

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEVELOPMENT STRATEGY INSTITUTE
MINISTRY OF PLANNING AND INVESTMENT
THE SOCIALIST REPUBLIC OF VIETNAM

**THE STUDY
ON
THE HOA LAC AND XUAN MAI AREAS
URBAN DEVELOPMENT PROJECT
IN
THE SOCIALIST REPUBLIC OF VIETNAM
PHASE - 1**

**CONCEPT PLAN
(VOLUME - 2)**

MARCH 1999

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US\$ 1.00 = VND 13,900
(October 1998)

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct "the Study on the Hoa Lac and Xuan Mai Areas Urban Development Project in the Socialist Republic of Vietnam (Phase-1)" and entrusted the study on the Japan International Cooperation Agency (hereinafter referred JICA).

JICA selected and dispatched a study team headed by Mr. Itaru Mae of Pacific Consultants International and consist of Japan Industrial Location Center and Nippon Koei Co., Ltd. to the Socialist Republic of Vietnam three times between December 1997 and March 1999.

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 continue 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.



March 1999
Kimio FUJITA
President
Japan International Cooperation Agency

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

March 1999

Letter of Transmittal

Dear Mr. Fujita,

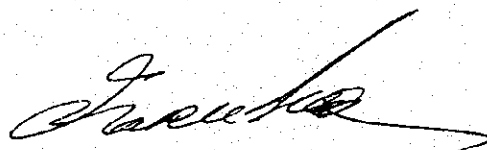
We are pleased to formally submit herewith the final report of "The Study on the Hoa Lac and Xuan Mai Areas Urban Development Project in the Socialist Republic of Vietnam."

This report compiles the results of the Study which was undertaken in the Socialist Republic of Vietnam from December 1997 through March 1999 by the Study Team, organized jointly by Pacific Consultants International, Japan Industrial Location Center, and Nippon Koei Co., Ltd. under the contract with the JICA.

This study is a national project aiming at the establishment of the "New Research and Education Town" in the Hoa Lac and Xuan Mai Area with 500,000 population. The New Town is planned to: 1) become a center of the human resource development, 2) lead the high-tech industry, 3) share urban functions with Hanoi, and 4) absorb increasing population of Hanoi. The economic crisis, which hit many Asian countries, including Vietnam, has forced the economic development of Vietnam to slow down. In order to be flexibly able to respond to such changing situations, this report proposes the phased development plan for every five years. We hope that the report will contribute to the future urban development of the New Town.

Finally, we would like to express our gratitude to all the officials of your agency, the JICA Advisory Committee, the Embassy of Japan in Vietnam, as well as the Ministry of Foreign Affairs. We also would like to send our appreciation to the Development Strategy Institute of Ministry of Planning and Investment, and related Ministries and Agencies for their cooperation with us during the course of the study.

Very truly yours,



Itaru MAE
Team Leader

The Study on the Hoa Lac and Xuan Mai Areas
Urban Development Project
in Vietnam

Foreword

A dire economic situation gripping many Asian countries is now rippling over the other parts of the world including Japan. And while the Study for the Hoa Lac and Xuan Mai Areas Urban Development Project is in progress by the "Japan International Cooperation Agency (JICA)" since its commencement in December 1997, it is even becoming more serious at the turn towards the 21st century.

In effect, the situation can be ascribed to many factors and reasons, but one thing to be learnt from the bitter experience is that the developing world needs to reorient its development path towards a more "endogenous direction". Many Asian countries have adopted to date a development path, which is overly dependent upon foreign capital resources and imported technologies, but without internalizing them properly. The endogenous development path implies to place more emphasis on domestic capital formation, exploitation of domestic market, utilization of domestic resources, human resource development, institutional building, promotion of science and technology, and so on.

The Hoa Lac and Xuan Mai Areas Urban Development is, in fact, responsive to these needs in that it will build a national center in the country for human resource development as well as the promotion of science and technology. The former is to realize the relocation and expansion of the Vietnam National University (VNU), and the latter is to develop the Hoa Lac High-tech Park (HHTP) in the Hoa Lac Area. Taking these principal objectives into consideration, the development is of truly national importance and significance, and hence, it should be regarded and treated as a "national project".

Given the difficult fiscal situation of the Government however, the development will face formidable challenges in light of the massive investment required for its implementation. As a solution to reconcile its necessity as a national project to the tight fiscal situation of the Government, an "Action Plan", which is, in fact, of the initial cost minimizing alternative, was proposed as a consequence of the Study. The Action Plan includes only core facilities of VNU, HHTP, and supporting urban infrastructure at a considerably reduced scale and cost.

As a matter of fact, in the circumstances where the Lang-Hoa Lac Highway linking the Hanoi Central Area and the Hoa Lac Area will be open for use very shortly, the Vietnam side is highly desirous to commence the development as early as possible. Towards this end, the continuous technical and financial assistance of the Japanese Government seems to be mandatory to put the development onto a right implementation track.

It will be more than a happy moment, if the JICA Master Plan can be of substantial help for the initiation of this highly strategic and important project. Also, the effective and efficient cooperation extended over the study period by the Vietnam side to the JICA Study Team is very much appreciated at the occasion of ending the Study.

March 1999, in Tokyo

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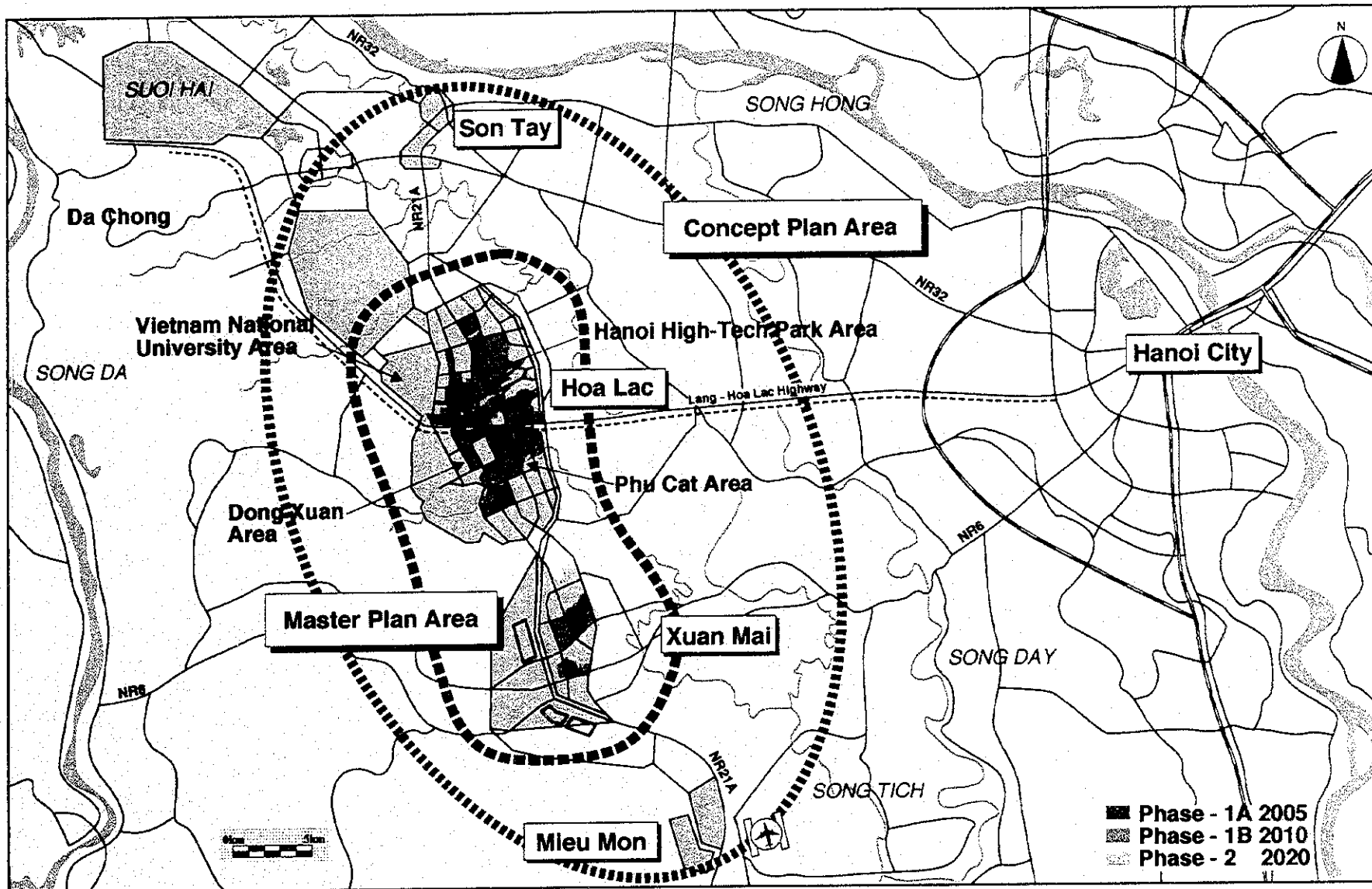
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The Study Area

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List of Abbreviation

A _____

ACSR	-----	Aluminum Cable Steel Reinforced
AFTA	-----	ASEAN Free Trade Area
AIT	-----	Asian Institute of Technology
ASEAN	-----	Association of Southeast Asia Nations

B _____

BFT	-----	Bank for Foreign Trade
BOT	-----	Build, Operate and Transfer
BT	-----	Build and Transfer

C _____

CAA	-----	Civil Aviation Administration
CAD	-----	Computer Added Design
CBD	-----	Central Business District
C-21	-----	Corridor 21
C-21DA	-----	The Corridor 21 Development Authority
CNC	-----	Computer Numeric Control
COD	-----	Chemical Oxygen Demand
C/P	-----	Concept Plan

D _____

DA	-----	Development Authority
DSI	-----	Development Strategy Institute

E _____

EIA	-----	Environmental Impact Assessment
EIRR	-----	Economic Internal Rate of Return

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EPZ	Export Processing Zone
E&T	Education and Training
EVN	Electricity of Vietnam

F

FDI	Foreign Direct Investment
Fe	Iron
FIRR	Financial Internal Rate of Return
FOT	Faculty of Technology
F/S	Feasibility Study

G

GDP	Gross Domestic Product
GDPT	General Department of Post and Telecommunications
GOJ	Government of Japan
GOV	Government of the Socialist Republic of Vietnam
GRDP	Gross Regional Domestic Product
GSO	General Statistical Office

H

ha	hectare
HCMC	Ho Chi Minh City
HDF	Housing Development Fund
HHTC	High-Tech Center
HHTP	Hoa Lac High-Tech Park
HHTP-ST	HHTP JICA Study Team
HMA	Hanoi Metropolitan Area
HN-PC	Hanoi People's Committee
HRD	Human Resource Development
HSEDP	Ha Tay Socio-Economic Development Plan
HT-PC	Ha Tay People's Committee
HUT	Hanoi University of Technology
HWL	High Water Level

I _____

IBRD ----- International Bank for Reconstruction and Development

IDC ----- Infrastructure Development Company

IP ----- Industrial Park

ISDN ----- Integrated Services Digital Network

ISI ----- International Statistical Institute

IT ----- Information Technology

IZ ----- Industrial Zone

J _____

JICA ----- Japan International Cooperation Agency

J/S ----- Joint Stock

J/V ----- Joint Venture

K _____

kg ----- kilogram

km ----- kilometer

kV ----- kilo-Volt

kVA ----- kilo-Volt-Ampere

kW ----- kilo-Watt

kWh ----- kilo-Watt-hour

L _____

LAN ----- Local Area Network

LRT ----- Light Rail Transit

M _____

m ----- meter

MARD ----- Ministry of Agriculture and Rural Development

MB ----- Management Board

MCI ----- Ministry of Culture and Information

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m ³ /d	-----	Cubic meter per day
MOC	-----	Ministry of Construction
MOET	-----	Ministry of Education and Training
MOFA	-----	Ministry of Foreign Affairs
MOF	-----	Ministry of Finance
MOI	-----	Ministry of Industry
MOLISA	-----	Ministry of Labor, Invalids and Social Affairs
MOSTE	-----	Ministry of Science, Technology and Environment
MOT	-----	Ministry of Transport
M/P	-----	Master Plan
MPI	-----	Ministry of Planning and Investment
MRT	-----	Mass Railway Transit
MU	-----	Manganese
MVA	-----	Mega-Volt-Ampere
MSL	-----	Mean Sea Water Level
MW	-----	Mega-Watt

N

NC	-----	Numeric Control
NCHRT	-----	National Center for High-tech Research and Training
NCST	-----	National Center for Natural Sciences and Technology
NDP	-----	National Development Plan
NHDC	-----	National Housing Development Corporation
NIURP	-----	National Institute of Urban and Rural Planning
NPIP	-----	North Phu Cat High-Tel integrated Industrial Park
NR	-----	National Road
NR21A	-----	National Road 21A
NSC	-----	National Steering Committee
NUDC	-----	New Urban Development Corporation
NUHDC	-----	New Urban Housing Development Corporation

Q _____

ODA	-----	Official Development Assistance
OECD	-----	Organization for Economic Cooperation and Development
OECF	-----	Overseas Economic Cooperation Fund, Japan
OJT	-----	On the Job Training
PTA	-----	Provincial Transport Authority

P _____

PC	-----	People's Committee
PCU	-----	Passenger Car Unit
pH	-----	Potential of Hydrogen
PMB	-----	Project Management Board
P/S	-----	Power Station

R _____

R&D	-----	Research and Development
RICCC	-----	Railway Investment Constructions and Consulting Company
RID	-----	Research Institute of Development
RIST	-----	Research Institute of Science and Technology
RR	-----	Ring Road
RRD	-----	Red River Delta
RRD MF	-----	Red River Delta Master Plan
RTMD	-----	Road Transport Managing Department

S _____

SC	-----	Steering Committee
SEZ	-----	Special Economic Zone
SOE	-----	State-owned Enterprise
SPM	-----	Suspended Particulate Matte
SME	-----	Small- and Medium-Enterprise
S/S	-----	Sub-Station
S&T	-----	Science and Technology

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T

TDS	-----	Total Dissolved Solids
TDSI	-----	Transport Development and Strategy Institute
TEDI	-----	Transport Engineering Design Incorporated
TQM	-----	Total Quality Management
TUPWS	-----	Transport and Urban Public Works

U

UDA	-----	Urban Development Area
UNESCO	-----	United Nations Educational, Scientific and Cultural Organization

V

VAT	-----	Value Added Tax
	-----	Vinamari Vietnam Maritime Bureau
VN	-----	Vietnam
VND	-----	Vietnamese Dong
VN-M/P&F/S	-----	
VNU	-----	Vietnam National University, Hanoi
VRA	-----	Vietnam Road Administration
VRU	-----	Vietnam Railway Union
VTC	-----	Vocational Training Center

W

WHO	-----	World Health Organization
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CHAPTER 1

INTRODUCTION OF THE CORRIDOR 21 DEVELOPMENT





CHAPTER 1 Introduction of the Corridor 21 Development

1.1 Overall Planning Process for the Master Plan Study

The principal objective of the Master Plan (M/P) Study is to formulate a comprehensive development plan for the creation of a targeted “one million new town” along the Corridor 21 development, by explaining, clarifying and estimating the development background, goals and objectives, needs and targets, framework, land suitability, land acquisition, development cost, operation and maintenance, and so on. Also, the M/P Study is to promote the creation of the attractive urban environment that should be appreciated by the people living and using the new town.

In the M/P Study however, there is a special condition distinct from ordinary urban development planning, which is the factual situation where the central urban functions such as the Vietnam National University (VNU) relocation project and the Hoa Lac High-Tech Park (HHTP) development, have been already moving towards embarkation with the target operations by the year 2005 and 2003, respectively. This situation implies that those projects are planned to be complete after 5 to 7 years from now, and therefore, the allowable planning period should be very much limited if the time required for pre-implementation arrangements are taken into consideration. In other words, it can be said that the M/P Study should not hinder their first phase implementation basically accepting their present progressive status as a *fait accompli*.

In recognition of the situation, the Japan International Cooperation Agency (JICA) Study Team will attempt to formulate the M/P within the limited period, taking full advantage of the master development plan prepared by Ministry of Construction (MOC) as well as the development plans prepared for the VNU relocation project and the HHTP development. It should be noted, however, that the existing development plans should not be blindly incorporated in the M/P but should be carefully reviewed of their rationale, and if necessary, they should be subject to revision or modification.

The objectives of the M/P Study are twofold as described below, having the target year of 2020.

- (1) To establish a Concept Plan (C/P) based on the findings on the existing conditions, development potentials and constraining factors, which ensures the balanced and

The Corridor 21 Development

sustainable development of a new satellite city¹, having the central functions of absorbing the spill-over population in the future Hanoi Metropolitan Area (HMA), and fostering the human resources development (HRD) and advance technology in the country; and

- (2) To formulate a M/P for the first phase development in the Hoa Lac and Xuan Mai Areas, which includes the first phase of the VNU relocation project, HHTP development, and some housing, as well as the Center Area as a core of the entire development.

In establishing the C/P, considerations in the regional context are given to the districts covered by the master development plan prepared by MOC, which are Son Tay, Hoa Lac, Xuan Mai, and Mieu Mon, as well as the future HMA. However, the principal objective of the C/P is to establish the basic concepts which shall serve as a basis for the development of the Hoa Lac and Xuan Mai Areas (hereinafter called "**the Project**") designated as a core of the proposed satellite city along National Road 21A (NR21A) which will be henceforth referred to as "**the Development.**"

The subsequent M/P will be prepared in the form of the following two categories of study output. The terminology of the "**Structure Plan**" and the "**Local Plan**" are explained in the Column for reference.

- (1) A Structure Plan that covers the whole Hoa Lac and Xuan Mai (hereinafter called the "Master Plan") area, the total development area of which amounts to approximately 15,000 hectares according to the MOC master development plan; and
- (2) A Local Plan that covers the designated area for the first phase development expected to be complete by the year 2010.

¹ Normally, it implies a small city newly developed in the suburban area of a large nucleus city for the purpose of solving or alleviating its urban problems. In the Study, it is used to imply that a city (smaller than Hanoi but quite a large city) to be developed to absorb over-concentrated urban functions in the central Hanoi area, and at the same time, to create a center for science and technology in Vietnam. In this context, it will be a self-contained city particularly in the early phase of its development having the latter functions (center for science and technology) but in the later phase, it will also add the former functions sharing various urban functions of the central Hanoi area. Also, it will not be of the "dormitory city" in Japan predominantly having the residential function where majority of residents commutes to its mother city for work. Presumably, even after conveniently linked to the central Hanoi area with mass transport systems, it will still be a new city where majority of residents work there, although a considerable number of Hanoi citizens will reside there for its quality living environment and it will become popular as a high quality residential quarter in Hanoi Metropolitan Area.

Structure Plan and Local Plan

The Structure Plan is basically a written statement accompanied by any necessary supporting diagrammatic illustrations and is designed to introduce a large measure of flexibility into the system. The Structure Plan is intended to translate national and regional, economic and social policies into a local context, and in doing so provide a framework for the implementation of local plans. The Structure Plan will be subject to continual review depending upon the changing needs and conditions of the community.

In the context of the Master Plan Study, the Local Plan is construed as the Action Plan, for comprehensive planning of those areas indicated in the Structure Plan for improvement, development or re-development, starting within the next ten years. The overall purpose of the Local Plan is to make the new system of development plans more adaptable to changing circumstances, being more detailed and more certain in character while at the same time being more flexible in application. The Local Plan is intended to guide the comprehensive planning of areas suitable for treatment within ten years, and as such is the leading instrument for short-term change.

Admittedly, the world is changing rapidly towards the 21st Century. In the macro context, the previous highly institutional and hierarchical societal systems were collapsed after the end of the cold war, followed by the predominance of the market-oriented systems. And nowadays, such market-oriented systems are further changing towards the global network systems based on the information technologies. Particularly in such changing societal circumstances, urban planning needs to be more “behavioral” rather than “normative” in order to properly respond to the changing circumstances.

Distinction is often drawn between the normative and the behavioral theories of planning, whereby a normative approach implies a concern with how planners rationally to proceed in an ideal world, whereas a behavioral approach concentrates more upon the actual limitations that circumscribe the pursuit and achievement of the rational action.

A further way of expressing these divergent views is summed up in the comparison of what is called “blueprint planning” with “process planning”. Blueprint planning adopts a comprehensive approach towards planning to act through the medium of a “master plan”, hence the description “blueprint, and operate upon a rigorous established administrative structure. In contrast, process planning sees planning as a continuous task, distinct from a static policy prepared at one particular point of time. In process planning, constant review is maintained regarding the performance of the plan and adjustments made whenever necessary, thus reducing

The Corridor 21 Development

delays to a minimum and preserving the relevance of the policy in the light of prevailing circumstances.

As a matter of fact, it appears to be neither practical nor sensible to depict the blueprint or precise perspective in the distant future, which may be particularly true in Vietnam currently being subjected by rapid societal changes. In the light of this, more efforts will be made by the JICA Study Team to prepare a viable Local Plan (which may be more specifically defined as the “Action Plan”), aimed at actualizing the Project within the foreseeable future (10 years).

1.2 Definition of the Study Area

The definition of the words of area zone names and functional names are showing in the Figure 1.2.1.

1.3 Compilation of the JICA Study Report

The JICA Study Report on the Hoa Lac and Xuan Mai Areas Urban Development Project will be prepared according to the following four (4) separate volumes:

Volume-1: Executive Summary

Volume-2: Concept Plan

Volume-3: Master Plan

Volume-4: Appendices

Volume-1: Executive Summary is aimed at providing the essence of Volume 2: Concept Plan and Volume 3: Master Plan, designed to readily understand the results of the JICA Study in its entirety.

Volume-2: Concept Plan (C/P) will cover the overall view on the development of the Study Area (including Son Tay, Hoa Lac, Xuan Mai, and Mieu Mon) along the NR21A in general and, in particular, the development of the Hoa Lac and Xuan Mai Urban Development.

Volume-3: Master Plan (M/P) specifically covers the Hoa Lac and Xuan Mai Urban Development by focusing on the Hoa Lac Urban Area, which will assume core functions in the Development and will be implemented on a priority basis.

Volume-4: Appendices includes information and data pertinent to and in support of the contents covered, but not necessarily to be included, in the C/P and the M/P.

The Corridor 21 Development

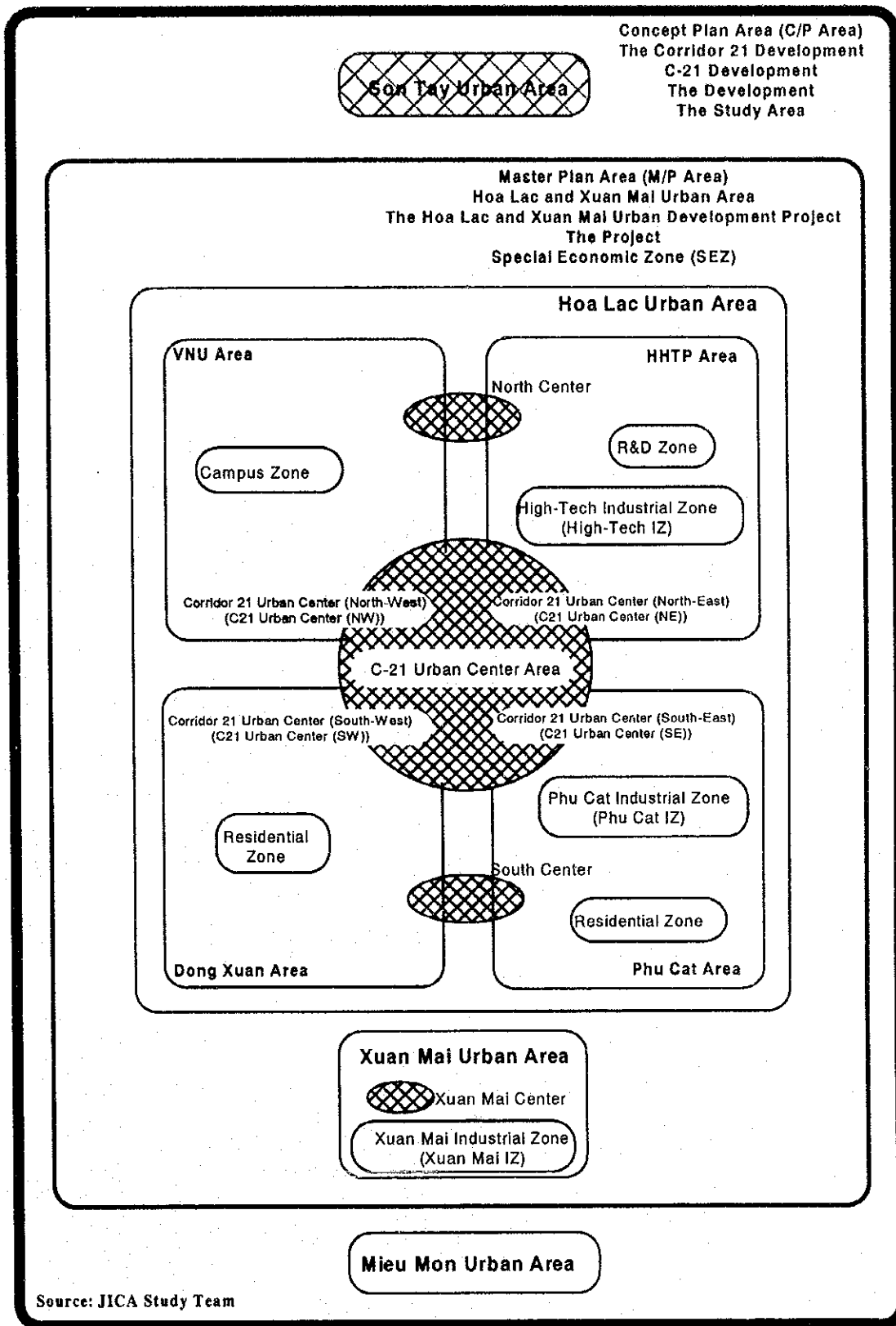


Figure 1.2.1 Definition of the Area Names and Zone Names

CHAPTER 2
UNDERSTANDING
OF
THE PRESENT SITUATION



CHAPTER 2 Understanding of the Present Situation

2.1 General Conditions Surrounding the Area

2.1.1 Natural Environment

(1) Location and General Issues

In general, Vietnam is zoned into eight agro-ecological regions, according to the natural environmental characteristics. Among these eight regions, the Red River Delta (RDD) is located in the coastal region of northern Vietnam and covers the area enclosed with the northernmost and southernmost tributaries of the Red River and all the intermediate complex river system. This region embraces seven provinces and cities in their entirety such as Hanoi, Hai Phong, Hai Hung, Thai Binh, Nam Ha, Ninh Binh and Ha Tay, and 21 districts of three other provinces, namely, Ha Bac, Quang Ninh, and Vinh Phu, having total area of about 16,600 km². It has the highest population density in Vietnam, and in some rural districts, the population density is over 1,500 persons/km². Also, the educational and cultural development of the region is the highest in Vietnam.

The planned area of Hoa Lac and Xuan Mai Urban Development Project mainly covers the half-mountainous areas of Ha Tay Province. Ha Tay Province lies between Vinh Phu, Hanoi, and Hai Hung to the east and Hoa Binh to the west. It falls under two district units as defined by their topography: the low lying plains (0.08 m to 10 m above sea level) which occupy the eastern and central areas, and a small band of hills lying along its western boundary adjacent to Hoa Binh Province. The western areas are partly forested and, being at a higher elevation, such as Ba Vi district, which is visited by tourists, its importance will be enhanced as the project develops in the future.

More than 80 % of the people in the area are engaged in agricultural activities (including fishery and forestry), and rice is the dominant crop. The limestone hills provide a useful source of construction materials as well as raw materials for a cement factory. However, at present, there is little industry in the area apart from small agro-processing plant, textile-processing factories, small-sized handicraft industry, and so on. Therefore, no serious environmental pollution and/or environmental deterioration are currently reported in the area. However, some environmental resources, particularly water, are being threatened or under increasing risks of degradation because environmental infrastructures, such as

The Corridor 21 Development

water supply, solid waste disposal, and sewage treatment, are insufficient to meet the needs of the current population.

The Development area is situated at approximate coordinates of north latitude 20°40' to 21°20' and east longitude 105°30' to 106°.

The Development covers urban areas that include four towns linked by National Road 21A running about 40 km from Mieu Mon through Xuan Mai, Hoa Lac to Son Tay and is about 30 to 40 km west from the Capital Hanoi. It embraces a total Development area of 17,500 ha, consisting of 12,500 ha in Hoa Lac, 2,500ha in Xuan Mai, 900 ha in Son Tay, and 600 ha in Mieu Mon. It borders Tich River to the east, Ba Vi mountains to the west.

The borders are:

- to the north : with Hong River,
- to the south : with Tuy Lai Lake – My Duc – Ha Tay,
- to the east : with Tich River, and
- to the west : with Ba Vi mountains and Hoa Binh province.

Administrative boundaries and constituents of the Study Area consist of 5 quarters and 9 communes of Son Tay town, 1 townlet and 31 communes of 5 districts in the provinces of Ha Tay and Hoa Binh, which are shown as follows:

1) Ha Tay Province

- Son Tay town, including 5 quarters (inner town) and 9 communes (external town).
- Thach That district, including 6 communes: Dong Truc, Binh Yen, Kim Quan, Tan Xa, Ha Bang and Thach Hoa.
- Quoc Oai district, including 4 communes: Phu Cat, Hoa Thach, Dong Yen and Phu Man.
- Chuong My district including Xuan Mai town and 6 communes: Thuy Xuan Tien, Tan Tien, Nam Phuong Tien, Thanh Lap, Tran Phu and Dong Lac.
- My Duc district: 1 commune – Dong Tam.

2) Hoa Binh Province

The Corridor 21 Development

Luong Son district, including 5 communes: Nhuan Trach, Hoai Son, Dong Xuan, Tien Son and Truong Son.

(2) Climate

1) General

The Study Area lies in the zone of tropical climate and is under the influence of the northeast monsoon. The climate area is classified into two seasons: hot and humid summer, and cold and dry winter. Characteristics of the climatic conditions in the Study Area are outlined below.

2) Radiation and Sunshine

Annual quantity of total radiation is about 122 – 125 kcal/cm² a year. In the summer, from May to September, total monthly radiation level, at a maximum, is about 13 – 15 kcal/cm² a month. In other months of the year, total radiation is lower than in the summer. Particularly, in the last half of the winter (from January to March) total radiation reaches the smallest level during the year, about 5.2 – 6.2 kcal/cm² a month.

Sunshine in the Study Area is not much, as well as in other northern areas of Vietnam. The annual average number of sunshine-hours is about 1,500 – 1,600 hr/year.

3) Wind Speed and Direction

In the first half of the winter (from September to December), the main wind directions (prevailing wind) are north (NW, NE and N) with total frequency: 35 – 40 %, and then southeast with frequency about 12 – 15 %. In the last half of the winter (from January to March), main wind directions are SE and NE, with frequencies of 22 – 45 % and 20 – 25 % respectively. In the summer (from April to August), main wind directions are SE and the E, each one with a similar frequency of about 15 – 46 %.

Because of the situation of the area, which lies relatively far from the sea, the frequency of clam wind reaches rather large values, about 20 – 50 %.

Wind speed in the area is moderate. Annual average wind speed varies between 1.5 and 1.8m/s. The values change in the year, but it is higher in transition period from winter to summer (from February to April). However, the main wind directions usually have higher average speeds of about 2 – 3 m/s. Figure 2.1.1 shows the wind rose in Son Tay and Ha Dong.

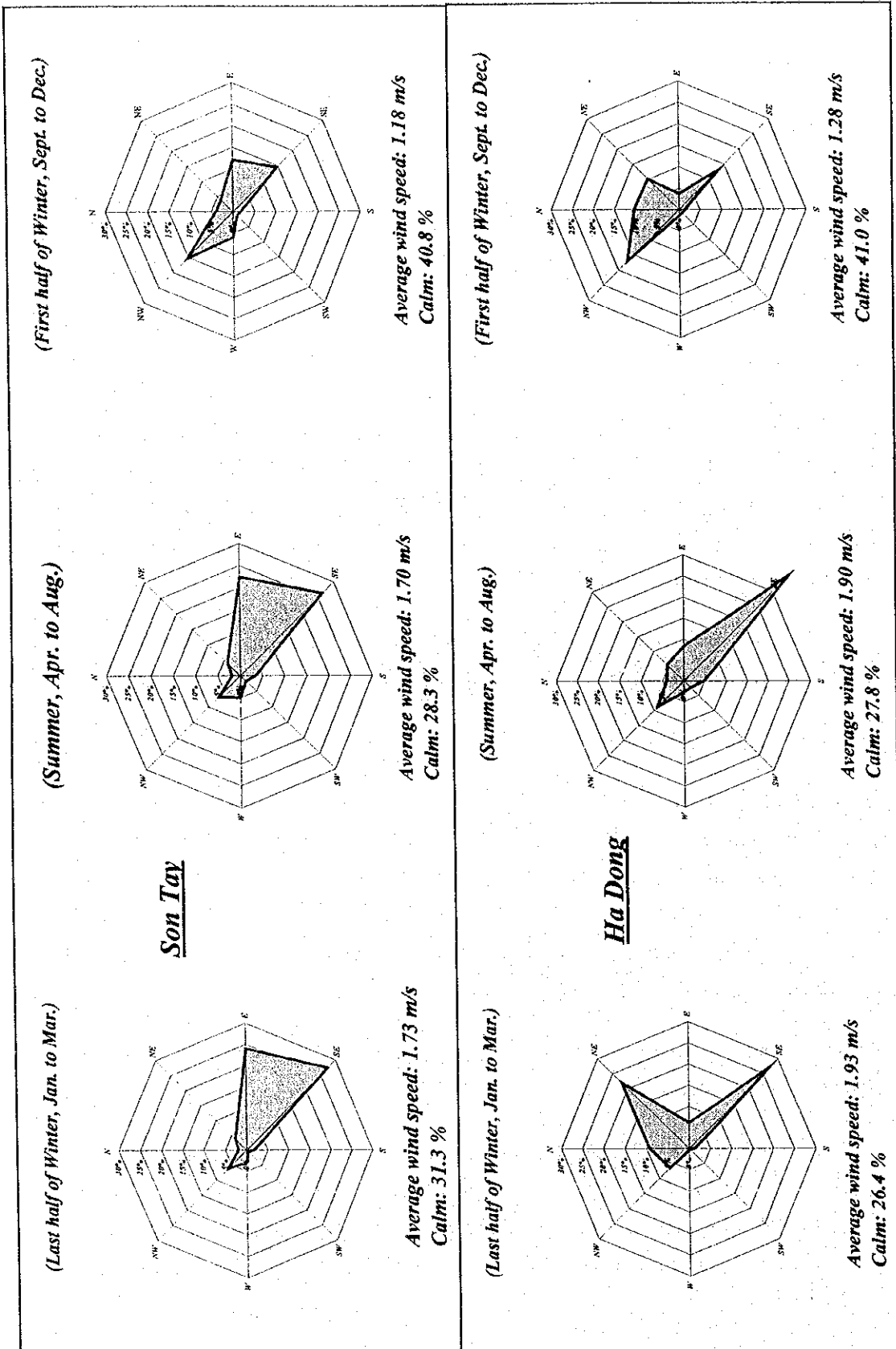


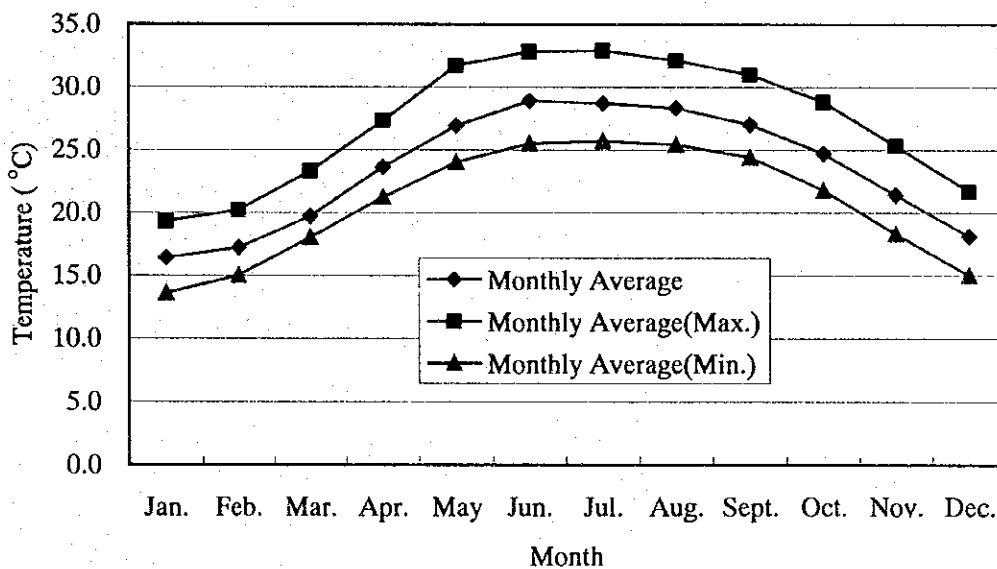
Figure 2.1.1 Wind Rose in the Study Area

4) Temperature

Due to low and rather flat relief topography of the Study Area, it has a rather high temperature. The annual average temperature is about 23 °C to 24 °C. However, in this area there are two seasons as to temperature: hot and cold. The hot season, which has a monthly average temperature higher than 25 °C, lasts for 5 months, from May to September. The period with a monthly average temperature lower than 20 °C lasts for four months, from December to March. Between these periods, there are about two to three cold months (January and February or from December to February) with an average temperature lower than 18 °C.

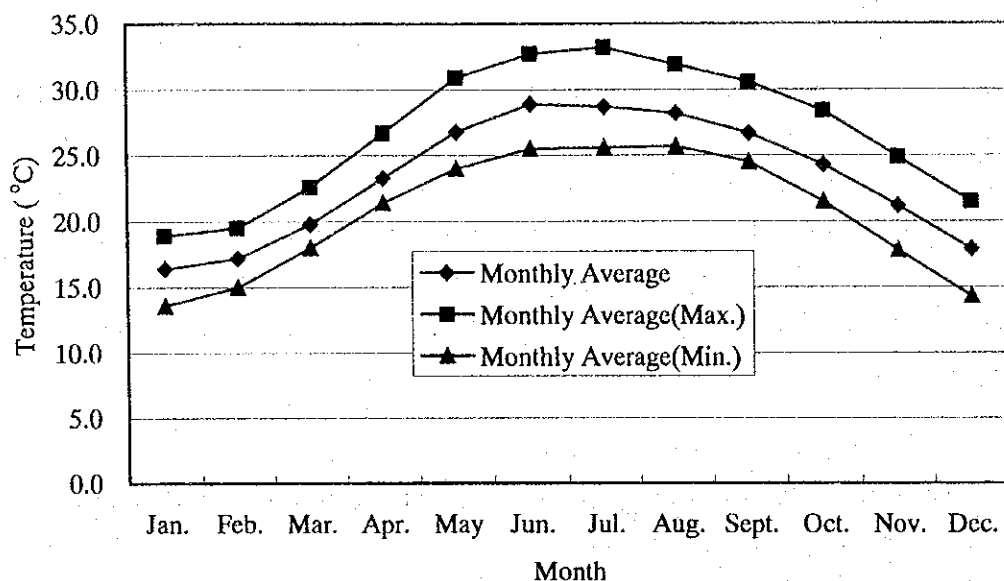
Annual average maximum temperature in the Study Area varies from 26.5 °C to 27.5 °C. In the summer (from May to December) this value is usually higher than 30 °C, and reaches the maximum of about 33 °C in June and July. Annual average minimum temperature is always higher than 20 °C, about 20.5 – 20 °C.

Following figures (Figures 2.1.2 and 2.1.3) show the monthly average temperature in Son Tay and Ha Dong.



Source: NCST.

Figure 2.1.2 Monthly Average Temperature in Son Tay

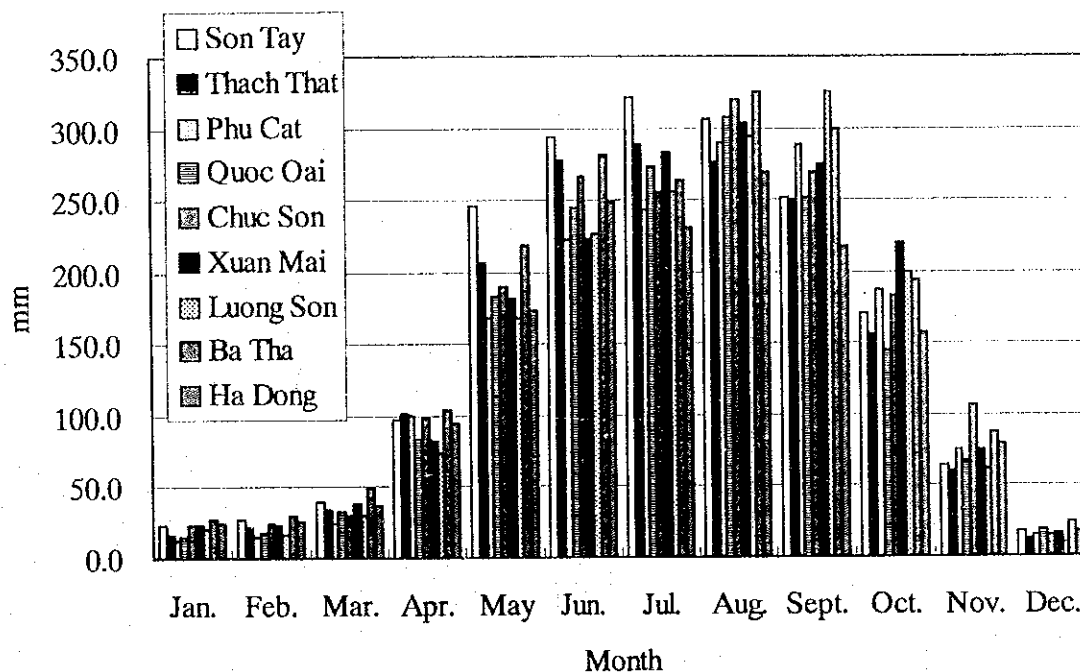


Source: NCST.

Figure 2.1.3 Monthly Average Temperature in Ha Dong

5) Rainfall

In the Study Area, there is moderate rainfall. The annual total rainfall distributes rather evenly on the territory, and varies from 1,600 to 1,950 mm/year. The rainy season usually lasts for six to seven months (from April or May to October). The quantity of rainfall for rainy season takes about 85 – 91 % of annual total rainfall. Annual distribution of rainfall has one maximum and one minimum. The maximum is observed in August or July with rainfall of 270 – 350 mm/month, the minimum, in December or January with rainfall varying from 10 to 25 mm/month. Figure 2.1.4 shows the monthly rainfall recorded in some places in the Study Area.



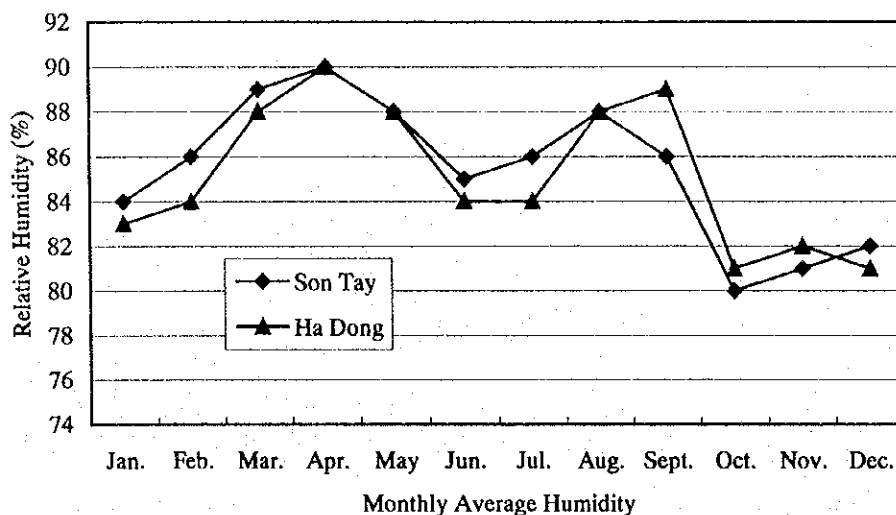
Source: NCST.

Figure 2.1.4 Monthly Rainfall

6) Humidity

The Study Area has high humidity. The annual average relative humidity reaches 84 – 85 %. All through the year, average relative humidity is always higher than 80 %. The annual distribution of humidity has two maximums and two minimums. The maximums have values of about 88 – 90 % and are observed in two periods (March – May and August – September). In the period from October to December, humidity has the smallest value of the year and varies from 80 to 82 %. Figure 2.1.5 shows the monthly average humidity in Son Tay and Ha Dong.

The Corridor 21 Development



Source: NCST.

Figure 2.1.5 Monthly Average Humidity

7) Others

In the Study Area, there are some special weather phenomena such as fog, hoarfrost, storm, hail, drizzle, hot and dry wind days and typhoon. However, the frequency of occurrence for most of them is not so high.

Table 2.1.1 shows the average values of typical climate indicators in the area.

Table 2.1.1 Typical Climate Indicators in the Study Area

Average Annual Temperature	Average Max. Annual Temp.	Average Min. Annual Temp.	Average Annual Humidity	Average Annual Rainfall
23.4°C	28.7°C	16.6°C	84%	1,839 mm

Source: Report on M/P of Mieu Mon – Xuan Mai – Hoa Lac – Son Tay Urban Areas, MOC

(3) Geography

1) Topographical Conditions

Generally speaking, the Study Area is flat, gradually sloping down from the northwest to the southeast. However, it exhibits great topographic diversity. There are high mountain, sloping hill, paddy field, lake, pond, river, reservoir and so on. The height of the ground varies from 9 to about 1,200 meters, stretching along the north-south axis from Son Tay to Mieu Mon along NR21A to the southwest of Hoa Binh Province. The area is formed by the last geological movement, which had raised alluvial soil up to the level of 15 – 20 meters. Near Ba Vi Mountain, it is 40 – 50 meter high. The area can be divided into the following three main categories from a topographical viewpoint.

(a) Topography of the Tich River side:

The Tich River flows through the Study Area from the northwest to the southeast parallel to NR21A. The area of the Tich River side is mostly flat plain with 5 % slope or less ($\leq 5\%$). Paddy fields interpose with low hills, streams, swamps, lakes and irrigation channels with elevations ranging from 5 – 12 meters. This area is also dotted with some relatively large lakes such as Suoi Hai Lake and Dong Mo Lake.

(b) Topography of Rampant Hills

There are green trees and fruit trees forest alternating with populated areas and some fallow hills, with elevation ranging up to 50 meters. The slope is under 10 % ($\leq 10\%$).

(c) Topography of Hilly Area:

This area has elevation ranging from 50 to 100 meters, slope from 10 % to 20 %, including Ba Vi National Park, Vien Nam Mountain, some limestone mountain of Xuan Mai and Mieu Mon.

2) Hydrological Conditions

There are a number of rivers, lakes, and hydrological facilities, which runs through the area. The following show the major hydrological bodies in the area:

The Corridor 21 Development

(a) River

a) Da River

Some small rivers flow into and/or out of Da River, which runs from Che to Trung Ha with the length of 42 km.

b) Red River

Red River flows through Son Tay urban area with the length of 30 km.

c) Tich River

Tich River originates in the Tan Vien Mountain range and flows into Bui River at Thuy Xuan Tien commune of Chuong My District. It is 15 to 150 meter wide with a vertical slope of 1 to 8 %. It is the main drainage channel for the entire Study Area from north to south.

d) Hang River

Hang River originates from Tan Vien Mountain and runs through Son Tay and Ba Vi Districts with the length of 10 km, and width of 50 merter merging into the Tich River.

e) Bui River

Bui River runs through Xuan Mai urban area and merges with the Tich River; originated from Bui Mountain in Luong Son District of Hoa Binh Province.

(b) Lakes and Other Hydrological Bodies

Apart from the rivers above mentioned, there are relatively some large lakes, water utilization facilities and dykes in the area.

a) Lake

Major lakes are: Suoi Hai Lake (960 ha), Xuan Khanh Lake (90 ha), Dong Mo Lake (1,250 ha), Tan Xa Lake (167 ha) and the lake of Mieu Mon, Dong Xuong and Van Son. All of them play important roles in the creation of a better climate, landscaped environment as well as the provision of water supply and drainage.

b) Water Utilization Facility

In relation with the water utilization facilities, there are 62 pumping stations for drainage and/or irrigation in the area. These pumping stations can be also divided into two types by scale: the small scale hydro-agricultural pumping station, which has a drainage and/or irrigation area of less than 200 ha, and the medium scale hydro-agricultural pumping station, which has a capacity of 200 to 10,000 ha. Tables 2.1.2 and 2.1.3 show the breakdown of the number of pumping stations in the area.

Table 2.1.2 The Number of Pumping Stations

District	For Drainage	For Irrigation	For Drainage & Irrigation	Total
Son Tay	2	17	0	19
Thach That	2	13	0	15
Quoc Oai	2	7	1	10
Chuong My	4	12	2	18
Total	10	49	3	62

Source: International Statistical Institute (ISI), Report on Hydrological Map, March 1998

Table 2.1.3 The Number of Pumping Stations by Scale

Scale	Son Tay	Thach That	Quoc Oai	Chuong My	Total
Small Scale	18	13	7	12	50
Medium Scale	1	2	3	6	12
Total	19	15	10	18	62

Source: ISI, Report on Hydrological Map, March 1998

c) Dike

Dike network, which has existed for more than a thousand years, now becomes a relatively integrated hydraulic system for the prevention of flood, for irrigation and drainage together with other hydrological systems in the area such as rivers, lakes and pumping stations. At present, the total length of dike in the area reaches some hundreds of kilometers. However, the present condition of the dikes is poor due to structural damage, lack of adequate management, lack of funds for maintenance, and other reasons. Locations of dikes in the area are shown on the hydrological map in Appendix.

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d) Soils

The Study Area consists primarily of alluvial soil, along with smaller amount of red-yellowish soil and degraded soil. According to the Vietnam soil classification, the Study Area has 12 soil types.

Table 2.1.4 shows that the soil group of hilly sub-zone composed of Fs, Fp and FL, and that of plain, low and valley composed of Pb, P, Pg, Pf, Pj, Py, J, B and Bg occupies an area of 21,480 ha, or 39 %, and 25,598 ha, or 46.5 %, of total area respectively. The following describe the characteristics of some typical soils: Brown-yellowish soil on old alluvium (Fp), which covers the largest area in the Study Area and concentrates in Son Tay, Chuong My and Thach That, is cultivated with tea, fruit trees and subsidiary crops, such as cassava, and sweet potato, by the local farmers.

Table 2.1.4 Types of Soil in the Study Area

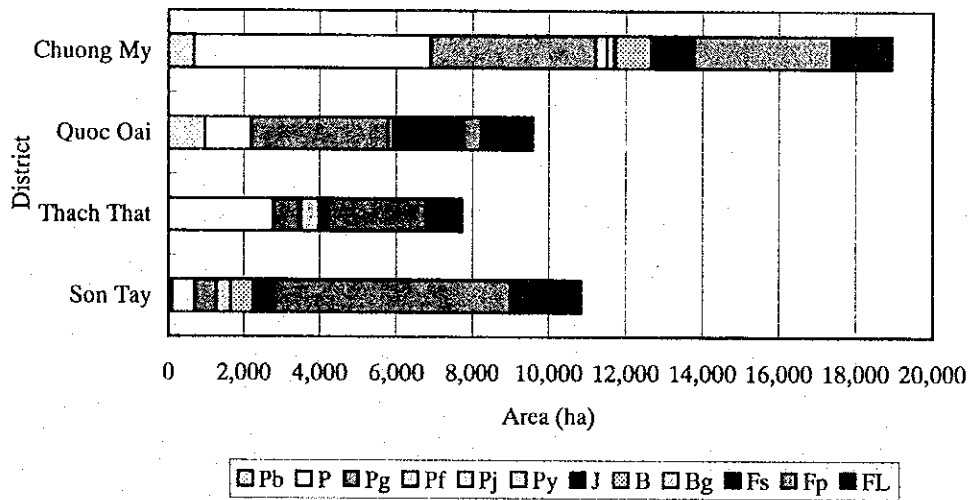
No	Soil Type	Symbol	Son Tay (ha)	Thach That (ha)	Quoc Oai (ha)	Chuong My (ha)	Area (ha)	Rate (%)
1	Deposited alluvium	Pb	93	0	967	671	1,731	3.14
2	Old alluvium	P	588	2,771	1,209	6,198	10,766	19.55
3	Gley alluvium	Pg	598	704	3,618	4,334	9,254	16.80
4	Alluvium spotted with red-yellowish layer	Pf	0	40	0	0	40	0.07
5	Waterlogged alluvium	Pj	374	473	134	298	1,279	2.32
6	Alluvium of streams	Py	0	0	0	177	177	0.32
7	Marshy soil	J	0	0	582	47	629	1.14
8	Degraded soil on old alluvium	B	588	46	90	923	1,647	2.99
9	Gley degraded soil on old alluvium	Bg	0	75	0	0	75	0.14
10	Red-yellowish soil in clay crystal rock	Fs	570	87	1,139	1,100	2,896	5.26
11	Brown-yellowish soil on old alluvium	Fp	6,218	2,582	510	3,635	12,945	23.50
12	Red-yellowish changed by growing rice	FL	1,811	937	1,334	1,557	5,639	10.24
Sub Total			10,840	7,715	9,583	18,940	47,078	85.47
13	Residential land	RSDT	1,886	1,121	987	732	4,726	8.58
14	Rock mountain	RM	0	0	34	185	219	0.40
15	River and Pond	RP	938	583	208	1,327	3,056	5.55
Total			13,664	9,419	10,814	21,184	55,079	100.00

Source: ISI, Report on Soil Source in Hilly Districts Along 21A Highway of Ha Tay Province, March 1998

Old alluvium soil (P) with an area of 10,766 ha, or 19.6 % of the total area, is distributed in all districts of the area. This soil is suitable for rice and subsidiary

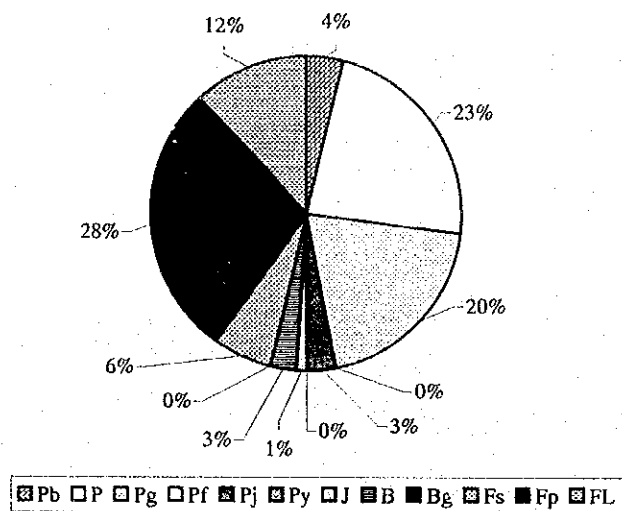
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crops. At present, most of this soil has been exploited for double rice crops and partly grow one more winter crops. Gley alluvium soil (Pg) covers an area of 9,254 ha, or 16.80 % of the total area, and distributes in all districts. The widest distributed areas are Chuong My and Quoc Oai. At present, double rice crops and one more winter crops are cultivated on this soil. Figures 2.1.5 and 2.1.6 show the types of soil by area and the structural composition of soil in the whole Study Area.



Source: JICA Study Team

Figure 2.1.6 Types of Soil in the Study Area



Source: JICA Study Team

Figure 2.1.7 Structural Composition of Soil Type

(4) Biological Resources

1) Ecological Conditions

The Study Area has the following five different ecological areas:

(a) Ecological Area of Evergreen Tropical and Broad-leaved Forest

The plant community of this ecological area has main characteristics of primary forest. The forest has stratum separation and high canopy. However, this area remains and is distributed only in mountain ranges at elevation above 400 meters at present.

(b) Ecological Area of Secondary-scrub Forest

The forest of this area is regenerated scrub forest after cutting the trees for making up the fields. The scrub community is dominant in elevation from 30 to 400 meters. At present, this area is managed by local people for planting trees such as pine, eucalyptus, and so forth.

(c) Ecological Area of Hills and Hillocks Fields

The plant community of this ecological area covers regenerated scrub and reestablished plants after making up the fields and/or grass fields.

(d) Ecological Area of Settlement

This area includes the part of the settlements of minor people, namely Muong, Kinh, Dao, and Tay people. Crop plants in this area include pineapple, corn, and eucalyptus. Furthermore, fruits and other plants such as Longan, lychee, orange, bamboo, and tea are included.

(e) Ecological Area of Rivers, Lakes, Paddy Fields and Gardens

This ecological area includes the region from the east side of NR21A to the Day River area.

2) Vegetation

Vegetation in the Study Area can be classified into the following 10 communities.

(a) Evergreen Broad-leaved Forest

This type of forest consists of a variety of broad-leaved trees, which form several strata. The highest stratum, which includes *Sapindus mukorossi*, *Pometia pinnate*, and *Choerospondias axillaris*, reaches the height of more than 30 meters. Other major species of this forest are *Diospyros dasyphylla*.

Formerly, a great part of the Study Area was covered with this type of forest. However, this forest is limited and distributed only in the area of Ba Vi National Park at present because of the exploitation in the Study Area. Soil types of this forest are mainly fertile soil which are created from limestone and other stones. The species of this forest also include that of epiphytes such as *Asplenium nidus*, *Pothos repens*, *Rhapidophora sp*, and so forth.

(b) Secondary Evergreen Scrub Land

This type of vegetation is distributed on ancient alluvial soils in the western mountainous area of the Study Area. This land is formed from the primary forest or evergreen broad-leaved forest mentioned above. The most general species in the scrub forest are *Rhodomyrtus tomentosa*, *Melastoma candidum*, *Psychoria rubra*,

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Maesa acuminata, and *Dillenia heterocephala*. The height of species is lower than 8 meters. In addition, there are other gramineous species such as *Gartotia patula*, *Miscanthus japonicus*, *Narenga fallax*, and so on.

(c) Secondary Grass Land

All grasslands in the Study Area are the secondary growth. The conditions of bioclimate and soil in the area do not agree with the existence of the primary grasslands. The grasslands are now utilized for agricultural cultivation and permanent grazing area. Common species, which have the height from 0.5 to 1.5 meters, are *Imperata cylindrica*, *Miscanthus japonicus*, *Panicum montanum*, *Panicum paludosum*, and *Cynodon dactylon*.

(d) Communities of Annual Food and Industrial Crops

The types of annual crops observed in the area are *Manihot esculenta*, *Zea mays*, and *Ipomoea batatas*. *Manihot esculenta* is planted on the hilly area as well as *Zea mays* and *Ipomoea batatas* on the river alluvial plains. However, the farmers have a tendency to change the cultivation of *Manihot esculenta* because of the economical value reduction of that species. In recent years, they have given priority to planting the fruit trees on the hilly area.

(e) Cultivated Forest of Eucalyptus species, Acacia species

There are many plantations of *Eucalyptus* that are 5 – 7 year old or older in the hilly area. The majority of hilly areas are ancient alluvial areas with poor soil, thin humus story. In recent years, in order to improve the fertile degree of soils, local people have a tendency to plant *Acacia* species, which grows well in the ancient alluvial areas, instead of *Eucalyptus* species.

(f) Communities of Cultivated Tree near Village

There are many kinds of cultivated trees, which are utilized for various ways such as fruit-tree, ornamental plants, plants for shade, and logs for construction. The kinds of trees for each use are as follows:

- a) Fruit-tree: *Citrus nobilis*, *Citrus sinensis*, *Citrusgrandis*, *Citrus limonia*, *Dimocarpus longan*, *Litchi chinensis*, etc.
- b) Plants for shade: *Terminalia catappa*, *Ficus elastica*, etc.

c) Logs for construction: *Melia azedarach*, *Bambusa* species.

d) Ornamental plants: *Ficus benjamica*, *Cycas* species.

(g) Bamboo Plantation

Bambusa species and *Dendrocalamus* sp. are planted near villages and on riverbanks. Bamboo plantation is useful not only to provide materials for construction but also protect soils from erosion, especially in the places near dikes.

(h) Tea Estates

Formerly, a tea garden covers a relatively wide portion in the Study Area; however, the areas for a tea garden have been reduced in recent years. Tea plants are mainly planted in the ancient alluvial hills and supply materials for the local tea factory in the way line from Xuan Mai to Mieu Mon.

(i) Paddy Fields

Rice is a staple food in the Study Area. Species of paddy fields include fifth-month crop and tenth-month crop. The soils are alluvial plains outside dikes and alluvial deltas inside dikes.

(j) Communities of Hydrophytic Herbaceous Species

These communities include the species growing in the waterside or underwater, such as *Sagetta sagittaefolia*, *Cyperus* sp., *Eleocharis* sp., *Nymphoides hydrophyllacea*, *Ceratophyllum demersum*, and *Vallisneria spiralis*.

3) Fauna

A large number of animal species, such as mammalia and aves are observed in the above-mentioned area. The fauna in the area is as follows.

(a) Mammalia

The species composition in the Study Area is shown in Table 2.1.5.

Most of the 51 species distribute not only in one ecological area; in fact, they may be found in two, three or four ecological areas. The table shows that the dominant mammal species in the area are that of small species such as Rodentia, Carnivora, Chiroptera, and the number of species of Peimates, Artiodactyla is rather small.

Table 2.1.5 Composition of Spices: Mammilla

No. of Species	Order
2	Insectivora
1	Scandenta
7	Chiroptera
3	Primates
17	Carnivora
3	Artiodactyla
1	Rholidona
17	Rodentia
51	Total

Source: Report on Ecological-Animal Map of New Xuan Mai- Hoa Lac Area, ISI, 1998

(b) Aves

At present 105 bird species that belong to 41 families and 15 orders are confirmed in the Study Area. Table 2.1.6 shows the species composition.

Table 2.1.6 Composition of Spices: Aves

Order	No. of families	No. of species
Podicipediformes	1	1
Pelecaniformes	1	1
Ciconiiformes	1	11
Anseriformes	1	3
Falconiformes	2	5
Gruiformes	2	4
Charadriiformes	3	6
Columbiformes	1	3
Psittaciformes	1	1
Cuculiformes	1	4
Strigiformes	1	1
Caprimulgiformes	1	2
Apodiformes	1	1
Coraciiformes	2	6
Passeriformes	22	56
Total	41	105

Source: Report on Ecological-Animal Map of New Xuan Mai- Hoa Lac Area, ISI 1998

The above 105 species can be classified into four-type accordance to their habitat as shown in Table 2.1.7.

Table 2.1.7 Habitat

Habitat	A ¹⁾	B ²⁾	C ³⁾	D ⁴⁾
No. of species	44	82	52	33
(%)	42	78	49.5	31

¹⁾ Habitat of lakes, rice paddy fields, wetland

²⁾ Habitat of hills, hillocks, man-made forests

³⁾ Habitat of secondary scrub forest

⁴⁾ Habitat of settlement, gardens

(c) Reptilia-Amphibia

With regard to reptilia and amphibian, there are 55 species belonging to 14 families and 4 orders in the Study Area, namely: 44 species of reptilia which belong to 10 families and 3 orders, and 11 species of amphibian which belong to 4 families and 1 order. A number of species of reptilia and amphibian in the area are relatively small, and they are about 17 % and 13 % of total species of the country respectively. Ba Vi mountain range has the highest species population with about 36 out of the 44 species. Representative species for each ecological area include the following.

- a) *Gecko gecko*, *Drako maculatus*, *Rhynchohis bonlengeri*, *Trimeresurus alblabri*, *Trimeresurus monticola*, etc. (evergreen broad-leaved forest)
- b) *Calotes fruhstorferi*, *Mabuya longicaudata*, *Mabuya multifasciata*, *Elaphe radiata*, *Pyas korros*, etc. (secondary scrub forest)
- c) *Mabuya multifasciata*, *Rana limnocharis*, etc. (hills and hillocks)
- d) *Hemidactylus frevatus*, *Mabuya longicaudata*, *Mabuya multifasciata*, *Elaphe radiata*, *Amphiesma stolata*, etc. (settlement)
- e) *Bufo mellanostitus*, *Xenochrophis piscator*, *Euhydris phumbea*, *Oeidozyga uma*, *Rana guentheri*, *Rana limnocharis*, etc. (lakes, ponds, paddy fields)

Aside from the above species, some rare, valuable species are distributed in the Study Area, for example, *Gecko gecko*, *Acanthosaura lepidogaster*, *Pytias koros*, and *Pytias mucosus*.

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(d) Hydro-biological Fauna

a) Phytoplankton

According to the survey conducted by International Statistical Institute (ISI) in February 1998, 62 species of Phytoplankton belonging to 6 phylum were confirmed. Among these species, Bacillariophyte is dominant in rivers, and Chlorophyte is dominant in stagnant waters such as lake and pond.

b) Zooplanktons

The ISI's survey conducted in March confirmed 37 species of zooplankton. Tropical species is dominant over the Study Area. However, the composition structure and concentration of zooplankton are quite different by type of water body. The concentrations in rivers are low, while those in ponds for aquaculture are high in general.

c) Zoobenthos

As for zoobenthos, 19 species including shrimp, crab, oyster, shellfish were confirmed by the survey of ISI. Dominant species are Oligochaete and Chironomid, but mollusk and crustacean were not confirmed in Suoi Hai reservoir.

d) Fish fauna

Analysis of samples, interviews with fishermen and local people, and publications ascertain that there exist 37 species of fish in the Study Area. Among these, four main species are cultivated in reservoirs and ponds. Some natural fish such as bagarius catfish, drawt catfish, which are caught in Da River, are restricted as commercial species.

(5) Environmental Quality

1) Water quality

There are no readily available regular monitoring data on surface water quality to be used as reference in the Red River Delta including the Study Area. However, some governmental agencies or institutions have conducted specific water surveys targeting particular issues, such as pesticides, in cities or specific projects. Tables 2.1.8 and 2.1.9 show the water quality of typical water bodies in the Study Area.

Table 2.1.8 Water Quality of Suoi Hai and Dong Mo Reservoirs

Parameter	Suoi Hai Reservoir	Dong Mo Reservoir
Temperature (°C)	16 – 31	19 – 31
Transparency ¹⁾ (cm)	80 – 150	70 – 155
PH	6.9 – 7.3	6.9 – 8.0
Dissolved oxygen (mg/l)	5.01 – 8.92	5.2 – 8.9
Dissolved CO ₂ (mg/l)	0.88 – 21.12	0.88 – 7.92
COD _{Mn} (mg/l)	7.0 – 18.7	5.04 – 11.2
NH ₄ ⁺ (mg/l)	0.1 – 0.25	0.05 – 0.15
PO ₄ ³⁻ (mg/l)	0.03 – 0.26	0.03 – 0.17
SiO ₂ (mg/l)	1.2 – 3.8	8.0
Ca ²⁺ (mg/l)	3.0 – 3.5	5.2
Mg ²⁺ (mg/l)	1.4	2.6
Hardness (Germany level)	0.86 – 0.98	0.9 – 1.9
HCO ₃ ⁻ (mg/l)	28 – 35.6	42.7
Total Iron (mg/l)	0.1 – 1.48	0.17
Cl ⁻ (mg/l)	10.0	10.65

Source: Dang Ngoc Thanh, 1980; Nguyen Van Hao, 1994

Table 2.1.9 Water Quality of Some Water Bodies in the Study Area

Location	Temperature (°C)	DO (mg/l)	pH	Conductivity (s/m)	Turbidity (mg/l)
Da river ¹⁾					
Surface (0.2m)	21.4	11.1	7.43	0.02	5
Layer(0.5m)	21.3	10.6	7.39	0.02	7
Ky Son					
Surface(0.2m)	21.4	10.1	7.85	0.02	3
Layer(0.5m)	21.4	9.8	7.52	0.02	4
Reservoir ²⁾					
Surface(0.2m)	24.8 – 24.9	10.5	7.16 – 7.17	0.01	17 – 18
Layer(0.5m)	24.6	8.2	7.02	0.01	18 – 22
Stream ³⁾	27.8	6.6	7.73	0.02	56 – 58
Tributary of Da river ⁴⁾	25.7				
Surface(0.2m)		6.6	7.58	0.01	105 – 110
Layer(0.5m)	26.4 – 26.7	6.2	7.04	0.01	104 – 120
Pond for aquaculture	31.3	12.7	8.5	0.03	101 – 102

Source: Measured by ISI in March 1998

Note: 1) Da Chong, 2) Da Chong, 3) Xuan Mai, 4) Near Xuan Mai

Figures in above tables indicate that the water quality of water bodies in the Study Area is slightly polluted by organic substances, but generally good and in stable condition

2) Air quality

There are no regular monitoring data on air quality in the Study Area. There exist only short-term air quality survey data on particular urban areas. However, some monitoring data indicate that the air quality in the area is relatively good, and most of air quality

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parameters are below the permissible levels. Table 2.1.10 shows the air quality in some places of northern Vietnam.

Table 2.1.10 Air Quality in Northern Part of Vietnam

Location	SPM ¹⁾		SO ₂		NH ₃	
	Max	Min	Max	Min	Max	Min
Hanoi	45.8	2.1	0.098	0.001	0.005	0.002
Viet Tri	1.9	0.4	0.100	0.003	0.034	0.001
Bac Giang	19.0	1.0	0.0001	-	0.0017	-
Permissible value	0.3 (1-Hr average value)		0.5 (1-Hr average value)		0.2 (24-Hr average value)	

Source: Proceeding of the National Seminar on Environmental Protection and Sustainable Development Research, Hanoi, 1993

Note: 1) suspended particulate matter

(6) Parks, Nature Resources, and Cultural and Historical Sites

Vietnam classifies protected areas into three categories: national parks, nature reserves, and culturally and environmentally protected areas, all under the responsibility of the Ministry of Forestry. National Parks are protected areas that possess profound value in nature conservation, research, preservation of cultural relic, and tourism. Nature reserves are the protected areas characterized by its importance to science and plant and animal-genetic conservation. In nature reserves, research is acceptable, while tourism and recreational purpose are not encouraged. Culturally and environmentally protected areas contain historical and cultural relics and scenes with aesthetic or environmental value, and tourist and recreation attraction. Within the study area of Ha Tay Province, there is one national park, namely Ba Vi National Park with an area of 2,144 ha.

The outline of the Ba Vi National Parks provided below is source from the "Environment and Bioresources of Vietnam," published in 1995.

- (a) Park Location: 20°01' – 21° 07'N, 105° 18' – 105° 25'E,
- (b) Natural conditions: Three parks : 1,226, 1,296, and 1,200 meters
- (c) Average temperature: 23 °4'C
- (d) Average humidity: 84 %,
- (e) Annual rainfall: 1,660 mm.

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Ba Vi is famous for the legend of Son Tinh – Thuy Tinh (the legend of the Spirit of the Mountain and the Water) and is considered as the shelter for Muong and Dao tribal groupings. In the vicinity of the National Parks, there are a series of scenic spots, namely Suoi Hai Lake (900 ha), Dong Mo - Ngai Son Lake (1,300 ha), Ngoc Nhi Stork Colony and Bang Ta Forest. These remarkable places together create an attractive tourist destination while the primary forest left therein serves as the Capital's park and is admired by the people throughout the country.

Ba Vi National Park is mainly extended in a semi-mountainous area including 3 peaks: Tan Vien (1,226 m), Dinh Vua (1,296 m) and Ngoc Hoa (1,200 m). Under 400 meter high, the slope may reach a gradient of 25 °, above 400 meters, and gradient is 35 °.

Generally, the western slope of the Parks down to the Da River is steeper than the east and north. The area below 100 to 500 meters is composed of stone, tight sand and clay sediment; above 600 meters is yellow ferrolites.

Ba Vi National Parks are seen as a greenery gem that have emerged from vast paddy fields. The forest extended therein plays an important role in regulating water current and supplying oxygen for Hanoi. The existence of the National Park substantially contributes to conserve the environmental resources and provide recreation to people. It is also a showcase of beautiful sub-tropical forest to be enjoyed by visitors from Hanoi.

2.1.2 Current Situation of Human Resource Development

(1) Outline of Human Resource Development

The literacy rate in Vietnam is 91 % in 1996, which is higher than that of neighboring countries. The total population is around 77 million, and labor force is 40 million, only 12 % of which have undergone training. The structure of education level is as follows: post graduates 0.3 %, university or college graduates 0.1 %, upper secondary school graduates 35.8 %, others 43.8 %. These mean that an engineer corresponds to 1.6 technicians and 3.6 skilled workers. Considering that ideal proportion is 1 / 4 / 14 or 1 / 5 / 10, Vietnam is short of technicians and skilled workers.

Trained labor force concentrates in a few major cities. Engineers and technicians in Hanoi and HCMC account for 95 % of the total and graduates from higher education institutes in Hanoi account for 62 % of the total.

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The education and training systems in Vietnam can be divided into four categories; i) general education, ii) technical education, iii) higher education and iv) vocational training. General education covers pre-school education, primary school, lower secondary school and upper secondary school. Technical education is provided in secondary vocational school and secondary technical school. Graduates from long-term courses can get the same qualification as graduates from upper secondary school. The education and training (E&T) system is shown in Table 2.1.11.

Table 2.1.11 Duration and Age of each Education Level

		Duration (year)	Age (year)
General Education	Nursery	2	4-5
	Primary school	5	6-11
	Lower secondary school	4	12-15
	Upper secondary school	3	16-18
Higher education	College	3	19-21
	University	4	19-22
	University	5	19-23
Technical education	Secondary technical school (graduates from lower secondary school)	3	16-18
	Secondary technical school (graduates from upper secondary school)	2	19-20
	Secondary vocational school (graduates from primary school)	3	12-14
	Secondary vocational school (graduates from lower secondary school)	2	16-17
Vocational Training	Vocational training center (short-term)		
	Vocational training center (long-term)		

Source: MOET

Primary school is compulsory education and enrolment ratio is 94 % in 1995. The ratio in urban area has already reached 100 %. Hanoi accomplished 100 % in 1990, Ha Tay in 1993.

The number of students is increasing at normal education level. In comparison with the 1990-1991 school year, the number of students in lower secondary school in 1997-98 school year recorded an increase 1.9 times, that of upper secondary school students 2.6 times and that of higher education students 4.6 times. However, number of technical education students does not increase (see Table 2.1.12).

Table 2.1.12 Number of Students in each Education Level

Unit: 1,000 students

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Primary	8,862	9,106	9,476	9,725	10,048	10,218	10,378	10,431
Lower secondary	2,708	2,633	2,814	3,101	3,679	4,312	4,861	5,242
Upper secondary	528	523	577	724	863	1,019	1,176	1,390
Secondary Vocational	105	77	79	46	63	79	-	90
Secondary Technical	118	114	110	88	133	-	-	125
Higher Education	144	160	210	242	356	414	569	671

Source: MOET

Note: Higher education does not include private.

Most schools are public, but recently private schools are increasing. In Hanoi, there are 21 private schools with the total students of 3,470. Private schools account for 0.5 % of the total number of schools and 0.3 % of the total number of students.

One of the problems is poor facility. Ministry of Education and Training (MOET) is setting up more and more schools to escape shifting of classes but some primary schools still offers 3 shifts in a day due to lack of classroom. In Ha Tay, there are some schools have 3 shifts in a day.

More than 70 % of primary schools in Hanoi do not have enough space to meet the MOET standard. Average land area per student of primary school in Hanoi is only 5.6 m²/student and the worst record is 1.9 m²/student. It is so difficult to solve this kind of problem.

Another problem is lack of teaching staff. At present, 103,000 new teachers are required throughout Vietnam.

(2) Higher education

Twenty higher education institutes are established in these years in response to increasing number of students. Especially number of private school is increasing. There are 62 universities and 64 colleges in 1998 (see Table 2.1.13). One hundred and ten of 126 institutes are public and 16 are private. Almost half of higher education institutes are in two major cities; Hanoi City (33 institutes), and HCMC (21 institutes). Number of students in Hanoi accounts for 40 % of the total, and that in HCMC 30 %.

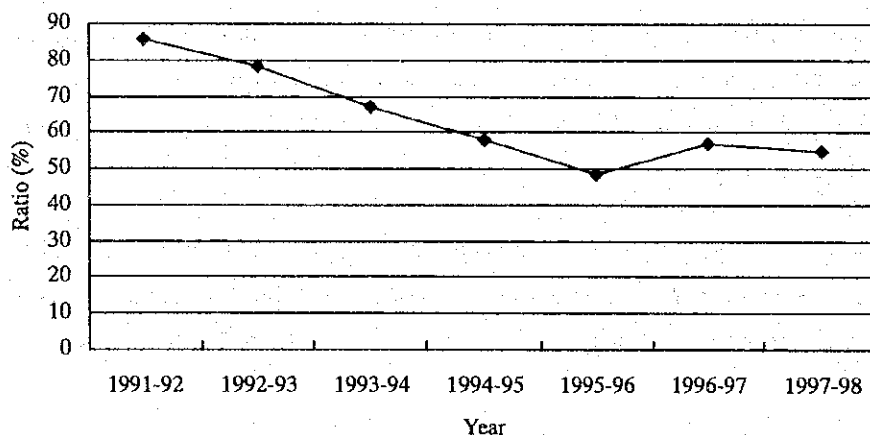
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Table 2.1.13 The number of Schools in Higher Education

	No. of schools in 1998	Of which	
		in Hanoi City	in HCMC
Public	110	31	13
National University	2	1	1
Regional University	3	0	0
University	42	23	4
College	63	7	7
Private	16	4	8
University	15	4	7
College	1	0	1
Total	126	35	21

Source: MOET

Number of part time students is increasing more than that of full time students. The ratio of full time to all students is decreasing from 85.5 % in 1992 to 55.1 % in 1998 (see Figure 2.1.7).



Source: JICA Study Team.

Figure 2.1.8 The Ratio of Full Time Student in Higher Education

Higher education institutes can divide into two groups, one is multi-discipline and the other is specialized one. Multi-discipline institutes comprise two national universities in Hanoi and the other in HCMC, three regional universities and three universities. Others are specialized universities or colleges focusing on engineering, pharmacy, law, economics, art, and pedagogy.

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Number of students by faculty is shown in the Table 2.1.14 . At university level, the ratio of education and training is so high and that of technical science is low.

Table 2.1.14 The Ratio of Number of Students by Faculty

	Unit: (%)	
	University	Post graduated university
Natural science	6.8	33.8
Technical science	25.5	31.6
Medicine & pharmacy	9.3	6.3
Agricultural science	8.1	6.6
Social science	17.0	21.7
Education & training	33.3	-

Source: MOET

Post graduates were trained mainly in the former Soviet Union or East European countries such as Poland, East Germany and so on. At present, some research institutes as well as universities offers post-graduate education.

According to the result of questionnaire survey on universities, there are more students in part time course than in full time course in Hanoi (see Table 2.1.15). There are 5.6 teachers per 100 students (12.7 teachers per 100 full time students), land area is 7.4 m² per one student (17.1 m² per one full time student) , floorage is 1.6 m² per one student (3.7 m² per one full time student) .

Table 2.1.15 Students, Staffs, and Area (31 institutes in Hanoi)

	No. of students		No. of staffs	Land Area (m ²)	Floorage (m ²)
	Full time	Part time			
Total	245,124	139,293	13,493	1,813,618	386,411
Average	7,907	4,493	435	58,504	12,465

Source: JICA Study team

(3) Technical education

Technical education is provided in Secondary Technical School and Secondary Vocational School. Graduates from these schools can go to university or college. Number of schools and number of students do not increase in spite of importance of technical education. The reason why these schools are not popular is that quality of teaching staff is not high level, facilities are out of data and teaching materials are shortage (see Table 2.1.16, 2.1.17 and 2.1.18).