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Japan International Cooperation Agency (JICA)

Hanoi People's Committee

Socialist Republic of Vietnam

The Study on Environmental Improvement for Hanoi City in The Socialist Republic of Vietnam

Final Report

Summary

July 2001

Nippon Koei Co., Ltd.

TEC Corporation

Japan International Cooperation Agency (JICA)

Hanoi People's Committee
Socialist Republic of Vietnam

The Study
on
Environmental Improvement for Hanoi City
in
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EX Corporation

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Volume 2	Environmental master Plan Methodologies for EMP
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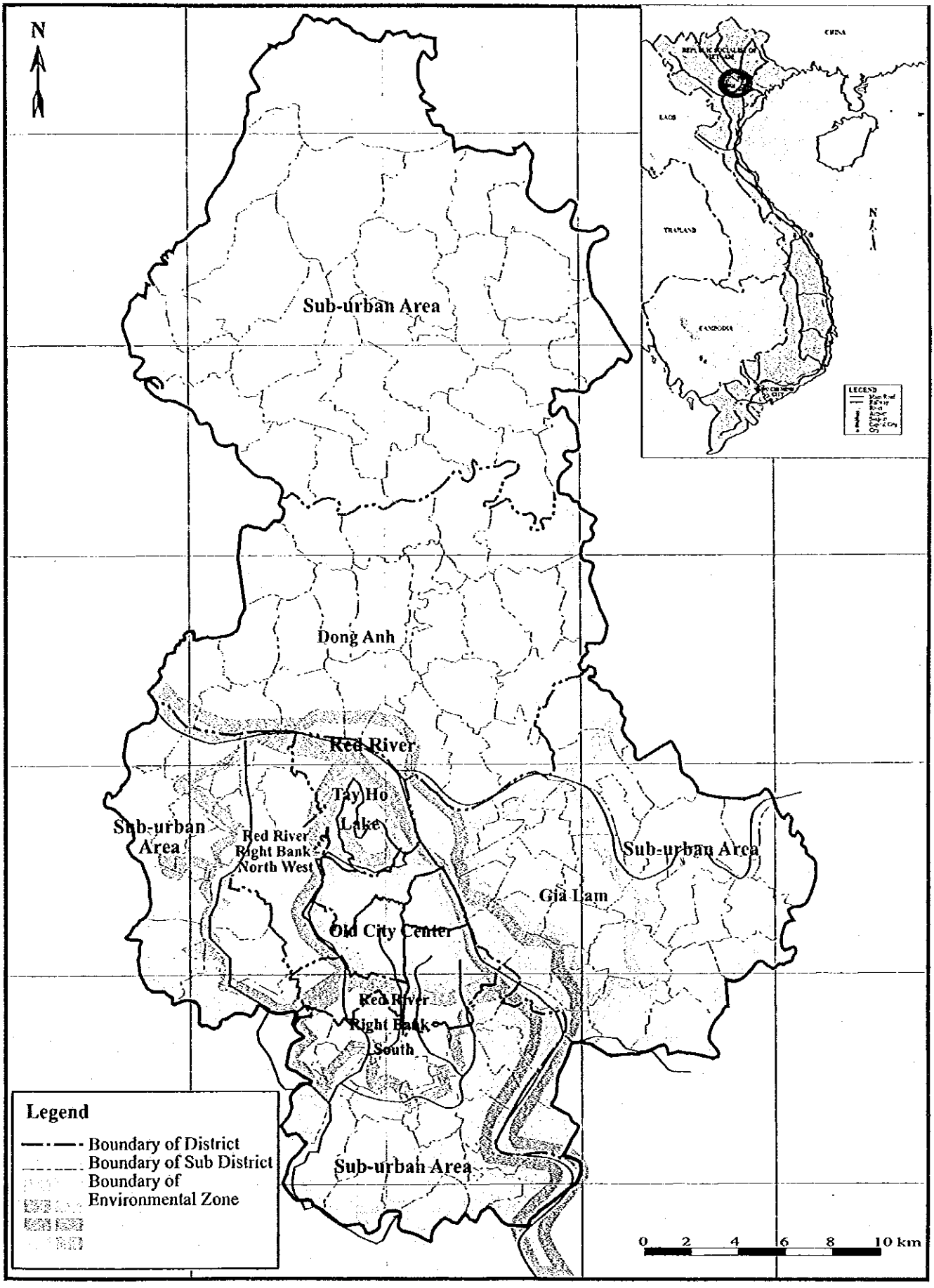
SUPPORTING REPORT

DATA BOOK

ESTIMATE OF PROJECT COST

Estimate of Base Cost : As of March 1999 Price Level
Currency Exchange Rate : USD1.0 = VND13,900 = Yen 122


N
Sub-urban Area
Dong Anh
Red River
Tay Ho Lake
Sub-urban Area
Red River Right Bank North West
Sub-urban Area
Gia Lam
Old City Center
Red River Right Bank South
Sub-urban Area
Legend
Boundary of District
Boundary of Sub District
Boundary of Environmental Zone
0 2 4 6 8 10 km

Study Area

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct the master plan and pre-feasibility study on Environmental Improvement for Hanoi City and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Masatoshi Akagawa, Nippon Koei Co., Ltd. and consisted of Nippon Koei Co., Ltd and EX Corporation to the Socialist Republic of Vietnam, three times between July 1998 and July 2000. In addition, JICA set up an advisory committee headed by Mr. Masahiro Ota, Environmental Policy Development Specialist of Institute for International Cooperation between July 1998 and July 2000, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of the Socialist Republic of Vietnam, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Socialist Republic of Vietnam for their close cooperation extended to the Team.

July, 2000

Kimio Fujita
President
Japan International Cooperation Agency

July, 2000

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Sir,

LETTER OF TRANSMITTAL

It is with great pleasure that we submit to you the Final Report of the Study on Environmental Improvement for Hanoi City completed by the Study Team with cooperative efforts of Hanoi People's Committee (HPC) and other parties concerned. The report has been prepared for the Government of the Socialist Republic of Vietnam in implementing the effective environmental improvement plan in the HPC area.

The report consists of the Summary, Main Report, Supporting Report and the Data Book. The Summary presents the outline of the study results and the Main Report gives all the study results regarding environmental improvement. The Supporting Report describes field surveys conducted during the first study period and guidelines for solid waste management. The Data Book compiles useful reference data relevant to the Study.

Taking this opportunity, on behalf of the Study Team, I would like to express my heartfelt gratitude to the personnel from JICA, Advisory Committee, Ministry of Foreign Affairs, Ministry of Health and Welfare, Environment Agency, Embassy of Japan in Vietnam, JICA Vietnam Office and Vietnamese officials from Steering Committee comprised of relevant government agencies who extended their kind assistance and cooperation for the entire study period to the Study Team. The Study Team hopes that the results of this Study contribute to the future implementation of the environmental improvement project in Hanoi City in Vietnam.

Yours faithfully,

Masatoshi Akagawa
Team Leader
The Study on Environmental Improvement
for Hanoi City

EXECUTIVE SUMMARY

1. Objectives of the Study

1. The principle objectives of the JICA Study on Environmental Improvement for Hanoi City are as follows.
   (i) Prepare an environmental master plan for Hanoi City with the target year of 2020.
   (ii) Select a project which should be implemented at the earliest opportunity as possible with a view to improving the environment of the city and conduct a preliminary feasibility study on it.
   (iii) Carry out technology transfer to the Vietnamese counterpart officials in environmental planning field through on-the-job training and workshops.

2. Ambient Environmental Qualities at Present

2. In the light of the current Vietnamese environmental standards and international ones including WHO's, the current conditions of the ambient environment of the Hanoi City were assessed.

3. Area-wise, there exists substantial difference between the urbanized areas and the suburban areas. The urbanized areas located on the right bank of the Red River, mainly comprising the seven urban districts including the old city center and Ho Tay area, accounts for only 9.1% of the city area of 927 km^2. However, nearly half of the city population is living in this area and economic activities as well as public administration both at city level and national levels together with relatively heavy traffic are concentrated in this area. As a consequence, the existing urban area is significantly polluted in certain aspects including water-related sanitary condition and water quality. The suburban areas are not yet polluted except for air and noise pollution in the areas along the major highways.

4. Sector-wise, water-related sanitary condition is very poor with frequent inundation by storm water due to the inadequate capacity of the drainage system/regime particularly in the city center almost every year which is suspected to cause water-borne diseases together with the inconvenience to the Hanoi citizens and economic loss due to the interruption of traffic and production activities.

5. In terms of non-hazardous pollutants including bio-chemical oxygen (BOD), water quality is seriously degraded especially in the urban rivers of To Lich, Lu, Set,Kim Nguu while certain degradation of water quality is observed in the West Lake and the lakes located in the urbanized area due mainly to the inflow of untreated municipal sewage including domestic and commercial as well as industrial origins. No clear observation has been made for the water pollution in terms of hazardous substances to date.

6. Except for total suspended particulate materials in the air, no serious pollution has been recorded for the whole city, though occasionally the standards have been exceeded particularly with regard to SO_2 near the industrial areas and NO_2 along the major highways. TSP value exceeds the standards in the urbanized areas, though it does not affect human health. Area-wise, particularly the old city center and its surrounding areas are very much polluted by TSP due mainly to the dust/particulate emission of domestic and industrial origins as well as the dust caused by the traffic on the roads.

7. Noise pollution has been observed along the major highways, almost throughout the entire day, except night time after 6 pm. In certain parts along the highways in the area located on the right bank of the Red River, noise level exceeds the standards even during night time.

8. In general, Hanoi City looks clean. However, in some parts of the city, dumped solid wastes are found along some back streets, drainage canals, rivers, lakes, etc. About 3/4 of the generated wastes are currently collected in the urbanized area (7 urban districts). Since 1999, URENCO has been using Nam Sun Phase 1 landfill site (about 13 ha), while is about 50 km to the north of the Hanoi city center.

9. Though rapidly improving, the establishment of the institutional and organization framework for the environmental management of Hanoi City started only several years ago and much remains to be done.

3. Expected Growth and Urbanization of Hanoi City

10. The population of the city is expected to increase to about 3.5 million in the year 2020 from the current 2.5 million or about a 1.6 % increase per year on the

average. In the Hanoi Urban Master Plan for 2020, urbanization is envisaged to the peripheral area surrounding the existing urban area of 7 urban districts in order to alleviate the excess concentration of population and economic activities, in particular the old city center area. Aiming at achieving more balanced growth of the city as a whole, urbanization is also envisaged on the left bank area of the Red River. Namely:

(i) The old city center is planned as a Development Restricted Area and the currently high population density of 264 person/ha in the old city center will be alleviated by about 120,000 population decrease in this area, resulting in about 229 person/ha population density by the year 2020.

(ii) The current urbanized area centering around the old city center and 7 urban districts will be expanded to the neighboring 2 suburban districts of Tu Liem and Thanh Tri which is planned as Development Expansion area population of which is envisaged to be about 700,000 in 2020.

(iii) New City area is planned to be formed in the left bank of the Red River, centering around the Dong Anh and Gia Lam towns with the planned population of about 1 million in the year 2020.

11. Accordingly, urban population will be increased to 2.5 million from the current 1.7 million or accounting for about 71.4 % of the city population as shown below.

Population Change in Hanoi City

	Present	2010	2020
Restricted Development Area	922,044	826,318	800,000
Expanded Development Area	-	607,543	700,000
New City	-	467,842	1,000,000
Subtotal for Urban	1,718,409	1,901,703	2,500,000
Subtotal for Suburban Area	762,175	908,446	1,007,923
City Total	**2,480,584**	**2,810,149**	**3,507,923**

12. However, nature oriented land use including green, agriculture, forest and rivers and lakes still will account for 68.0% in the year 2020.

13. Based on the past records and potential of the city, economic growth rate in terms of its Gross Regional Product (GRP) may range from about 7.5% to 15.0% depending on various factors including the international economic environment in the future, in particular as market of Vietnamese products and direct investment

into Vietnam. New industrial zones are envisaged to be developed rapidly in the coming years, the total area of which would reach 2,115 ha in the year 2020 from the current 570 ha.

4. Ambient Environmental Qualities in the Future Without Counter-measures

14. With the expected population increase and economic growth as well as the envisaged urban expansion in the future, the environmental qualities of the city would quickly be degraded. With the planned population increase and urbanization expansion, the following environmental degradation is expected, assuming the pollution load increase of about 7.5% taking into account the future efforts for re-use, recycle and cleaner production in the case that no further actions and improvement measures are not taken beyond the present level.

Environmental Qualities in 2020 Without Countermeasures

	Conditions
Sanitary Water Environment	Old City Center area would continue to be affected by frequent inundation.
Water Quality	Seriously polluted area would expand to include the whole of the Nhue river and the West Lake. Without adequate monitoring and inspection as well as law enforcement against violation, incidences of hazardous discharge from the enterprises might happen frequently, endangering the water environment and human health.
Air Quality	Except for some parts of the suburban districts, TSP value would exceed the allowable limit in the whole city. In addition, NO_2 limit will be exceeded in the old city center area frequently SO_2 limit would be exceeded occasionally in the old city center and some other urbanized areas.
Noise	Along major highways in the whole city would be affected by traffic noise throughout the day.
Cleanliness of the city	If measures are not taken, generated solid waste can not be disposed of and the whole city would be full of dumped and scattered wastes, endangering the public health and the function of the capital city.

5. Necessity of Environmental Master Plan

15. Long-term and comprehensive master plan is needed considering:

(i) Though limited in the area and aspects, environmental deterioration is already observed especially in water quality in the 4 urban rivers and the West Lake.

(ii) With the rapid economic development together with urbanization expansion, environmental degradation will be worsened in the wider area.

(iii) It would require long time and large cost to improve the polluted environment so it would be wiser to prevent pollution from taking place.

(iv) Institutional and organizational strengthening as well as facility development cannot be implemented in a short time period.

16. Master plan for environmental improvement and management is, therefore, formulated considering the following points.

(i) Set long term target year of 2020 with middle target year of 2010

(ii) Consider both structural and non-structural or institutional countermeasures and projects

(iii) Based on the Hanoi Urban Master Plan for 2020 which has already been approved by the Prime Minister

6. Implementation of the Urgent Project

17. Providing the disposal facility and system for the solid waste which is generated everyday is the most urgent and HPC has already started the Phase 1 of the Nam Son landfill project. However, Phase 1 area is rather limited with expected capacity of a few years and the preparation of the large sized second phase should be started at the earliest timing. Dong Ngac site is selected based on its advantageous location for transferring waste from collection vehicles to large transport vehicles as well as social condition. The following system comprising sanitary landfill and transfer system, is recommended to be implemented.

Component of the Urgent Project

Nam Son Landfill	
- Type and facility	Sanitary landfill
- Waste disposal capacity	10,853 thousand tons
- Operation period	2004 through the beginning of 2018
Dong Ngac Transfer System	
- Area	6.0 ha
- Waste transfer capacity	1,600 tons/day at start of operation in 2004
Transport Vehicles	
- Dump trucks	44 vehicles of 25 tons gross vehicle weight [26 m^3] (11 tons of carrying capacity)

18. The total investment cost of the urgent project amounts to about US$ 45.8 million

19. It should be noted that proper facilities including leachate and gas treatment facilities are planned for preventing the infiltration of polluted water into the

groundwater as well as for gas control. If properly operated and managed, no environmental impacts is expected.

7. Implementation of Priority Projects and Other Counter-Measures

20. Various counter-measures are recommended to be implemented with short, middle and long-term timeframes. Among all, the following projects are recommended to be placed high priority so that they should be completed by the year 2005 or by 2010 at the latest.

Classification of Priority Projects

Purpose	Structural	Non-Structural
Integrated Environmental Management		Establishment and Reinforcement of the Monitoring System
		Establishment of Environmental Coordination Committee and Revolving Environmental Master Plan Procedure
		Reinforcement of Hanoi DOSTE
		Strengthening of Environmental Management at District Level
Sanitary & Clean Water	To Lich Drainage	Reform of HSDC
	West Lake Water Quality Improvement	
	14 City Lakes in Old City Center	
	Public Sewerage for Old City Center	
	Septage Collection & Disposal	
Clean City	Improvement of Collection of Solid Waste	Shift of SWM Authority to Districts and Privatization of SWM services
		Study on the Possibility of a Waste Incinerator with Power Utilization for Hanoi
Diversification of Financial Facility		Establishment of Environmental Fund

21. Total initial investment cost of the 6 structural type priority projects added with that of the urgent project would amount to about US$514 million.

8. Ambient Environmental Qualities in the Future With Countermeasures

22. With the implementation of EMP, Hanoi City would be clean except for limited aspects in limited areas as shown below.

Environmental Qualities in 2020 With Counter-measures

Environmental Sectors	Conditions
Sanitary Water Environment	Whole Hanoi City would be protected from inundation due to storm water, either fully (against storm water with 10 year return period) or sufficiently (against storm water with 5 year return period).
Water Quality	Owing to the implementation of EMP, no seriously polluted surface water bodies would be found in the Hanoi City in 2020, though slightly polluted reach would be found in the downstream and middle-stream of Lu and To Lich rivers, flowing in the environmental zone 3.
Air Quality	In terms of SO_2, the whole city will be unpolluted. In terms of NO_2, the whole city will be unpolluted except for the old city center area, EZ 1, where slightly polluted condition would be observed. Similarly, the whole city would be freed from TSP pollution except the old city center.
Noise	The whole city would be free from noise pollution.
Cleanliness of the city	95 % collection target will be achieved and the whole city will be clean in terms of solid waste except small uncontrolled dumping.

9. Cost Required and Affordability of EMP

23. The overall financial requirement for the implementation of EMP for environmental management and environment-related services including capital and recurrent costs, is summarized below.

Cost of EMP

Unit: US$ million

2000 – 2005	2006 – 2010	2011 –2020	Total
403	371	680	1,454

24. As shown above, US$1,454 million would be required in total for the implementation of the recommended projects and measures for EMP for the period of 21 years from 2000 through 2020, which comprises the capital cost of about US$1,207 million and about US$247 million for institutional projects cost and incremental recurrent costs including O&M and personnel costs.

25. Capital costs will be financed through various fund sources which are yet to be known at this moment. In this JICA Study, the total cost is capitalized, assuming the weighted average loan condition of 25 year repayment period with 5 % interest rate. Affordability of EMP costs or financial implementability of EMP is checked by the capitalized cost of EMP added with all the recurrent costs including the current against GRP of the city and the total revenue of HPC, assuming that HPC revenue grows at the same rate as that for GRP. Two cases of economic growth are assumed, i.e, high case with 15.0% annual growth and low case with 7.5%. The calculated ratios for 2010 and 2020 are given below.

Range of Ratios of EMP Costs to HPC Revenue and GRP

Unit: %

	2010	2020
High Economic Growth Case		
- Ratio to HPC revenue	7.0	2.7
- Ratio to GRP	1.0	0.4
Low Economic Growth Case		
- Ratio to HPC revenue	16.9	12.7
- Ratio to GRP	2.3	1.7

10. Subsequent Actions Recommended

26. In order to materialize the EMP, actions should be taken for the finalization and authorization of EMP at the city level and at the national level based on the recommendations by the JICA Study. Detailed study and design should be carried out for Nam Son Phase 2 landfill. Finalization and land acquisition arrangement should be made for the transfer station. Financing arrangement for the both including the transport vehicles should be made. Feasibility studies for the recommended priority projects should be carried out.

THE STUDY
ON
ENVIRONMENTAL IMPROVEMENT FOR HANOI CITY
IN
THE SOCIALIST REPUBLIC OF VIETNAM

FINAL REPORT

SUMMARY

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Tables and Figures shown in the text do not have the numbers but referred in the text.

ABBREVIATIONS

Government of Vietnam/Public Institutions

APNEH	:	Hanoi Association for Protection of Nature
CEETIA	:	Center for Environmental Engineering of Towns and Industrial Areas
CEST	:	Center for Environmental Science and Technology
DFP	:	Department of Finance and Pricing
DI	:	Department of Industry
DOC	:	Department of Construction
DOSTE	:	Hanoi Department of Science, Technology and Environment
EMD	:	Environmental Management Division
GOV	:	Government of Vietnam
HAPI	:	Hanoi Authority of Planning and Investment
HCAO	:	Hanoi Chief Architect's Office
HD	:	Healthcare Department
HPC	:	Hanoi People's Committee
HSDC	:	Hanoi Sewerage and Drainage Company
HT	:	Hanoi Television
MOC	:	Ministry of Construction
MOET	:	Ministry of Environment and Training
MOF	:	Ministry of Finance
MOI	:	Ministry of Industry
MOSTE	:	Ministry of Science, Technology and Environment
MPI	:	Ministry of Planning and Investment
NEA	:	National Environmental Agency
NIED	:	National Institute for Educational Development
PMB	:	Project Management Board
SC	:	Steering Committee
SCPE	:	Scientific Center for Population and Environment
TUPWS	:	Hanoi Transport and Urban Public Works Service
URENCO	:	Hanoi Urban Environment Company
VCCI	:	Vietnam Chamber of Commerce and Industry
VIWASE	:	Vietnam Consultant on Water Supply, Sanitation and Environment

International /Foreign Organizations

ADB	:	Asian Development Bank
ASEAN	:	Association of Southeast Asian Nations
CIDA	:	Canadian International Development Agency
EU	:	European Union
IBRD	:	International Bank for Reconstruction and Development (World Bank)
JICA	:	Japan International Cooperation Agency
JBIC		Japan Bank for International Cooperation
NGO	:	Non-Government Organization
OECD	:	Organization for Economic Cooperation and Development
SIDA	:	Swedish International Development Agency
The JICA Study Team	:	The JICA Team for the Study on Environmental Improvement for Hanoi City
UNDP	:	United Nations Development Program
UNICEF	:	United Nations International Children's Emergency Fund
UNIDO	:	United Nations Industrial Development Organization
WHO	:	World Health Organization

Others

BOD	:	Biochemical Oxygen Demand
C	:	Carbon
CECS	:	Center for Environmental Chemistry Studies
CEST	:	Center for Environmental Science and Technology
CH_4	:	Methane
CO_2	:	Carbon dioxide
COD	:	Chemical Oxygen Demand
CRES	:	Center for Regional and Environmental Studies
Cl	:	Chlorine
DID	:	Densely Inhabited District
DO	:	Dissolved Oxygen
EAR	:	Environmental Awareness-Raising
EARET	:	Environmental Awareness-Raising, Education and Training
EE	:	Environmental Education
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Master Plan
ES	:	Executive Seminars

F/S	:	Feasibility Study
GDP	:	Gross Domestic Product
GRP	:	Gross Regional Product
H	:	Hydrogen
IUPM	:	Industrial and Urban Pollution Management
LEP	:	Law on Environmental Protection
LM	:	Laboratory and Monitoring
MEIP	:	Metropolitan Environmental Improvement Program
M/P	:	Master Plan
N	:	Nitrogen
O	:	Oxygen
ODA	:	Official Development Assistance
O&M	:	Operation & Management
SEDS	:	National Socio-Economic Development Strategy
P	:	Phosphorous
PVC	:	Polyvinyl chloride
SS	:	Suspended Solid
STW	:	Sewage Treatment Works
SWM	:	Solid Waste Management
SWS	:	Solid Waste Services
SWTC	:	Solid Waste Treatment Complex
The JICA Study	:	The Study on Environmental Improvement for Hanoi City
T-N	:	Total Nitrogen
T-P	:	Total Phosphorous
TCVN	:	Vietnam Standard
TMS	:	Time and Motion Survey
TSP	:	Total Suspended Particulate
VAT	:	Vietnam-Australia Training Project
VCEP	:	Vietnam Canada Environment Project
WSP	:	Waste Stabilization Pond

UNITS OF MEASUREMENT

T/Y	:	tones per year
US$	:	United States Dollar
VND	:	Vietnamese Dong
dB	:	decibel(s)
g/d	:	Grams per day
ha	:	hectare
km^2	:	Square kilo meter
m^2	:	square meter
m^3	:	cubic meter
m^3/d	:	Cubic meter per day
mg/l	:	milligram per liter
t/m^3	:	tonnes per cubic meter
wt%	:	weight percent

CHAPTER 1 INTRODUCTION

1.1 Objectives of the Study

(1) Objectives

This study, the Study on Environmental Improvement for Hanoi City in the Socialist Republic of Vietnam (the Study) was started in July 1998 and will be completed in June 2000 by the submission of the Final Report for the Study. The Study has the following three major objectives.

a) To formulate a comprehensive environmental master plan, including the environmental management of water quality, air quality, solid waste and noise, which should encompass:
   - Identification and selection of priority projects and work out their basic outlines,
   - Formulation of a comprehensive environmental master plan, which should propose both structural and non-structural measures,

b) To carry out technology transfer, aiming at the capacity development in environment and improvement of institutional strength, and

c) To conduct a preliminary feasibility study (Pre-F/S) for a selected urgent project

(2) Study Area

The Study Area encompasses the whole of Hanoi City comprising seven urban districts and five suburban districts, with the area of 927.5 km^2.

(3) Target Years

Considering the coordination with the relevant plans and programs, in particular the Hanoi Urban Master Plan for the Year 2020, and practical time-range for the future projection, the target year for the Study was set as 2020. Before 2020, a middle target year of 2010 was set.

1.2 Cooperation with the Vietnamese Side and Technology Transfer

(1) Cooperation of the Vietnamese Side

To support the work of the JICA Study Team (JICA Team), Hanoi People's Committee (HPC) has set up the Steering Committee (SC) and Project Management Board (PMB) comprising the Departments/Authorities/ Organizations of HPC concerned with preservation and improvement of the environment of the Hanoi City as well as the relevant Ministries of the Government. Chairmanship of SC is assumed by the Vice Chairman of HPC with Department of Science, Technology and Environment (Hanoi DOSTE) as technical secretariat while Hanoi Authority of Planning and Investment (HAPI) as coordinator for the Study. PMB comprises the chief officials of Hanoi DOSTE including the Director and Vice Director.

Key departments have extended helping hands to the JICA Team by providing counterpart officials including:

- Hanoi DOSTE
- HAPI
- Hanoi Chief Architect Office (HCAO)
- TUPWS (Transport and Urban Public Service)
- URENCO (Urban Environmental Company)
- HSDC (Hanoi Sewerage and Drainage Company)

Vietnamese consultants have been utilized fully for the survey works where they are more capable with comprehensive understanding of the local conditions, including;

- Environmental quality surveys
- Topographic and geological surveys
- Surveys for the environmental impact assessment
- Other surveys for current conditions analyses
- Environment Impact Assessment

(2) Technology Transfer

As technology transfer (TT) is one of the major objectives of the JICA Study, utmost efforts were made for TT in the forms of on-the-job training of counterpart officials and workshops and seminar. Altogether 15 workshops with 17 subjects and one seminar were held, titles of which are given below:

List of Workshops held during survey in Hanoi

	Theme
1.	Environmental awareness and education in Hanoi
2.	Zonong for environmental management plan, Water pollution control
3.	Environmental economics
4.	Waste transfer station and Sanitary landfill site system
5.	Sanitary landfill system, Post-closure land use of landfill site
6.	Waste Treatment and Disposal Options
7.	Environmental Education and awareness
8.	Public sewerage development plan, Water pollution control
9.	Waste transfer options including railway
10.	Institutional strengthening for environmental management for Hanoi City
11.	Sewerage management
12.	Solid waste management master plan
13.	Planning methodology for the environmental improvement and recommended structural measures
14.	Institutional strengthening for environmental management for Hanoi City
15.	Technology transfer seminar

In total, about 350 people participated in these workshops/seminar from various sectors including the Government, academic and private sector as well as aid organizations/technical cooperation personnel. It should be noted that of the 15 workshops, No.10 workshop was held jointly with the CIDA/VCEP which share the common subject of the institutional strengthening of the environmental management for Hanoi city.

(3) Composition of the Final Report

The Final Report comprises the followings:

- Summary Report
- Main Report (4 volumes)
  - Volume 1: Introduction and Current Environmental Conditions
  - Volume 2: Environmental Master Plan: Methodologies for EMP
  - Volume 3: Environmental Master Plan: Recommended EMP and Future Environmental Conditions
  - Volume 4: Pre-Feasibility Study for Nam Son Landfill Phase 2 & Waste Transfer System
- Supporting Report and Data Book
- Technology Transfer Report

(4) Subsequent Study

The Final Report will be submitted to the Vietnamese side by the end of September, 2000.

1.3 Donor Map

The studies and projects completed or stated before 2000 by international donors for Hanoi City are summarized in the table below and donor map is presented as shown in Figure 1-1

List of project for Hanoi City (as of 2000)

Sector	Donor	Activities	Imp. Period
Environmental Management including Integrated Environmental Conservation	CIDA	Vietnam Canada Environmental Project (Phase I & II)	1997-2000 2000-2004
	UNDP/SIDA	Environmental Toxicology Project VIE97/031	1998-2000
		Evaluation of Environment issues in Investment Planning	1998-2001
	ADB	Hanoi Dyke System Protecting Project (Phase I & II)	1996-1999 1999-2000
	JBIC	Thang Long North - Van Tri Urban Infrastructure Development Project	1999-2003
		Special Assistance for Project Implementation for Hanoi Drainage Project	2000
Sewerage and Water Supply	FINNIDA	Water Supply Master Plan of Hanoi City & Improvement Project	1985-1993
		Yen Phu Water Treatment Extension Project	1996-1998
	World Bank	Feasibility Study of Water Supply Project	1994
		Water Supply Extension Program (Cao Dinh & Nam Du)	1999-2002
	JICA	The Project for the Water Supply System in Gia Lam Area (Phase I & II)	1993-1996
		The Study on Urban Drainage and Wastewater Disposal System in Hanoi City	1993-1995
		The Study on Hanoi Water Supply Systems	1996-1997
	JBIC	Drainage Project for Environment Improvement in Hanoi-First Stage	1997-2002
		Feasibility Study of the Nhue River Basin Drainage	2000-2001
		Drainage Project for Environment Improvement in Hanoi-Second Stage	2002-2006
	Austria	West Lake Water Quality Improvement Project	2000-2003
Solid Waste Management	UNDP	Cau Dien Compost Pilot Plant	1993
	Australia	Waste Minimization Project	1998
	JICA	Pre - Feasibility Study for the Transfer System and Nam Son Phase 2 Landfill	1998-1999
	Spain	Upgrading of Cau Dien Compost Plant	2000

CHAPTER 2 CURRENT CONDITIONS AND FUTURE WITHOUT COUNTER-MEASURES

2.1 Administrative Division, Population, GRP and Land Use at Present

Area of Hanoi City, capital of Vietnam, is about 927km^2 of which urbanized area accounts for only 9.1% and remaining 90.9% is rural or suburban. Current land use is dominated by agriculture, forest and other nature type use, together accounting for about 70 (69.4) % of the city area.

Administratively, Hanoi City is divided into 7 urban districts lying on the right bank side of the Red River and 5 suburban districts. Population of the whole city was about 2.5 million in 1997, of which about 1.3 million living in urbanized area and the remaining 1.2 million in the suburban area. The population by district as of 1997 is given below.

Population in Hanoi City for 1997

	Name of Districts	Population for 1997
7 Urban Districts	Ba Dinh District	181,350
	Tay Ho District	84,654
	Hoan Kiem District	182,800
	Hai Ba Trung District	337,211
	Dong Da District	289,552
	Than Xuan District	133,339
	Cau Giay District	104,196
7 UrbanTotal		**1,313,102**
5 Suburban Districts	Soc Son District	233,166
	Gia Lam District	313,220
	Tu Liem District	170,006
	Thanh Tri District	207,273
	Dong Anh District	243,817
5 Suburban Total		**1,167,482**
Hanoi City Total		**2,480,584**

Gross regional product (GRP) of the city recorded about VND 15,272,886 million in 1997. Per capita GRP was around VND 6,156,972, which is higher than the national average.

2.2 Current Frameworks for the Environmental Management and Public Services for the Hanoi City

History of environmental management of the city is rather short, with the Law of Environment enacted in 1994. Hanoi Department of Science, Technology and Environment (Hanoi DOSTE) is responsible for the management of the environment of the city which is established only in 1994 Of the whole organization, the Environmental Management Division is in charge of the environmental management with only about 20 staff. Considering the already degraded environment particularly in the urbanized area of the city and expected growth of economy and population of the city, the current strength of the division is deemed to be lagging far behind the need for effective environmental management.

Transport and Public Works Service (TUPWS) is responsible for the planning and implementation of environment related works including drainage and sewerage, solid waste management and green and parks development besides transport facility development. However, drainage and sewerage infrastructure development have just started and fully sanitary solid waste facility is yet to be developed and organizational reinforcement by clearer responsibilities for these environment related fields staffed with enhanced personnel seems indispensable. In the similar context, URENCO which is responsible for solid waste management including waste collection and HSDC which is responsible for operation and maintenance of sewerage and drainage facility should substantially be reinforced.

Various government organizations as well non-government organizations are making efforts to raise the environmental awareness among the people and organizations in the public and the private sectors including industrial circle, consciousness and awareness for preserving environment remain low.

Being new subject to the city, specialists and management personnel for environmental management and preservation are in serious shortage. Budget allocation for environmental management and preservation also accounts only for a small portion of the total budget at present.

2.3 Current Ambient Environmental Qualities in the Hanoi City

(1) Division of the Hanoi City into Environmental Zones

With a view to the effective management of the environment, Hanoi City is divided into 8 environmental zones (EZ), taking the followings into account.

a) Current and future land use in the area
b) Characteristics and level of the quality of environment to be secured in the area
c) Administrative boundaries of the districts

For the future land use, the Hanoi Urban Master Plan for 2020 (Urban Master Plan) prepared by HPC and approved by the Government is referred to.

In consequence, 8 environmental zones are proposed to be set up as given below.

It should be noted that the Urban Master Plan put focus on drawing land use picture for the urbanized areas, existing and future, i.e., 37 urban units, while no specific picture is drawn for the suburban areas. Emphasis in this JICA Environmental Study, the land use plan of which is based on the Urban Master Plan, is therefore also placed on the urbanized areas. It is also noted that EZ 8 lies along the right bank of the Red River located outside of the dike, and development in principle is restricted, though currently limited population are living together with agricultural activities and road traffic. Overall environmental study in the JICA Study was carried out, taking these into consideration.

(2) Ambient Environmental Qualities at Present

In the light of the current Vietnamese environmental standards and international ones including WHO's, the current conditions of the ambient environment of the Hanoi City is assessed.

Area-wise, there exists substantial difference between the urbanized areas and the suburban areas. The urbanized areas located on the right bank of the Red River, mainly comprising the seven urban districts including the old city center and Ho Tay area account for only 9.1 % of the city area of 927 km^2. However, nearly half of the city population is living in this area and economic activities as well as public administration both at city level and national levels together with relatively heavy traffic are concentrated in this area. As a consequence, the existing urban area is significantly polluted in certain aspects including water-related sanitary

condition and water quality. The suburban areas are not yet polluted in most of the aspects excepting that particular parts including the areas along the major highways are to some extent affected by air pollution and noise.

Sector-wise, water-related sanitary condition is very poor with frequent inundation by storm water due to the inadequate capacity of the drainage system/regime particularly in the city center, which is suspected to cause water-borne diseases together with the inconvenience to the Hanoi citizens and economic loss due to the interruption of traffic and production activities. The condition is the most serious in the most urbanized area of the city comprising the basins of the 4 urban rivers of To Lich, Lu, Kim Nguu, and Set where flooding due to the inadequate drainage capacity occurs almost every year or once every 1.2 years on average as shown below.

Flood Probability

Drainage Systems	Flood Probabilities (Without measures)
To Lich River	3-year to 5-yearr
Lu River	1.2-year
Kim Nguu River	1.6-year
Set River	1.1-year
Overall To Lich River System	1.2-year
Nhue River System	Less than 5-year
Red River System	More than 100-year
Flood plain area	5-year
Other Main Rivers	5-year to 10-year
Channels	0.5-year to 5-year
Sewers	Less than 1-year

In terms of non-hazardous pollutants which is not harmful to the human health including bio-chemical oxygen (BOD), water quality is seriously degraded specially in the urban rivers of To Lich, Set, while certain degradation of water quality is observed in the West Lake and the lakes located in the urbanized area due mainly to the inflow of untreated sewage of municipal sewage including domestic and commercial as well as industrial origins. No clear observation has been made for the water pollution in terms of hazardous substances to date.

Except for total suspended particulate materials (TSP), no serious pollution has

been recorded for the whole city, though occasionally the standards have been exceeded particularly with regard to NO_2 near the industrial areas and SO_2 along the major highways. TSP values exceed the standards in the urbanized areas, though it does not affect human health. Area-wise, particularly the (7 urban areas) old city center and Ho Tay areas and their surrounding areas are very much polluted by TSP due mainly to the dust/particulate emission of domestic and industrial origins as well as the dust caused by the traffic on the roads.

Noise pollution has been observed along the major highways, almost throughout the entire day, except night time after 6.00 p.m.. In certain parts along the highways in the area located on the right bank of the Red River, noise level exceeds the standards even during night time.

In general, Hanoi City looks clean. However, in some parts of the city, dumped solid wastes are found along some back streets, drainage canals, rivers, lakes, etc. In terms of collection ratio of the generated solid wastes, the figure is about 77 % in the 7 urban districts or 23 % is not collected, while in the suburban districts, uncollected ratio is high with 72 % as shown below.

Current Cleanliness in terms of Uncollected Solid Waste in 1999

	Uncollected Solid Waste (ton/day)	Ratio of Uncollected Waste to Generation Amount
1. Urban Districts	391	23%
2. Suburban Districts		
2.1 Soc Son	69	74%
2.2 Dong Anh	78	80%
2.3 Gia Lam	79	62%
2.4 Tu Liem	47	70%
2.5 Thanh Tri	63	76%
2.6 Total of Suburban Districts	336	72%
3. Total of Hanoi City	727	33%

However, considering the spacious area under the main land use of agriculture and other non-residential type with low population, the high ratio of the uncollected does not necessarily mean the suburban area is not clean.

Though about 3/4 of the generated wastes are currently collected in the urbanized area, the disposal facility is already filled up and dumping and scattered wastes would be found everywhere in the urban area of the city, affecting the health of the citizens an as well as the environment, so measure need to be urgently taken.

Though rapidly improving, the establishment of the institutional and organization framework for the environmental management of Hanoi City started only several years ago and much remains to be done.

2.4 Future without Counter-measures

(1) Future Macro Frame

1) Population and urbanization

The population of the city is expected to increase to about 3.5 million in the year 2020 from the current 2.5 million or about a 1.6% increase per year on the average.

In the Hanoi Urban Master Plan for 2020, urbanization is envisaged to the peripheral area surrounding the existing urban area of 7 urban districts in order to alleviate the excess concentration of population and economic activities, in particular the old city center area. Aiming at achieving more balanced growth of the city as a whole, urbanization is also envisaged on the left bank area of the Red River. Namely:

a) The old city center is planned as Development Restricted Area and the currently high population density of 264 person/ha in the old city center will be alleviated by about 120, 000 population decrease in this area, resulting in about 229 person/ha population density.
b) The current urbanized area centering around the old city center and 7 urban districts will be expanded to the neighboring 2 suburban districts of Tu Liem and Thanh Tri which is planned as Development Expansion area population of which is envisaged to be 700,000 in 2020.
c) New City area is planned to be formed on the left bank side of the Red River, centering around the Don Anh and Gia Lam towns with the planned population of about 1 million in the year 2020.

Accordingly, urban population will increase to 2.5 million from the current 1.3 million or accounting for about 71.4% of the future city population. The future population of the city by areas designated by the Hanoi Urban Master Plan and by environmental zones adopted in the JICA Study for the years of 2010 and 2020 are given below.

Population Frame for Present, 2010 and 2020

	Present	2010	2020
Restricted Development Area	922,044	826,318	800,000
Expanded Development Area	*	607,543	700,000
New City	*	467,842	1,000,000
Subtotal (1)	1,718,409	1,901,703	2,500,000
Suburban Area (2)	762,175	908,446	1,007,922
City Total (1)+(2)	**2,480,584**	**2,810,149**	**3,507,922**

Remarks: Expanded Development Area and New City are the areas only specified for the future land use plan and for the present no population data is available for each area.

Population in each environmental zone (EZ) to be set up in the JICA Study in given below.

Population by Each Environmental Zone

Environmental Zones	Present	2010	2020
1. Old City Center (Restricted Development Area)	922,044	826,317	800,000
2. Red River Right Bank – North West	265,010	332,414	383,000
3. Red River Right Bank – South	258,812	247,357	285,000
4. Dong Anh Urban Area	114,427	314,390	672,000
5. Gia Lam Urban Area	137,510	153,452	328,000
6. Suburban Area	762,175	908,446	1,007,922
7. Ho Tay Area	20,606	27,773	32,000
City Total	**2,480,584**	**2,810,149**	**3,507,922**

Geographically, urban area is expected to expand to form much wider area comprising 37 urban units with 250 km^2 from the current 84.13 km^2 or only 9.1 % of the city area, by the year 2020 based on the Urban Master Plan. The expected urban area in 2010 and 2020 and unformigation toward 2020 are shown in Figures 2-1 and 2-2. It is noted that urbanization as of 2010 is derived in the JICA Study based on the Urban Master Plan and change of expected population densities of the 37 urban units.

2) Expected land use and economic growth

Despite the urbanization, the principal land use in the city in 2020 is expected to be agriculture, accounting for 43% of the total. Nature oriented

land use including agriculture, green, forest as well as rivers and lakes still will account for 68% in the year 2020. The future land use in 2020 envisaged in the Urban Master Plan is given in Table 2-1.

Based on the past records and potential of the city as well as the available forecast, growth rate of the city's economy in terms of its Gross Regional Product (GRP) may range from about 7.5% to 15.0% depending on various factors including the international economic environment in the future, which would affect exports of the Vietnamese products and direct investment to Vietnam. Sector-wise, growth of the industry/construction would be the fastest, followed by the services.

Expected range of the GRP growth is as shown below.

Expected GRP Growth for Hanoi City

Unit: US$ million

	1997	2010	2020
Low Growth Case	1,305	3,341	6,887
High Growth Case	1,305	8,025	32,481

According to the Urban Mater Plan, 17 large scale industrial zones will either be newly set up or expanded as the driving force to achieve further industrialization of the city. Total area will increase to 2,115 ha in 2020 from current 570 ha. Geographical distribution will also substantially be changed in line with the basic policy of HPC for spatial development. No further development is planned in the development restricted area of old city center and limited development is envisaged in the development expansion area while rapid development is expected in the new city area and suburban area in Soc Son. Namely, though at present Thanh Tri district or EZ 3 accounts for the biggest share of the industrial zone area followed by Tu Liem district or EZ 2, biggest increase of industrial zone area is planned in Dong Anh district (EZ 4) which will account for more than 1/3 of the total area followed by Gia Lam district (EZ 5) and Soc Son district (EZ 6) each would account for about 1/5, in the coming years. They together will account for about 3/4 (74.3%) of the total large scale industrial zones.

3) Future Pollution Loads

Due to the rapid economic growth as well as population increase and urban

expansion, environmental pollution loads will sharply increase over extended area of the city, if adequate counter-measures are not taken. In terms of bio-chemical oxygen demand (BOD), the generated load would be about 1.6 times as big as that of the current amount in the year 2010 and 2.2 times in the year 2020 as shown below.

BOD Pollution Load Generated in each Environmental Zone

(Case where No Measures Are Taken)

(kg/day)

Environmental Zones	Area (ha)	1997	2010	2020
Zone 1 Old City Center	3,499	47,946	59,082	62,400
Zone 2 Red River Right Bank – North West	5,590	14,391	26,920	35,746
Zone 3 Red River Right Bank – South	2,695	17,062	21,574	26,118
Zone 4 Dong Anh Urban Area	8,525	7,044	30,479	66,736
Zone 5 Gia Lam Urban Area	4,295	9,272	15,932	33,744
Zone 6 Suburban Area	62,988	40,753	66,394	80,218
Zone 7 Ho Tay Area	410	1,067	1,986	2,496
Total Study Area	88,002	137,535	222,366	307,458

With regard to the emitted air pollutants, loads would be about 1.5 to 3 times of these at present in the year 2010 and 2 to 5 times in the year 2020, depending on the kinds of pollutants as shown below.

Estimated air pollutant emissions (t/y) by sector of activity in Hanoi for 2010 and 2020

Units: tons/year

Base case : 1997

Sector of Activity	SO_2	NOx	CO	TSP	PM10	Lead
Industry(fuel combustion only)	2 794	1 893	489	8 111	6 083	--
Industry(process)	--	--	--	82 000	16 400	--
Transport	1 266	9 953	145 093	2 389	2 034	22
Road dust resuspension	--	--	--	21 766	4 173	--
Domestic (fuel combustion)	1 335	315	8 908	1 483	1 483	--
Total	**5 395**	**12 162**	**154 490**	**115 749**	**30 173**	**22**

Without countermeasures: 2010

Sector of Activity	SO_2	NOx	CO	TSP	PM10	Lead
Industry(fuel combustion only)	10 654	7 218	1 865	30 928	23 196	--
Industry(process)	--	--	--	82 000	16 400	--
Transport	3 858	29 077	329 715	6 533	5 737	52
Road dust resuspension	--	--	--	47 105	9 030	--
Domestic (fuel combustion)	1 547	360	10 339	1 721	1 721	--
Total	16 059	36 655	341 918	168 287	56 084	52

Without countermeasures: 2020

Sector of Activity	SO_2	NOx	CO	TSP	PM10	Lead
Industry(fuel combustion only)	16 067	10 886	2 812	46 642	34 982	--
Industry(process)	--	--	--	82 000	16 400	--
Transport	6 362	47 550	495 108	10 444	9 257	81
Road dust resuspension	--	--	--	67 237	12 889	--
Domestic (fuel combustion)	1 962	450	13 131	2 185	2 185	--
Total	24 391	58 886	511 051	208 508	75 713	81

Pollutants in the form of solid waste would also be increased sharply, though pace is assumed to be slower than that of economic growth due to the recycle and cleaner production efforts in the future. The expected waste volumes to be generated in the future by districts are given below.

Future Pollution Loads in Terms of Solid Waste Generation (ton/day)

	1998	2010	2020
1. Urban Districts	1626	2,908	4,162
2. Suburban Districts			
2.1 Soc Son	91	115	141
2.2 Dong Anh	95	171	306
2.3 Gia Lam	122	196	263
2.4 Tu Liem	66	95	127
2.5 Thanh Tri	81	115	155
2.6 Total of Suburban Districts	456	692	992
3. Total of Hanoi city	2,082	3,600	5,154

As shown in the table, generated volume of solid waste would increase to about 1.8 times by 2010 and about 2.5 times by 2020 in the city.

Pollution load of noise would be increased with the increase of traffic in terms of running kilometers, as shown below.

Expected Noise and Vibration Level without Counter-measures

	Present	2010	2020
Running Kilometers (10^6km/y)			
Motorcycle	6,816	14,223	19,937
Car	103	379	693
Bus	144	231	281
Truck	340	1,189	1,959
Potential Noise Power (running kilometers coefficient)			
Motorcycle (coefficient: 1.0)	6,816	14,223	19,937
Car (coefficient: 1.0)	103	379	693
Bus (coefficient: 3.1)	446	716	871
Truck (coefficient: 3.1)	1,054	3,686	6,073
Total Power (%)	100	226	328
Expected Noise Level (dB)			
1, Old City Center	69.1	72.6	74.3
2, Red River Right Bank North- West	68.9	72.4	74.1
3, Red River Right Bank South	68.9	72.4	74.1
4, Dong Anh urban area	62.6	66.1	67.8
5, Gia Lam urban area	67.7	71.2	72.9
6, Sub-urban Area	59.8	63.3	65.0
7, Ho Tay Area	69.1	72.6	74.3

As shown in the table, noise power would be more than doubled by 2010 and more than tripled by 2020.

(2) Future Environmental Qualities without Counter-measures

1) Water-related Sanitary Conditions

Water-related sanitary conditions would remain the same or eventually further degraded in pace with the progress of the urbanization as shown in Figure 2-3.

2) Water Quality

In terms of BOD, seriously polluted area would expand to include the Ho Tay lake by 2010 besides the 4 urban rivers of To Lich, Lu, Set, and Kim Nguu which are already seriously polluted at present. Slightly polluted area would include the downstream reach of the Nhue river by 2010. By 2020, the slightly polluted area would expand to include the whole stretch of the Nhue river in the city area and part of To Lich river. Progress of the water quality degradation in terms of BOD is shown in Figure 2-4, "present, 2010,

2020 without counter-measures by major rivers" in terms of environmental zones, except EZ6, all the environmental zones, will be endangered as shown below.

Prediction without Countermeasures

		1997	2010	2020
Zone 1 Old City Center	To Lich River Lu River Set River Kim Nguu River	P	P	P
Zone 2 Red River Righ Bank – North West	Nhue River (upper) & Other	U S	S S	S P
Zone 3 Red River Right Bank – South	To Lich River Lu River Set River Kim Nguu River	P	P	P
Zone 4 Dong Anh Urban Area	Van Tri Lake & Other	U	S	P
Zone 5 Gia Lam Urban Area	Bac Hong River & Other	S	S	P
Zone 6 Suburban Area Soc Song Dong Anh Gia Lam Tu Liem Thanh Tri		 U U S S S	 U S S S S	 U P P S S
Zone 7 Ho Tay Area		S	P	P
Major River	Cau River Ca Lo River Red River Duong River Nhue River (Lower)	U U U U S	U S U U S	U S U U S

Note: Un-polluted, S: Slightly Polluted, P: Polluted (Refer to Section 3.3 (2) for the definitions of each classification)

Hazardous materials should not be discharged but if effective monitoring and law enforcement against violation are not carried out, incidences of hazardous discharge might happen frequently, endangering the water environment and human health.

3) Air Quality

Except for some parts of the suburban districts, TSP pollution would expand as time and growth goes on to cover almost whole city by 2020 as shown in

Figure 2-5. In addition, NO_2 limit will be exceeded in the old city center area frequently and SO_2 limit would be exceeded occasionally in the old city center and some other urbanized areas as shown in Figure 2-6 and 2-7.

4) Cleanliness of the city

If measures are not taken, generated solid waste can not be disposed of and the whole city would be seriously polluted by dumped and scattered wastes, endangering the public health and the function of the capital city. Uncollected waster ratio by district would range from the minimum of about 70% to well over 90 % and 74 % for the whole city as shown in Table 2-2.

5) Noise

Along major highways, noise pollution would continue to be observed as shown below. The whole city would be affected by traffic noise throughout the day as shown in Table 2-3.

6) Co-existing with Nature and Amenity

Due to the rapid urtramization and industrialization accompanied with the resulting depletion of the green area and water fronts, co-existing with nature and amenity condition will be aggravated quickly as predicted in Table 2-4.

7) Cultural and Historical Assets

Due to poor maintenance and overage facilities for preserving the assets, conditions of cultural and historical assets are considered to be worsened as shown in Table 2-5.

CHAPTER 3 METHODOLOGY AND FRAMEWORK FOR EMP

3.1 Necessity of EMP and Methodology for the Formulation

(1) Necessity and Objectives of EMP

Considering the deteriorated environment of the city expected for the future, an Environmental Master Plan (EMP) should be formulated for working out the counter-measures in the form of infrastructure development and institutional/organizational strengthening as well.

(2) Methodology for EMP Formulation and Necessary Procedure for Materialization

With a view to effective and efficient formulation of EMP, the following steps are recommended to be adopted.

Step 1 : Assessment of Present Conditions

Step 2 : Formulation of Macro-frame for the Future

- Population, Economy
- Land use

Step 3 : Zoning for Effective Environmental Management

- Current and future land use
- Administrative boundaries
- Current conditions of environmental pollution

Step 4 : Future Pollution Situation without Counter-measures

- Sanitary conditions, water, air, cleanliness, noise, etc.

Step 5 : Setting Environmental Targets by Environmental Zone

1) Goal of Becoming Environmental City
2) Clean & Quiet: free from the public nuisance
   - Sanitary/hygenic environment
   - Clean water
   - Clean air
   - Quiet environment
3) Co-existing with Nature and Provision of Amenity
4) Preservation of Culture and Historical Assets

Step 6 : Basic Strategies for Environmental Improvement

1) Achievement of recycle society and cleaner production

2) Proper land use and transport planning

3) Establishment of appropriate system for the disposal of the discharged pollutants

4) Participation of all the players concerned with environment

Step 7 : Measures & Projects for Environmental Management & Improvement

1) Institutional/organizational measures

2) Structural measures/systems (Infrastructures)

Step 8 : Selection & Planning of Priority Projects (PP)

- 7 Institutional PP
- 6 Structural PP

Step 9 : Evaluation of PP

1) Target satisfaction

2) Cost effectiveness

3) Affordability

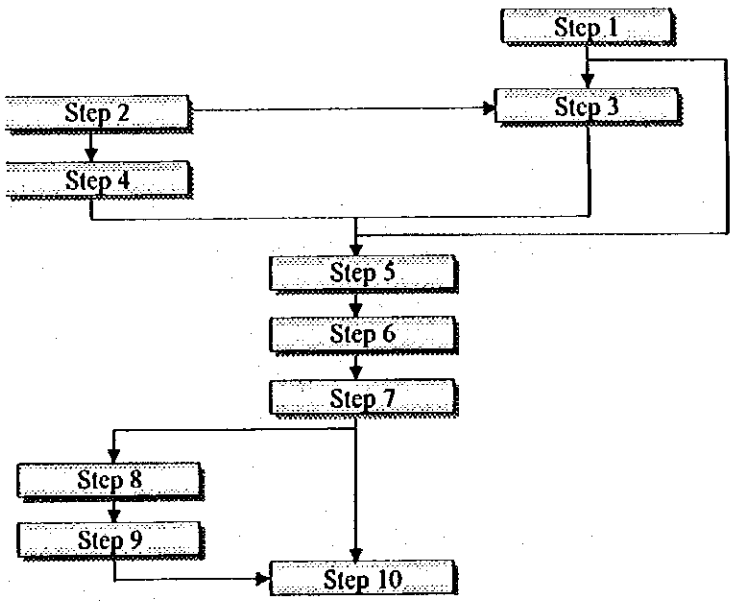
Step 10 : Implementation Schedule, Financial Requirement and Implementability of Environmental Master Plan (EMP)

1) Implementation schedule of EMP

2) Financial requirement

3) Affordability of the implementation of EMP

The flow and relationship among these 10 steps are shown below.



Necessary Procedure for Materialization of EMP

3.2 Environmental Zoning of the Hanoi City

For effective management as well as improvement and preservation of the environment, the Hanoi City is divided into 8 environmental zones, within each of which same environmental quality should be sought to be maintained. Environmental zoning is made mainly in consideration of the future land use in the Urban Master Plan as follows.

- Current and future land use pattern and intensity
- Administrative boundaries of districts
- Current conditions of environmental pollution
- Physical continuity of natural environment including the drainage basins

The adopted environmental zones (EZ) are shown in Figure 3-1.

The name of the each adopted EZ together with the area and current population is given below.

Established Environmental Zones

Zone No.	Name	Area (km^2)	Population in 2020 (persons)
1	Old City Center	35.0	800,000
2	Red River Right Bank North-West	55.9	383,000
3	Red River Right Bank South	27.0	285,000
4	Dong Anh urban area	85.3	672,000
5	Gia Lam urban area	43.0	328,000
6	Suburban area	657.6	1,007,922
7	Ho Tay area	4.1	32,000
	Total	907.9	3,507,922
8	Red river quasi zone	19.6	-

Remarks: According to the Hanoi Urban Master Plan for 2020, population living in EZ 8 are included in these in EZ 1 Old City Center.

3.3 Goal and Targets for Environmental Improvement and Management

(1) Goal of Environmental City

Hanoi is the state capital of the country with the total population of about 2.5 million with more than 900 km^2. There still remains large area of agriculture land as well as green and open space and water surface. Though the central part of the city is affected by environmental degradation, remedial measures still can cope with the situation. With the planned rapid urbanization and economic growth expected in the future, however, situation would quickly be worsened and expanded spatially.

With a view to having common understanding and common perspective for the desirable environment of the city toward the future among all players concerned with environment, it is recommended to establish a goal of "Becoming an Environmental City Acknowledged in the World". Considering the very important occasion of the 1,000 year anniversary of Hanoi city in the year 2010 as well as the practicable schedule for the environmental improvement, the following steps are recommended to be taken.

Year of 2000

- 990 Year Anniversary of the City
- Declare the First Year for Achieving the Goal of Becoming "Environmental City"

Year of 2010

- 1000 Year Anniversary of the Hanoi City
- Urgent and Priority Projects proposed by this JICA Study will all be completed.
- Environmental improvement in the Core Part of the City will be completed.
- Declare that Hanoi City has achieved the Goal

Year of 2020

- Environmental Improvement will be extended to surrounding area of the core area & New Capital City of Don Anh & Gia Lam.
- Other Projects & Measures proposed by this JICA Study will be realized.

Considering the perspective envisaged in the Urban Master Plan, the following prospects or the goals for environmental zones are proposed for the Environmental Master Plan.

Prospects and Goals for Environmental Zones

Zone No.	Name	Environmental Prospects
1	Old City Center	Zone with cultural and historical heritage
2	Red River Right Bank North-West West	International city with comfortable space
3	Red River Right Bank South	Gateway zone with clean industries
4	Dong Anh urban area	Eco-city co-existing with industry
5	Gia Lam urban area	New industrial city
6	Suburban area	Fresh suburban zone with gentle nature
7	Ho Tay area	Waterfront amenity zone
8	Red river quasi zone	Motherly romantic river front. Development restricted.

Area lying outside of the dike system of the Red River is designated as EZ 8 Red river quasi zone. Though agricultural activities are practiced by limited size of population together with roads, future development should be restricted because of its location.

(2) Environmental Quality Targets

1) Environmental targets

Three kinds of comfort targets or integrated targets are set in the JICA Study which are indicative of the quality of environment of the city as shown below.

a) Clean and Quiet comfort target: Achieving clean and quiet city
b) Co-existing with Nature & Provision of Amenity: Achieving living environment co-existing with nature
c) Preservation of Cultural & Historical Assets: Achieving cultural city with cultural and historical assets

Clean and quiet target is to seek the environment free from public nuisance. Co-existing with nature and provision of amenity target seeks to secure the environment where people can enjoy living together with the nature as well as urban environment. Hanoi being the capital of the country with long history, having many cultural and historical assets, preservation of cultural and historical assets should be among the major targets. These comfort targets are subdivided into several sectoral targets as given below.

Comfort & Sectoral Targets

Comfort Targets	Sectoral Targets
Clean & Quiet	i) Securing sanitary water environment ii) Securing clean water environment iii) Securing clean city environment iv) Securing clean air environment v) Securing quiet city environment
Co-existing with Nature & Provision of Amenity	i) Securing green environment ii) Securing water surface and waterfront iii) Providing nature-oriented amenity
Preservation of Cultural & Historical Assets	i) Preserving cultural assets including buildings, urban landscape, etc. ii) Preserving historical assets including ancient quarters, Mausoleum, etc.

2) Classification of the levels of satisfying the targets

The levels of satisfying the sanitary water environment target (satisfaction levels) are classified as shown below.

Classification of Flood Control Level

Classification	Flood Control Level
Protected	more than 10-year return period
Sufficiently protected	between 5-year and 10-year return period
Un-protected	less than 5-year return period
No flooding	

Levels of water quality environment should be assessed in terms of two kinds of pollutants, one is related to human health, hazardous pollutants, and the other to living environment, BOD. The defined classifications are given below.

Classification of Surface Water Quality related to Human Health

Classification	Water Quality	
Unpolluted	As:	not more than 0.05 mg/ℓ
	Cd:	not more than 0.01 mg/ℓ
	Pb:	not more than 0.05 mg/ℓ
	Cr(VI):	not more than 0.05 mg/ℓ
	CN:	not more than 0.01 mg/ℓ
	Cu:	not more than 1.0 mg/ℓ
	Hg:	not more than 0.002 mg/ℓ
Polluted	As:	more than 0.05 mg/ℓ
	Cd:	more than 0.01 mg/ℓ
	Pb:	more than 0.05 mg/ℓ
	Cr(VI):	more than 0.05 mg/ℓ
	CN:	more than 0.01 mg/ℓ
	Cu:	more than 1.0 mg/ℓ
	Hg:	more than 0.002 mg/ℓ

Classification of Surface Water Quality related to Living Environment

Classification	Rivers	Lakes
Unpolluted	BOD, less than 10 mg/ℓ	COD, less than 35 mg/ℓ
Slightly Polluted	BOD, 10 mg/l to 25 mg/ℓ	COD, 35 mg/l to 50 mg/ℓ
Polluted	BOD, more than 25 mg/ℓ	COD, more than 50 mg/ℓ

For air quality, six pollutants are selected and appropriate standards are set as given below.

Selected Evaluation Criteria for Air Quality

Pollutant	Averaging time	Selected Evaluation Criteria
Sulfur dioxide	1 hour	0.5 mg/ m^3
	24 hours	0.3 mg/ m^3
	1 year	0.05 mg/ m^3
Nitrogen dioxide	1 hour	0.4 mg/ m^3
	24 hours	0.1 mg/ m^3
Carbon monoxide	1 hour	30 mg/ m^3
	8 hours	10 mg/ m^3
	24 hours	--
Total Suspended Particulate (TSP)	1 hour	--
	24 hours	0.2 mg/ m^3
	1 year	0.09 mg/ m^3
PM10 (3)	24 hours	0.1 mg/ m^3
	1 year	0.06 mg/ m^3
Lead	24 hours	--
	3 months	0.001 mg/ m^3

Air quality is classified based on this criteria as shown below.

Categories of Air Quality

Category	Definition of category
Unpolluted	Air contaminant levels are below (meeting) the selected criteria for all contaminants for every averaging period all of the time.
Slightly polluted	For any contaminant: Levels are above (not meeting) one of the short term criteria less than 2% of the time and Average levels are below (meeting) the long term criteria
Polluted	For any contaminant: Levels are above (not meeting) one of the short term criteria more 2% of the time or Average levels are above (not meeting) the long term criteria

Cleanliness of the city in terms of scattered solid waste is rather difficult to define. Instead, levels of the cleanliness are measured by the ratio of the uncollected waste to the generated. Considering the physical difficulty and illegal dumping, 5% is set to be the minimum ratio.

For noise pollution control, the following standards are recommended.

Proposed Noise Standards

(Unit: dB)

Category of Areas	Target Area	Time of Day		
		6h-8h, 19-23h	8h-19h	23-6h
Category I: Residential areas, offices, hospitals, schools, etc.	Roadside (1 lane for one side)	50	55	45
	Roadside (more than 2 lanes for one side)	55	60	50
	Other areas	45	50	40
Category II: Commercial and industrial areas	Roadside (1 lane for one side)	60	65	55
	Roadside (more than 2 lanes for one side)	65	65	60
	Other areas	55	60	50

Based on the above, the following classification is set in the JICA Study.

Classification of Noise Pollution at Roadside

(Unit: dB)

Classification	Target Area	Noise Level		
		M, E	D	N
Unpolluted	Residential	<55	<60	<50
	Commercial & Ind.	<65	<65	<60
Polluted	Residential	>55	>60	>50
	Commercial & Ind.	>65	>65	>60

Note: M: Morning, D: Daytime, E: Evening, N: Night

(3) Envisaged Achievement Schedule for the Selected Targets

Achievement schedule, that is, time schedule of achieving various levels of the selected target, is set for each target, considering the future goals for the environmental zones and the current environmental conditions as well as the financial requirement for achieving.

The following achievement schedule is set for clean water environment target.

Target for Water Pollution Control

	1997	2010	2020
Zone 1 Old City Center	P	U	U
Zone 2 Red River Right Bank – North West	S	S	U
Zone 3 Red River Right Bank – South	P	S	S
Zone 4 Dong Anh Urban Area	U	S	S
Zone 5 Gia Lam Urban Area	S	S	S
Zone 6 Suburban Area	U	S	S
Zone 7 Ho Tay Area	S	U	U
Major River	U	U	U

Note: U: Unpolluted, S: Slightly Polluted, P: Polluted

The following achievement schedule is set for clean air environment target.

Target of Air Pollution Level in each Environmental Zone

	1997	2010	2020
Zone 1 Old City Center	P	S	S
Zone 2 Red River Right Bank – North West	U-P-S	U	U
Zone 3 Red River Right Bank – South	P-U-S	U	U
Zone 4 Dong Anh Urban Area	U	U	U
Zone 5 Gia Lam Urban Area	U-S	U	U
Zone 6 Suburban Area	U-S-P	U	U
Zone 7 Ho Tay Area	U-P	U	U

Note: U: Un-polluted, S: Slightly Polluted, P: Polluted

For the 7 urban districts and town areas in suburban districts, 95% collection target relative to the generated, which is considered as eventually the maximum possible rate, should be achieved by 2007 to secure clean city environment. For the remaining suburban areas, 65% target should be achieved by 2020.

At present, due mainly to the traffic, all the areas along the major highways are affected by noise, though the level varies depending on the urbanization of the areas and time of the day. By carrying out various measures including strict regulations, better traffic control and restriction of lead gasoline, the noise standards will not be exceeded or unpolluted condition will be achieved in the whole city throughout the day by 2010 and 2020.

Considering the characteristics of land use at present and that envisaged for the future, the following target is set for 2010 and 2020 by environmental zone.

Target for Co-existing with the Nature and Provision of Amenity by Environmental Zone

1. Old City Center	
2010/2020	• Increase the park area per capita from the current level of 1.8 m^2 to 10 m^2 In 2010 and 20 m2 in 2020 and not reduce the total area of the green and increase the number and kinds of street trees • Maintain the number and area of the lakes as at 1999 and increase the waterfront with easy access by people for the 14 urban lakes
2. Red River Right Bank North- West 3. Red River Right Bank South 5. Gia Lam urban area	
2010/2020	• Not reduce the total area of the green and increase the number and kinds of street trees • Maintain the number and area of the lakes as at 1999 • Limit the conversion of agriculture land to urban area within the range specified in the Hanoi Urban Master Plan for 2020
4. Dong Anh	
2010/2020	• Limit the conversion of agriculture land to urban area within the range specified in the Hanoi Urban Master Plan • Construct recreational lake
6. Suburban are	
2010/2020	• Minimize the conversion of agriculture and forest land to urban area
7. Ho Tay Area	
2010/2020	• Increase the park area per capita from the current level of to 10 m^2 in 2010 and 20 m^2 in 2020 and not reduce the total area of the green and increase the number and kinds of street trees • Maintain the current lake area as at 1999 and improve the water quality • Increase the waterfront with easy access by people with promenade and develop recreational facilities