Therefore, it is necessary to pay attention on the water quality in the southern outskirts of the EMP area.

- develop and implement a wide-range environmental monitoring program,
- research and clarify the mechanism of environmental impacts (degrees, seasonal and yearly changes) on the EMP area brought from the outside as much quantitatively as possible,
- develop comprehensive projects and programs against the wide-range environmental issues such as development of land use plan,
- review and update the EMP based on the results of the monitoring and research, and
- promote cross-provincial cooperation on the environmental issues.

(8) To Reinforce Capability of Emergency Response against Environmental Accidents

There is always a possibility that an environmental accident such as fire, oil leakage and spill, or vessel collision could occur in the EMP area. These environmental accidents would damage natural and social assets including human lives especially in the World Heritage area. Therefore, an emergency response system in case of such accidents should be established aiming to:

- reinforce capability of emergency response system,
- clarify responsibilities of ships owners and enterprises for emergency response legally,
- install facilities for emergency response such as oil spill and absorption booms (oil fences), mobile pump for sucking oil, and extinguishers in each port and industry, and responsible agency,
- organize emergency response team in each port and industry, and responsible agency , and
- examine the preventive measures of the risks in detail by individual EIA.

10.1.2 Recommendations on Technical Aspects

For the execution of the EMP, recommendations and suggestions in technical aspects are given as follows:

(1) Review and Update of the EMP

- The EMP should be reviewed/updated by DOSTE and agencies concerned under IC,
- The EMP should be reviewed timely according to the change of economic and social conditions, and be updated at least once every five years.
- Statistical data should be collected and arranged continuously, and database should be updated timely according to the statistical survey periods.
- The EMP should be reviewed based on the results of the environmental monitoring.

(2) Sanitation

- Flush toilets should be provided in all tourism and commercial developments. They are also recommended for high density residential development.
- Dry sanitation methods and septic tanks draining to soakaways are generally suitable in low density and rural areas.
- Education and advertisement to campaign for promoting public environmental awareness should be urgently undertaken.
- The existing anti-littering bye laws should be enforced.

- Measures to control increase of residents on the sea, such as registration of boat, and regulation and restrict of anchor place, should be implemented.
- All factories should treat their wastewater to meet the proposed conservation criteria.
- Industrial parks should have collection sewer systems so that the combined discharges can receive further treatment or be transferred to a suitable discharge location.
- Regulation of the handling and disposal of hazardous wastes in EMP area is urgently required.
- Collection of the solid wastes should be carried out either by industry itself, or private contractors, or by the public sector at commercial rates.
- Minimization of industrial solid wastes generation, maximization of recycling and reuse, and co-siting of 'compatible' industries should all be encouraged.

(3) Coal Mining

- Responsibility of environmental measures for coal mining issues should be clarified.
- Rehabilitation plan of coal mining areas should be developed and submitted to the Ministry of Industry, MOSTE, and QNPC for review and approval.
- Assessment of environmental damages caused by coal mining should be implemented and evaluated periodically.
- Internal environmental performance auditing system should be established.
- Environmental considerations should be integrated into production plan.

(4) Tourism

- Educational signs and information boards about, for example, the brief explanation of geology, cave systems, animals and plants found in the area, ecosystem should be installed.
- Tourists should be clearly instructed about prohibited activities, such as littering, wastewater discharge, and damaging or trading sensitive environmental resources such as corals.
- Tours should be conducted with qualified guides.
- Access control for the conservation areas should be strictly imposed.

(5) Environmental Resources

- Reclamation on tidal flats and mangrove swamps should be strictly controlled with environmental consideration.
- Binh Huong estuary should be designated as an environmental conservation area.
- Prohibited fishing methods and gears should be controlled strictly to conserve fishery resources.
- Landscape conservation and harmony with surroundings should be taken into consideration in design of new buildings.
- Beautification activities should be implemented periodically and continuously.

(6) Environmental Monitoring

- Reinforcement of staff and intensive and routine training for monitoring skills should be commenced soon.
- The monitoring equipment in possession by DOSTE should be utilized soon and their maintenance and overhaul should be implemented periodically and continuously.
- Research and monitoring of the EMP area should be implemented continuously, so that the pollution mechanism can be analyzed more clearly and accurately.
- Wide-range environmental monitoring covering the inter-provincial areas should be established.
- Monitored data and results of the environmental inspection should be opened.
- Environmental survey and monitoring of flora and fauna in the Ha Long bay area should be implemented together with local institutes.

10.1.3 Recommendations on Institutional and Organizational Aspects

The EMP shows desirable organization for its execution. The recommendations for institutional and organizational aspects are summarized as follows:

- Unified environmental management system should be established, and rights and responsibilities of each agency and organization should be set up clearly.
- EMD in DOSTE should be an implementation and coordination agency for the EMP.
- ERMU and TFMD should be set up soon, at least by 2000, for the execution of the EMP.
- The Quang Ninh Environmental Management Authority (QNEMA) should be set up in future for a new authority with a broad mandate for environmental conservation.
- Legal obligation for EIA of various development projects and establishment of the evaluation system should be establishment.

10.1.4 Recommendations on Economic and Financial Aspects

The recommendations for economic and financial aspects are summarized as follows:

- Further basic study on socio-economy and environment for the study area should be carried out to accumulate reliable data to enhance the benefit evaluation of the EMP or the World Heritage site.
- A system of environmental bonds should be actually introduced on the central and local levels, under the Environmental Protection Law, to provide immediate financial sources for environmental conservation.
- The central government and QNPC should make a special arrangement to finance the EMP implementation including exclusive budget allocation to the EMP based on the proposed environmental and wastewater fees collected from tourists and local residents.
- There should be active coordination on the central and local levels so that VINACOAL and other industrial sectors are directed to pay the proposed charges to recover the costs for the EMP.

10.2 Conclusion

The Ha Long bay area is planned to be developed as the North Focal Economic Area in Vietnam. Without proper countermeasures, however, environmental deterioration caused by the socioeconomic growth has gradually become serious, so that the negative impacts will fall on the economic growth. Therefore, environmentally sound and sustainable development should be recognized as one of the important issues in this area.

In the course of the Study, the current environmental problems were identified and also the possible environmental problems which would be caused by the future development projects were predicted. The Study presented a vision, namely "Environmentally Sound and Sustainable Development of the Ha Long Bay Area", for the target year 2010, and three goals were set to attain this vision. In addition, the environmental conservation criteria by environmental zones were examined, together with necessary counter and preventive measures. Consequently, total 32 projects and programs consisting of both hard and software components were proposed. The Environmental Management Plan for Ha Long Bay (EMP) was developed by systematizing the proposed projects and programs.

Realization of the EMP surely contributes to absolute protection of the World Heritage area and the achievement of environmental protection for sustainable economic growth in the Ha Long bay area. The EMP plays an important role as a guidepost for not only environmental protection but also sustainable development in the Ha Long bay area. Although the realization of the EMP would need much time, costs, and endeavors by all organizations concerned, the commencement of the concrete measures as early as possible toward the target year 2010 is strongly recommended.







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