

JAPAN INTERNATIONAL
COOPERATION AGENCY (JICA)

MINISTRY OF WATER RESOURCES
THE SOCIALIST REPUBLIC OF VIET NAM

THE STUDY
ON
IMPROVEMENT PROJECT OF DRAINAGE SYSTEM
IN
SOUTH BAC DUONG AGRICULTURAL AREA
IN
THE SOCIALIST REPUBLIC OF VIET NAM

**MAIN REPORT
(APPENDICES)**

MARCH, 1995

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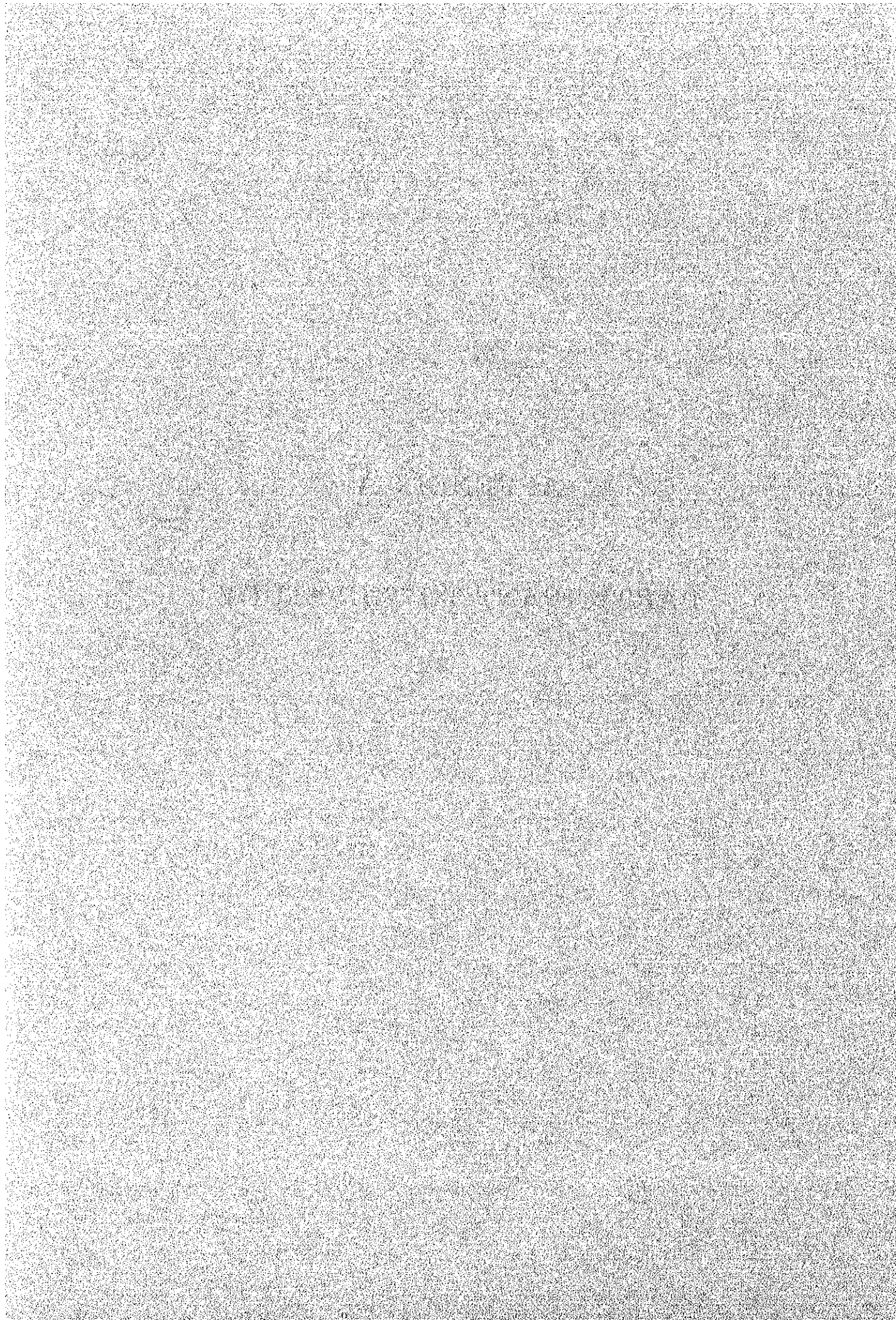
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APPENDIX A

PARTICIPANT TO THE STUDY



APPENDIX A

PARTICIPANT TO THE STUDY

A-1 JAPANESE SIDE

A-1.1 JICA Advisory Committee

<u>Name</u>	<u>Position</u>
* Mr. Shintaro HAYASHI	Chairman for Phase I Study Director General, Planning Department, Hokuriku Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries (MAFF);
* Mr. Akihiko KUBOTA	Chairman for Phase II Study Standing Director, Japanese Center for Rural Environment Protection;
* Mr. Takeshi OHTA	Irrigation and Drainage Chief Researcher, The Japanese Institute of Irrigation and Drainage;
* Mr. Nobumasa Hachou	Irrigation and Drainage for Phase II Study Assistant Professor, International Resources Management, Faculty of Agriculture, Kinki University
* Mr. Tomoyuki TOMITA	Geology Resources Division, Planning Department, Agricultural Structure Improvement Bureau, MAFF;
* Mr. Hiroyuki OSAWA	Regional Farming Deputy Director, Crop Production Division, Agriculture, Sericulture and

- Horticulture Bureau, MAFF.
- * Mr. Tomozou Takashima Regional Farming for Phase II Study
Deputy Director, Crop Production
Division, Agriculture, Sericulture and
Horticulture Bureau, MAFF.
- * Mr. Masami MIZUNO Economic Evaluation
Director, No. 2 Office for
Development, Economy and Area Study.
Overseas Department, National Research
Institute of Agricultural Economics,
MAFF.

A-1.2 JICA Study Team

<u>Name</u>	<u>Position</u>
* Mr. Fumimichi OBU	Team Leader/Rural Development
* Mr. Osamu ISHIYAMA	Asst.T.L./Irrigation & Drainage
* Mr. Masaaki UEDA	Hydrology/Hydraulics/Drainage Analysis for Phase I Study
* Mr. Toshinobu NAKANO	Ditto for Phase II Study
* Mr. Mitsuru KAKIZAKI	Rural Society/Organization
* Dr. Do Anh	Soil/Land Use
* Mr. Junichiro KAWAKAMI	Farming/Cultivation Inland Fishery
* Mr. Yasunobu KIHARA	Facility Plan/Cost Estimate (Pump)
* Mr. Kazuo OHTSUBO	Facility Plan/Cost Estimate (Canal)
* Mr. Akira TAKUBO	Environment
* Mr. Yoshihiro UCHIDA	Agro-economy/Project Evaluation
* Mr. Yasuo MATSUBARA	Survey
* Mr. Norikatsu HOTTA	Coordination

A-1.3 Embassy of Japan in Vietnam

<u>Name</u>	<u>Position</u>
* Mr. Kiyoshi KOINUMA	Councilor, Embassy of Japan
* Mr. Masao MIYAZAKI	Second Secretary, Embassy of Japan

A-2 VIETNAMESE SIDE

A-2.1 GOVERNMENT COMMITTEE/MINISTRIES

(1) State Planning Committee (SPC)

<u>Name</u>	<u>Position</u>
* Mr. PHAN DOANH	Vice Director, Department of Agriculture
* Mr. NGUYEN TIEN TRONG	Expert, Department of Agriculture-Forestry

(2) Ministry of Water Resources (MWR)

<u>Name</u>	<u>Position</u>
* Mr. HOANG TRONG QUANG	Director General, Department of International Cooperation;
* Dr. NGUYEN DONG	Director, Institute of Water Resources Planning and Management (IWRPM);
* Dr. NGUYEN TRONG SINH	Vice Director, IWRPM;
* Dr. LE NGO	Deputy Director, Vietnam Hydraulic Investigation and Design Corporation;
* Ms. DAO MINH LOC	Engineer, Department of International Cooperation;
* Mr. DINH BA TUAN	Specialist, Planning Department;
* Mr. NGO DINH DAT	Specialist, Planning Department;

- * Ms. TRUONG THI HONG LOAN Expert, Planning Department;
- * Mr. PHAN XUAN SU Chief of Environmental Division,
IWRPM;
- * Mr. TO TRUNG NGHIA Chief of Technical Division, IWRPM;
- * Mr. VU HONG CHAU Engineer, IWRPM;
- * Mr. TRAN SY VINH Expert, Irrigation and Drainage
Department.

(3) Ministry of Agriculture and Food Industry (MAFI)

- | <u>Name</u> | <u>Position</u> |
|------------------------|---|
| * Dr. NGHIEM CHUNG LAN | Vice Director, International
Cooperation Department |
| * Dr. TRAN AN PHONG | Director, National Institute of
Agricultural Planning and Projection
(NIAPP); |
| * Dr. VU NANG DUNG | Vice Director, NIAPP; |
| * Mr. VU CONG LAN | Engineer, International Cooperation
Department |

(4) Ministry of Sciences, Technology and Environment

- | <u>Name</u> | <u>Position</u> |
|--------------------|--|
| * Dr NGUYEN DAC HY | Senior Officer, National Environment
Agency |

A-2.2 Ha Bac Province

(1) People's Committee

<u>Name</u>	<u>Position</u>
* Mr. NGUYEN THAC GIAP	Vice Chairman of the Provincial people's Committee;
* Mr. NGUYEN VAN LOC	Head of Foreign Relation Board;
* Mr. VU VIET DAC	Secretary for Vice Chairman of Provincial People's Committee;

(2) Agriculture and Forestry Services

<u>Name</u>	<u>Position</u>
* Mr. BUI VAN COM	Director;
* Mr. FAM DRUNG BE	Deputy Director.

(3) Water Resources Services

<u>Name</u>	<u>Position</u>
* Mr. NGUYEN VAN THUC	Deputy Director;
* Mr. NGUYEN DINH VU	Head of Irrigation Section

(4) Bac Duong Irrigation Enterprise

<u>Name</u>	<u>Position</u>
* Mr. NGUYEN DUC BA	Director;
* Mr. NGUYEN TAT LUYEN	Head of Planning and Technical Section.

(5) Tien Son District

<u>Name</u>	<u>Position</u>
* Mr. DO QUANG QUYEN	Chairman of District People's Committee;
* Mr. NGUYEN HUU MANH	Head of Water Resources, Transportation and Construction Section;
* Mr. NGUYEN HUU THANH	Head of Agriculture and Handcraft Section;
* Mr. NGUYEN THE BAY	Deputy Head of Administration.

(6) Que Vo District

<u>Name</u>	<u>Position</u>
* Mr. NGUYEN DUC LE	Chairman of People's Committee;
* Mr. TRAN DUC NHAN	Vice Chairman of People's Committee;
* Mr. LE XUAN VUNG	Head of Agriculture Section;
* Mr. NGUYEN HUNG HIEP	Officer, Agriculture Section.

(7) Yen Phong District

<u>Name</u>	<u>Position</u>
* Mr. NGUYEN DUC BINH	Vice Chairman of Yen Phong District People's Committee
* Mr. NGUYEN TRONG THUC	Head of Water Resources Section
* Ms. TRAN THI THU	Agronomist, Agriculture Section
* Mr. NGO VAN SUU	Head of Administration section

(8) Bac Ninh Town

<u>Name</u>	<u>Position</u>
* Mr. PHAM SON	Chairman of Bac Ninh Town People's Committee
* Mr. DUONG DUC THINH	Head of Water Resources and Agricultural Section
* Mr. NGUYEN VAN PHU	Head of Administration section

A-2.3. Ha Noi City

(1) Water Resources Services

<u>Name</u>	<u>Position</u>
* Mr. HOANG NAN QUY	Officer in Charge;
* Mr. BUI KIM QUY	Officer in Charge.

(2) Gia Lam District

<u>Name</u>	<u>Position</u>
* Mr. NGUYEN PHU TRUNG	Vice Chairman of the People's Committee;
* Mr. DAO CONG TU	Officer in Charge of the People's Committee;
* Mr. HOANG VAN CAP	Chief of Water Resources Division;
* Mr. DUONG DUNG	Deputy Director, Gia Lam Irrigation Enterprise

(3) Dong Anh District

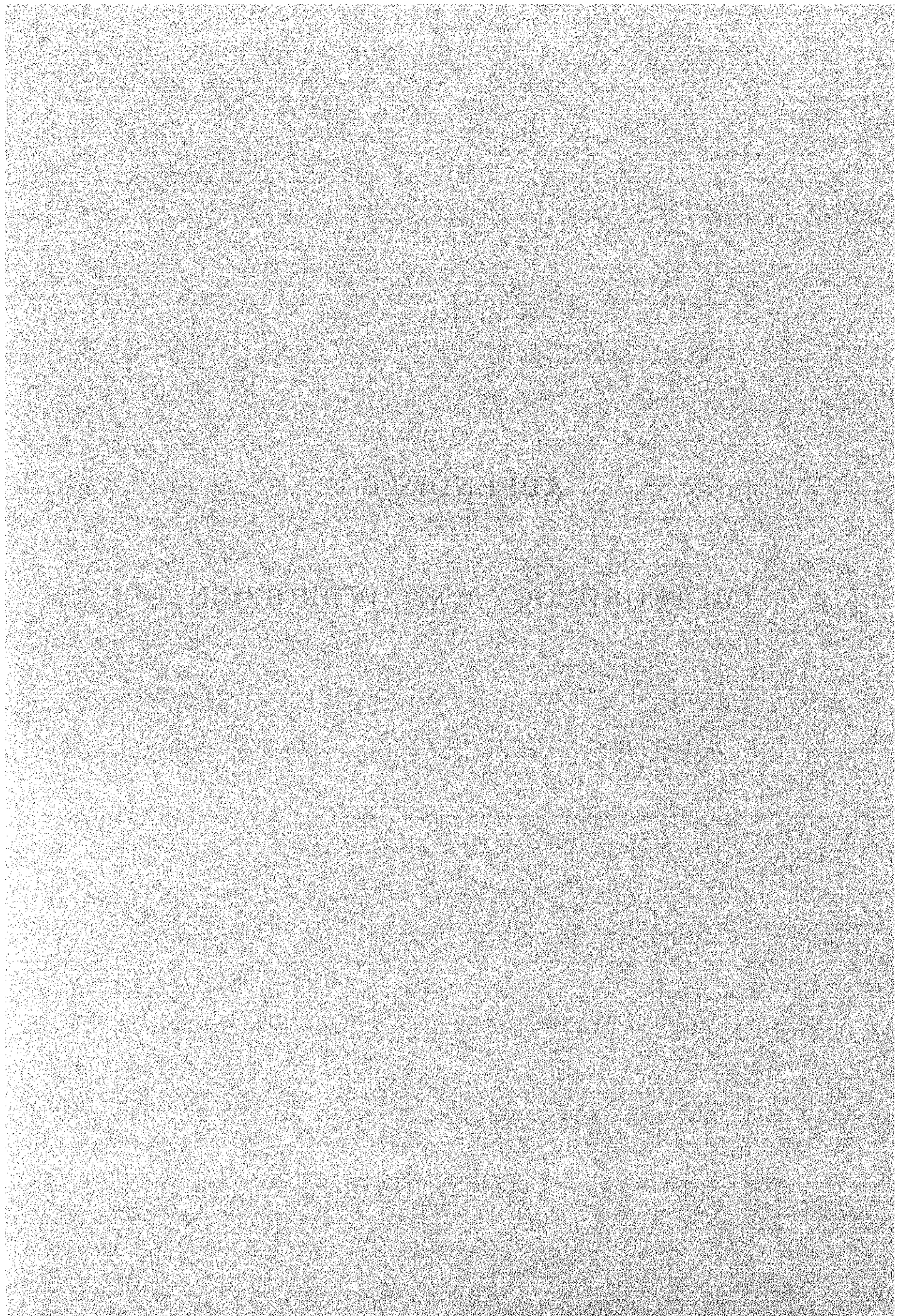
<u>Name</u>	<u>Position</u>
* Mr. TO VAN MINH	Vice Chairman of the people's Committee;
* Mr. NGUYEN VAN THUC	Chief of Statistic and Plan Division;
* Mr. NGUYEN MAU LAI	Chief of Water Resources Division;
* Mr. LE BA THAT	Engineer, Water Resources Division;

A-2.4. Counter-Part Personnels

<u>Name</u>	<u>Position</u>
* Mr. LE VAN HOC	Chief of Bac Bo Division, IWRPM, MWR;
* Mr. NGUYEN VAN HANH	Engineer, IWRPM, MWR;
* Mr. BUI NAM SACH	Engineer, IWRPM, MWR;
* Mr. BUI DANG CAO	Engineer, IWRPM, MWR;
* Mr. VU HONG CHAU	Engineer, IWRPM, MWR;
* Ms. TRAN THI HUONG	Engineer, IWRPM, MWR;
* Mr. DUONG NGUYEN	Engineer, NIAP, MAFI;
* Mr. DUONG VAN NHUNG	Engineer, NIAP, MAFI.

APPENDIX B

METEOROLOGY AND HYDROLOGY



APPENDIX B

METEOROLOGY AND HYDROLOGY

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B-1 Climate and Meteorology

The climate in the area belongs to the tropical monsoon zone, consisting of the dry season, November to March, and the wet season, April to October. The climate records at Hanoi meteorological station are adopted due to lack of the data in the area. Hanoi meteorological station locates vicinity of the project area and also, the records are available for long term from 1960 to 1992.

a. Temperature

Average annual temperature is 23.5 °C.

In wet season, maximum value in June	40 °C
mean value	27 °C
In dry season, minimum value in February	5 °C
mean value	18 °C

Annual average monthly temperature

(Unit: °C)

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
16.3	17.1	20.0	23.7	27.4	28.8	29.1	28.5	27.5	24.8	21.3	18.0

b. Relative humidity

Annual average relative humidity is about 82.4 %.

In wet season, maximum value in August	99 %
mean value	83 %
In dry season, minimum value in January	71 %
mean value	81 %

Annual average monthly relative humidity

(Unit:%)

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
81.3	84.2	85.8	86.3	82.5	82.2	81.8	83.9	82.7	81.1	79.0	78.4

c. Evaporation

Annual average evaporation is about 984 mm.

In wet season, maximum monthly evaporation in August 149 mm
 mean value 89 mm

In dry season, minimum monthly evaporation in February 36 mm
 mean value 72 mm

Annual average monthly evaporation

(Unit:mm)

<u>Jun</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
70.3	58.6	57.9	65.8	96.7	97.7	99.4	84.7	85.9	95.8	88.0	83.3

d. Wind - Typhoons

The prevalent wind direction in Winter season is North-East with average speed of about 2.0 m/s. The prevalent wind direction in summer season is South-East with average wind speed of about 1.8 m/s. Typhoons and storms occur in the season from July to October. There are about 6.5 typhoons landed in a year, maximum times in 1973 is twelve ones. Annual average monthly wind speed is as follows.

Annual average monthly wind speed

(Unit:km/hour)

<u>Jun</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
6.99	7.99	7.39	7.99	7.88	6.59	6.54	5.49	5.61	6.10	5.91	6.17

e. Rainfall

Annual average rainfall is 1661 mm.

In wet season, maximum monthly rainfall in August 756 mm
 mean value 211mm

In dry season, minimum monthly rainfall in December 0 mm
 mean value 36mm

Annual average monthly rainfall

(Unit:mm)

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
22	27	42	105	174	256	256	287	247	156	72	16

f. Sunshine hour

Annual average sunshine hour is about 4.4 hour.

In wet season, maximum value in Jun 8.7 hour

mean value 5.5 hour

In dry season, minimum value in March 0.1 hour

mean value 2.9 hour

Annual average monthly sunshine hour

(Unit:hour)

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
2.4	1.7	1.6	2.9	6.1	5.8	6.5	5.7	6.0	5.3	4.6	4.1

Detailed climate records are shown as follows.

B-1.1 Climate Records at Hanoi Meteorological Station

- (1) Monthly Total Rainfall (1960---1992)
- (2) Monthly Average Relative Humidity (1961---1992)
- (3) Monthly Average Maximum Relative Humidity (1960---1992)
- (4) Monthly Average Evaporation (1960---1992)
- (5) Monthly Average Wind Speed (1961---1992)
- (6) Monthly Average Sunshine Hour (1960---1992)
- (7) Monthly Average Temperature (1960---1992)
- (8) Monthly Average Maximum Temperature (1960---1992)

Table B-1.1 (1) AVERAGE MONTHLY RAINFALL AT HANOI STATION (UNIT: mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1960	22.5	3.7	40.5	10.3	79.7	122.9	438.9	384.5	269.3	69.6	44.2	1.9	1488.0
1961	5.3	28.4	27.6	116.3	145.6	104.1	219.9	372.7	367.5	189.9	129.9	51.0	1758.2
1962	1.0	7.7	36.5	134.5	171.7	262.2	139.7	173.8	273.6	25.8	48.1	0.7	1275.3
1963	1.0	12.6	48.9	25.5	80.4	171.2	245.1	281.9	301.0	220.2	181.0	103.7	1672.5
1964	23.2	12.0	26.5	146.1	92.6	393.8	314.3	297.9	268.8	342.9	13.3	19.7	1951.1
1965	4.2	14.9	42.9	99.7	248.8	419.2	410.0	63.4	171.1	86.4	42.7	54.3	1657.6
1966	35.4	8.4	34.5	58.5	214.4	427.9	101.7	110.4	41.5	326.4	58.9	15.6	1433.6
1967	16.5	42.6	17.1	85.4	120.0	193.9	408.3	76.6	186.9	10.4	84.9	6.8	1249.4
1968	15.7	61.9	72.0	68.0	186.4	247.5	151.4	522.2	356.0	155.0	55.2	5.1	1896.4
1969	38.9	13.1	20.9	92.0	116.3	228.5	233.2	158.7	279.4	46.8	54.9	1.6	1284.3
1970	11.1	12.7	33.6	124.9	99.0	271.6	286.6	252.7	176.8	81.6	23.8	16.1	1390.5
1971	8.8	17.1	22.2	89.6	265.3	175.1	392.3	443.8	311.6	200.6	2.4	6.3	1935.1
1972	0.8	25.0	16.8	95.7	214.1	122.6	274.6	756.7	189.9	86.4	53.0	4.0	1839.6
1973	5.0	10.5	40.7	242.6	175.1	252.2	307.8	307.9	472.4	122.7	5.8	1.8	1944.5
1974	44.2	11.0	30.0	118.6	110.9	199.7	187.6	190.2	254.4	272.8	69.2	38.6	1527.2
1975	75.7	7.2	53.0	142.9	299.0	234.0	166.3	446.3	341.8	59.9	139.2	20.6	1985.9
1976	9.9	77.6	21.3	136.7	141.3	129.1	142.8	239.5	187.3	199.9	6.4	0.3	1292.1
1977	56.7	5.8	20.1	89.2	28.9	233.2	491.7	231.4	172.7	131.9	15.2	37.6	1514.4
1978	12.6	12.7	19.0	106.9	247.4	322.9	163.1	282.7	562.0	238.7	145.8	1.3	2115.1
1979	28.4	83.6	21.9	100.6	244.5	230.9	212.4	449.9	295.8	19.5	0.0	0.0	1687.5
1980	6.4	43.5	44.3	135.6	131.3	262.6	344.1	509.6	277.4	263.1	1.0	14.4	2033.3
1981	7.1	24.4	35.0	138.8	164.1	342.9	132.0	294.7	129.3	339.1	37.7	0.0	1645.1
1982	14.3	46.9	29.9	96.9	98.4	168.6	330.9	408.5	385.7	52.3	128.1	5.8	1766.3
1983	57.3	28.4	32.5	96.3	104.9	128.2	219.0	283.0	205.2	407.4	69.6	14.9	1646.7
1984	2.2	23.6	27.8	129.8	205.4	399.1	107.4	319.3	237.0	146.0	614.4	13.1	2225.1
1985	37.3	38.4	74.1	179.6	48.1	213.6	169.4	302.9	369.4	119.3	41.2	2.8	1596.1
1986	7.8	17.6	9.0	268.3	550.7	450.4	275.3	231.1	276.5	96.4	41.1	22.1	2246.3
1987	5.0	25.0	22.4	56.9	194.1	195.7	220.2	436.2	159.7	125.0	70.5	0.0	1510.7
1988	19.3	49.9	25.2	16.5	148.0	39.8	181.0	220.3	46.3	278.8	8.0	0.0	1033.1
1989	52.2	7.4	76.5	33.5	241.9	522.7	220.5	145.2	152.4	299.1	7.1	2.1	1760.6
1990	21.4	91.8	259.5	90.7	163.4	156.5	351.5	39.4	186.6	108.7	61.4	7.2	1538.1
1991	5.8	2.7	76.4	91.1	275.6	420.9	246.9	198.0	83.4	7.2	112.6	15.9	1536.5
1992	97.4	26.9	29.8	46.0	117.4	396.2	359.2	37.8	161.7	20.0	32.5	36.4	1371.3
AVERAGE	22.7	27.1	42.1	105.0	173.5	255.7	256.2	286.9	247.0	156.1	72.7	15.8	1660.8
MIN	0.8	2.7	9.0	10.3	28.9	39.8	101.7	37.8	41.5	7.2	0.0	0.0	1033.1
MAX	97.4	91.8	259.5	268.3	550.7	522.7	491.7	756.7	562.0	407.4	614.4	103.7	2246.3

Table B-1.2 (2) MONTHLY AVERAGE RELATIVE HUMIDITY AT HANOI STATION (UNIT:%)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1960													
1961	77	85	89	87	83	82	81	85	86	84	81	84	84
1962	75	79	84	88	82	83	83	85	83	79	79	78	82
1963	71	84	88	90	85	81	85	85	86	84	86	79	84
1964	81	84	87	88	82	84	81	84	87	88	76	81	84
1965	81	85	87	88	84	85	82	81	82	82	77	82	83
1966	87	84	85	87	80	85	82	84	79	85	79	84	83
1967	75	84	87	84	83	79	80	84	86	78	86	82	82
1968	87	88	90	88	86	85	82	85	81	80	86	82	85
1969	86	83	88	87	83	84	84	85	84	81	79	76	83
1970	81	90	89	88	83	84	83	87	87	77	80	85	85
1971	80	85	87	89	83	83	85	88	82	79	77	79	83
1972	79	84	84	86	85	80	83	90	84	84	85	82	84
1973	81	86	86	85	81	82	84	86	88	79	74	73	82
1974	85	76	85	86	81	80	83	84	84	79	78	81	82
1975	87	84	88	87	83	84	80	84	84	77	78	73	82
1976	78	86	85	87	83	80	78	84	81	83	73	79	81
1977	84	75	80	85	78	79	83	80	78	81	72	83	80
1978	80	79	87	86	84	84	81	84	84	79	84	81	83
1979	87	83	88	87	83	84	82	85	83	73	65	75	81
1980	80	86	89	85	82	85	84	85	81	85	80	78	83
1981	82	87	86	86	82	80	81	82	80	81	83	70	82
1982	83	87	90	83	81	81	82	86	87	85	82	74	83
1983	80	84	82	87	81	77	79	83	83	85	79	77	81
1984	78	85	86	90	83	84	78	83	82	80	78	78	82
1985	87	87	83	85	81	81	79	84	81	80	81	75	82
1986	78	85	82	86	84	83	82	82	82	81	77	80	82
1987	79	84	85	79	81	78	82	83	80	83	84	71	81
1988	85	90	85	83	83	79	82	86	76	83	70	78	82
1989	82	81	81	85	82	84	81	83	82	80	76	80	81
1990	83	86	86	84	82	81	80	79	81	81	81	78	82
1991	80	85	84	85	83	84	81	80	82	80	82	75	82
1992	81	84	83	84	84	85	83	79	80	79	80	77	82
AVERAGE	81.3	84.2	85.8	86.3	82.5	82.2	81.8	83.9	82.7	81.1	79.0	78.4	82
MIN	71.0	75.0	80.0	83.0	78.0	77.0	78.0	79.0	76.0	73.0	65.0	70.0	75
MAX	87.0	90.0	90.0	90.0	86.0	85.0	85.0	90.0	88.0	88.0	86.0	85.0	88

Table B-1.3 (3) MONTHLY MAXIMUM RELATIVE HUMIDITY AT HANOI STATION (UNIT: %)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1960	92	95	97	95	94	94	95	95	96	96	96	92	95
1961	92	95	96	96	95	95	94	96	97	96	96	95	95
1962	91	93	94	96	95	95	94	96	96	94	92	96	94
1963	94	95	97	98	96	94	96	94	97	97	97	96	96
1964	94	95	97	97	97	97	95	97	98	97	93	96	96
1965	96	97	96	96	97	96	94	95	96	96	94	96	96
1966	97	95	96	97	94	96	95	95	96	96	94	94	95
1967	91	94	95	96	95	95	95	97	96	95	97	94	95
1968	97	97	97	97	97	96	95	96	94	95	96	96	96
1969	97	95	97	97	97	96	96	95	97	96	95	95	96
1970	94	97	97	97	95	95	95	97	98	94	95	96	96
1971	96	96	97	98	97	97	96	98	95	95	96	93	96
1972	94	94	95	97	96	94	96	98	96	94	96	95	95
1973	93	95	96	96	93	94	96	98	97	96	92	94	95
1974	97	91	96	97	94	94	93	93	94	92	92	93	94
1975	96	96	97	97	94	94	94	96	95	93	92	93	95
1976	93	96	94	95	94	93	92	96	95	96	90	92	94
1977	94	90	94	93	92	94	95	94	93	95	93	96	94
1978	93	91	96	95	95	94	93	95	96	95	94	96	94
1979	96	94	97	95	94	94	94	95	94	93	86	93	94
1980	92	95	96	94	94	96	95	95	94	93	94	91	94
1981	94	97	95	95	94	94	93	94	93	93	93	86	93
1982	94	95	96	92	92	93	93	95	95	95	92	90	94
1983	93	93	93	95	93	91	91	94	95	94	94	92	93
1984	91	92	96	98	95	96	94	95	95	93	93	93	94
1985	99	100	99	99	96	99	97	98	98	99	97	99	98
1986	100	99	99	99	98	99	98	99	99	99	98	99	99
1987	98	99	99	99	98	97	98	98	99	99	98	95	98
1988	99	98	99	98	97	97	98	98	96	98	96	97	98
1989	99	98	98	97	98	97	97	98	97	99	97	99	98
1990	100	99	98	98	96	97	96	98	98	98	98	97	98
1991	99	97	99	98	97	97	98	95	95	94	97	96	97
1992	98	98	99	97	97	97	98	94	96	93	98	99	97
AVERAGE	95	95	97	96	95	95	95	96	96	96	95	95	96
MIN	91	90	93	92	92	91	91	93	93	92	86	86	91
MAX	100	100	99	99	98	99	98	99	99	99	98	99	99

Table B-1.4 (4) MONTHLY AVERAGE EVAPORATION AT HANOI STATION (Unit:mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1960	98.1	89.5	61.3	88.0	127.5	148.6	101.0	75.9	61.2	84.2	65.0	79.3	1079.6
1961	87.7	54.9	49	73.6	97	97.4	113	91.9	68.5	85	83.2	67.6	968.8
1962	90.9	81.4	69.3	56.6	102.5	93.6	105.1	83.8	85.2	109.2	91.7	86.8	1058.1
1963	107.5	56.2	55.7	59.5	91.5	99.8	96.4	84.9	75.6	76.3	64.9	80.1	950.4
1964	77.4	60.2	58.5	64.0	106.8	94.3	109.9	80.6	66.0	57.8	104.2	85.2	964.9
1965	80.7	66.2	53.2	60.3	91.2	74.5	101.4	100.5	88.6	89.4	107.8	67.4	981.2
1966	51.1	63.2	67.1	71.3	106.4	77.5	104.2	81.8	105.5	78.8	86.3	64.4	957.6
1967	99.7	58.3	59.8	72.5	112.1	131.9	110.3	98.0	75.2	112.1	72.2	72.1	1074.2
1968	58.0	49.5	46.2	64.6	94.1	74.0	94.1	80.7	94.3	92.2	59.7	82.4	889.8
1969	58.9	62.0	55.8	68.6	103.8	95.5	95.2	81.4	86.2	98.8	78.3	93.3	977.8
1970	67.4	46.6	47.3	54.7	92.0	85.9	95.6	72.3	72.0	116.8	83.4	64.4	898.4
1971	76.5	53.8	62.2	60.6	92.3	104.3	94.5	64.8	92.8	103.5	103.7	78.7	987.7
1972	79.1	57.4	67.3	61.7	85.0	111.2	91.8	58.5	82.1	83.3	65.9	87.8	931.1
1973	67.9	53.0	64.0	72.5	98.0	91.1	81.2	73.4	55.1	102.9	98.1	92.8	950.0
1974	48.4	77.9	50.4	64.8	98.1	92.8	90.0	77.3	75.9	97.2	82.1	69.8	924.7
1975	44.8	51.6	44.8	61.2	83.9	82.1	101.6	80.5	74.0	108.5	85.4	100.8	919.2
1976	72.3	52.6	59.7	54.6	85.8	100.8	119.3	76.1	93.2	72.1	103.4	77.1	967.0
1977	49.4	80.2	83.1	65.1	122.6	111.0	82.1	100.6	114.3	88.4	112.1	62.7	1071.6
1978	74.8	66.2	49.9	57.9	74.7	73.1	95.1	82.6	89.7	105.9	67.6	78.1	915.6
1979	47.7	61.2	48.4	59.6	87.6	75.5	97.2	77.0	83.9	123.4	144.6	99.9	1006.0
1980	81.6	48.4	53.5	72.3	89.6	72.5	81.9	75.1	93.5	85.6	86.3	78.4	918.7
1981	61.2	43.9	60.1	70.3	95.9	109.7	105.4	91.7	103.6	86.4	67.7	115.4	1011.3
1982	66.0	54.4	39.4	72.5	102.8	108.7	90.5	71.9	67.8	84.6	88.7	103.7	951.0
1983	70.9	52.6	70.0	64.6	104.7	126.3	126.3	79.9	83.7	77.6	83.8	92.6	1033.0
1984	72.3	47.6	53.9	47.2	93.4	98.8	119.7	98.0	91.1	96.9	84.6	78.9	982.4
1985	42.7	43.1	61.2	67.0	94.5	102.3	106.0	85.6	97.1	104.8	80.3	97.5	982.1
1986	79.5	49.0	73.0	55.8	76.9	90.4	96.5	99.7	94.8	96.9	101.4	82.9	996.8
1987	91.5	68.3	78.2	79.8	116.7	121.6	94.4	99.0	100.6	90.0	72.7	113.9	1126.7
1988	59.9	39.7	54.9	77.6	97.4	118.7	105.0	72.2	99.1	91.4	117.4	87.7	1021.0
1989	66.5	65.1	72.7	67.5	97.6	88.7	104.9	88.3	92.0	110.5	99.1	73.7	1026.6
1990	63.2	47.5	56.5	79.2	87.6	95.8	88.0	119.4	98.1	91.7	78.2	86.8	992.0
1991	57.1	74.1	36.2	66.4	100.4	86.0	98.2	91.4	100.8	135.2	94.8	77.4	1018.0
1992	70.6	57.8	47.3	58.5	82.1	89.8	85.7	98.7	74.7	122.1	89.4	68.8	945.5
AVERAGE	70.3	58.6	57.9	65.8	96.7	97.7	99.4	84.7	85.9	95.8	88.0	83.3	984.2
MIN	42.7	39.7	36.2	47.2	74.7	72.5	81.2	58.5	55.1	57.8	59.7	62.7	688.0
MAX	107.5	89.5	83.1	88.0	127.5	148.6	126.3	119.4	114.3	135.2	144.6	115.4	1399.4

Table B-1.5 (5) MONTHLY AVERAGE WIND SPEED AT HANOI STATION (Unit: km/hour)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1960													
1961	8.28	9.72	9.72	9.72	9.00	8.64	7.20	7.20	6.84	6.48	6.48	8.28	8.13
1962	7.92	9.00	8.64	8.28	10.10	7.92	7.92	6.84	8.64	6.48	9.00	6.84	8.13
1963	5.40	9.36	10.10	11.50	12.00	7.56	10.10	8.28	7.92	7.92	6.48	6.12	8.56
1964	10.40	11.20	9.00	11.50	9.00	9.36	10.40	6.12	6.48	7.92	7.56	8.28	8.94
1965	9.72	11.50	9.36	10.80	9.36	8.64	9.72	7.56	6.48	7.92	7.56	9.00	8.97
1966	7.92	9.72	9.36	10.80	9.36	7.92	9.36	7.56	5.76	8.28	8.28	10.10	8.70
1967	9.36	10.10	11.20	9.72	10.40	10.40	7.56	7.56	9.00	7.20	9.36	10.40	9.36
1968	9.00	9.72	9.72	9.00	9.36	6.12	7.20	6.48	7.56	6.12	6.48	7.56	7.89
1969	9.00	9.72	9.36	9.72	8.64	7.92	5.76	5.76	6.12	5.76	6.48	4.32	7.38
1970	6.84	8.64	7.20	9.72	9.00	6.12	7.20	3.60	5.76	6.48	5.04	7.20	6.90
1971	5.76	6.84	8.64	10.40	8.28	7.20	9.00	6.48	3.60	7.56	4.32	5.04	6.93
1972	6.48	9.72	8.28	6.84	7.56	6.12	5.40	5.04	4.68	6.12	6.48	5.40	6.51
1973	5.40	6.12	6.48	6.84	7.56	6.48	6.48	6.48	4.68	6.12	4.68	3.96	5.94
1974	6.84	7.92	7.92	6.84	7.92	7.92	6.48	5.76	4.68	5.76	4.68	5.04	6.48
1975	4.32	8.28	6.48	7.92	7.20	6.48	5.04	5.04	6.12	5.04	5.04	6.48	6.12
1976	5.04	8.28	7.20	7.20	6.48	5.76	6.12	4.32	5.40	5.04	6.12	4.68	5.97
1977	6.12	5.40	6.48	6.84	6.84	5.76	5.76	4.32	5.40	4.32	6.12	4.32	5.64
1978	7.92	6.12	7.20	7.20	5.40	4.68	6.48	5.40	6.84	5.76	5.76	5.04	6.15
1979	7.20	6.84	6.84	7.20	7.92	6.12	5.76	4.68	4.68	3.96	5.04	5.04	5.94
1980	7.92	6.48	7.56	6.84	7.20	4.68	5.76	5.40	4.32	5.04	3.96	7.92	6.09
1981	5.76	7.56	6.84	6.48	6.12	4.68	6.48	5.04	4.68	7.56	6.84	5.40	6.12
1982	6.48	8.28	6.48	6.84	6.84	5.04	3.96	3.96	6.12	4.68	6.48	6.12	5.94
1983	6.12	7.56	6.12	7.20	7.92	7.92	7.92	3.96	5.40	6.12	5.04	6.48	6.48
1984	6.84	6.48	5.76	6.84	8.28	6.48	6.12	5.04	5.76	5.76	4.32	8.64	6.36
1985	6.48	6.48	7.20	6.48	7.20	5.76	5.76	5.40	5.40	5.40	6.48	5.76	6.15
1986	6.48	7.56	6.84	6.48	5.76	6.12	6.84	5.40	5.76	6.48	6.48	5.76	6.33
1987	7.56	7.92	7.56	7.92	8.28	5.76	5.04	6.48	4.32	6.12	6.48	3.96	6.45
1988	5.40	6.84	5.40	5.40	7.20	5.40	5.40	4.32	5.40	5.76	4.68	4.68	5.49
1989	7.92	6.84	2.52	6.84	6.12	6.12	4.68	3.24	4.68	6.48	5.04	3.69	5.35
1990	6.12	6.12	5.40	5.76	5.40	4.32	3.24	4.32	3.96	3.96	4.68	5.04	4.86
1991	7.20	7.20	6.12	7.20	7.20	4.32	5.40	4.32	3.60	4.32	3.60	3.60	5.34
1992	4.32	6.12	3.60	7.20	7.20	7.20	3.60	4.32	3.60	7.20	3.60	7.20	5.43
AVERAGE	6.99	7.99	7.39	7.99	7.88	6.59	6.54	5.49	5.61	6.10	5.91	6.17	6.72
MIN	4.32	5.40	2.52	5.40	5.40	4.32	3.24	3.24	3.60	3.96	3.60	3.60	4.05
MAX	10.40	11.50	11.20	11.50	12.00	10.40	10.40	8.28	9.00	8.28	9.36	10.40	10.23

Table B-1.6 (6) MONTHLY AVERAGE SUNSHINE TIME AT HANOI STATION (Unit:hour/day)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1960	3.7	3.2	2.8	1.5	5.2	5.6	5.0	5.5	4.5	4.6	3.3	2.8	4.0
1961	2.1	0.5	1.2	0.7	5.8	5.8	6.4	5.5	4.6	5.5	4.8	3.7	3.9
1962	2.5	4.2	1.4	2.2	7.1	4.4	6.1	6.0	5.1	4.7	4.4	5.7	4.5
1963	5.8	1.5	1.8	1.9	6.2	6.6	5.3	6.6	5.4	4.7	4.4	5.7	4.7
1964	2.7	1.7	1.6	3.9	7.8	6.0	7.7	6.6	4.7	4.1	5.5	3.9	4.7
1965	4.2	2.8	1.1	4.1	6.2	4.1	7.9	7.8	6.9	6.9	6.7	2.4	5.1
1966	1.8	2.7	3.1	3.8	5.1	3.8	7.0	6.0	8.0	4.7	4.5	1.7	4.4
1967	2.5	1.1	1.4	4.2	7.6	8.7	7.4	5.5	4.7	7.1	4.7	1.8	4.7
1968	3.0	0.4	1.0	2.2	6.8	4.4	6.9	5.0	6.6	6.6	3.7	6.6	4.4
1969	2.0	1.7	1.6	3.1	6.1	5.2	5.4	5.5	6.4	4.9	5.0	5.4	4.4
1970	1.4	1.2	0.2	2.3	5.1	6.0	5.2	5.1	5.3	5.0	3.8	1.5	3.5
1971	3.5	1.3	2.4	2.6	6.5	5.5	5.5	4.2	7.0	5.9	7.4	3.5	4.6
1972	3.3	1.2	2.0	3.2	6.4	7.3	7.0	3.8	6.9	5.1	3.2	2.9	4.4
1973	1.5	2.4	2.1	3.8	7.1	5.8	5.9	5.2	3.1	5.8	5.8	6.1	4.6
1974	3.3	2.5	1.5	3.8	8.2	5.4	5.1	5.0	6.4	5.6	4.9	1.9	4.5
1975	1.2	1.9	1.1	3.4	5.8	5.9	7.3	5.9	7.4	5.7	4.6	6.0	4.7
1976	3.4	2.4	0.9	3.3	5.4	5.9	7.9	6.1	5.5	5.0	4.1	3.7	4.5
1977	0.7	2.0	2.4	1.6	8.0	7.8	5.2	5.9	6.2	5.6	4.7	4.1	4.5
1978	1.9	1.6	1.4	2.6	5.1	5.6	8.1	5.4	4.9	5.6	3.9	5.0	4.3
1979	1.6	3.2	2.2	2.7	4.9	4.6	7.7	4.6	5.6	7.2	6.9	5.9	4.8
1980	2.1	0.6	2.5	3.4	5.5	4.9	5.4	5.2	6.7	5.3	7.0	2.5	4.3
1981	3.0	2.0	2.6	4.9	5.5	7.2	5.6	6.3	6.9	4.5	2.6	2.3	4.5
1982	2.7	1.2	0.6	2.9	5.0	4.5	5.9	5.1	3.7	5.1	4.4	5.1	3.9
1983	2.5	0.9	1.7	2.8	6.2	7.5	8.0	6.1	6.5	4.0	5.8	4.7	4.7
1984	2.4	0.7	1.0	1.5	5.5	6.0	8.1	6.3	6.1	5.0	4.8	3.7	4.3
1985	0.5	0.8	0.7	3.3	7.3	5.8	7.8	5.5	6.1	5.9	3.7	4.5	4.3
1986	4.2	1.2	3.5	3.3	4.3	5.8	5.3	7.1	6.7	4.2	5.1	3.2	4.5
1987	3.5	3.0	3.4	3.6	7.5	5.7	6.2	6.3	6.7	6.2	2.4	6.6	5.1
1988	1.0	0.5	0.4	2.5	5.2	7.3	7.4	4.0	6.6	3.1	5.7	4.5	4.0
1989	1.6	1.8	1.2	3.2	5.4	6.1	7.4	5.7	7.1	5.0	5.4	4.5	4.5
1990	0.8	1.6	1.5	3.7	5.5	5.8	5.8	7.4	6.5	4.0	4.1	5.1	4.3
1991	1.4	2.1	0.1	1.9	6.7	5.7	5.8	6.0	6.8	5.4	3.5	2.6	4.0
1992	2.0	1.3	0.8	2.0	4.8	5.6	5.1	7.2	5.2	5.0	1.4	4.8	3.8
AVERAGE	2.4	1.7	1.6	3.0	6.1	5.8	6.5	5.8	6.1	5.3	4.6	4.1	4.4
MIN	0.5	0.4	0.1	1.5	4.3	3.8	5.1	3.8	3.1	3.1	1.4	1.5	2.4
MAX	5.8	4.2	3.5	4.9	8.2	8.7	8.1	7.8	8.0	7.2	7.4	6.6	6.7

Table B-1.7 (7) MONTHLY AVERAGE TEMPERATURE AT HANOI STATION (Unit:°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAG
1960	17.2	18.8	22.5	22.6	26.6	29.6	27.9	28.5	26.6	24.3	22.1	17.0	23.6
1961	15.7	16.1	20.3	24.7	27.1	28.3	29.5	28.4	27.3	25.3	22.1	18.8	23.6
1962	14.3	18.1	19.5	22.7	27.9	28.5	29.1	28.2	27.1	24.9	21.0	17.9	23.3
1963	14.8	16.4	19.2	22.9	27.0	28.6	28.6	28.5	27.8	23.8	22.9	18.6	23.3
1964	16.8	14.9	20.3	25.1	27.5	28.4	29.1	28.6	27.2	24.9	20.6	17.0	23.4
1965	18.0	19.6	19.6	24.8	26.9	27.5	29.0	28.9	27.3	25.9	22.6	17.4	24.0
1966	18.2	19.6	21.6	25.4	26.4	27.5	29.2	28.5	27.2	24.8	21.3	18.9	24.1
1967	15.1	14.9	19.9	23.4	28.6	29.2	29.6	29.1	26.5	24.3	21.7	15.3	23.1
1968	17.6	12.0	19.4	21.8	27.0	28.1	29.6	28.8	27.8	24.8	22.7	22.2	23.5
1969	17.0	16.4	19.7	23.3	28.3	28.7	29.2	28.2	27.4	25.7	19.3	17.4	23.4
1970	16.2	19.0	17.8	22.6	27.2	28.2	29.0	28.0	27.2	24.1	20.3	18.1	23.1
1971	14.7	16.7	19.5	24.2	26.8	29.1	28.3	27.1	27.5	22.9	20.3	18.0	22.9
1972	16.8	16.7	20.6	22.4	27.4	29.2	28.3	27.0	27.1	26.3	21.1	17.6	23.4
1973	16.2	20.7	22.3	25.1	28.6	29.2	28.3	27.7	26.7	24.2	21.0	16.9	23.9
1974	15.9	15.7	18.0	23.3	27.8	28.8	28.8	27.9	27.8	24.6	21.7	18.4	23.2
1975	16.3	18.5	21.2	24.7	27.8	28.5	29.5	28.3	27.7	25.1	19.9	15.3	23.6
1976	16.1	18.1	19.0	22.4	26.9	28.4	29.3	27.9	27.5	24.7	18.6	18.1	23.1
1977	13.1	14.7	20.4	23.6	28.9	29.7	28.9	29.1	27.4	25.7	20.3	19.6	23.5
1978	16.2	16.7	20.5	24.0	27.0	28.5	29.1	28.6	26.4	24.3	21.0	19.3	23.5
1979	17.3	20.0	20.2	23.7	26.8	28.5	29.8	28.2	27.6	24.7	20.5	20.1	24.0
1980	17.4	15.2	22.0	23.8	27.2	28.2	28.8	28.7	27.3	25.0	23.6	18.0	23.8
1981	17.2	18.1	22.2	25.9	26.4	28.8	29.0	29.5	28.3	24.5	20.8	16.9	24.0
1982	18.0	16.5	20.1	23.1	26.9	29.2	29.4	28.5	26.8	25.9	22.6	15.7	23.6
1983	14.5	16.4	18.5	23.7	28.2	29.8	30.4	28.7	28.3	25.0	20.5	16.5	23.4
1984	13.7	14.8	19.1	23.9	26.7	28.8	29.6	28.6	27.6	23.8	22.8	17.2	23.1
1985	14.1	17.4	17.0	22.0	28.2	29.4	29.1	28.6	27.3	25.3	22.0	18.1	23.2
1986	16.6	16.2	19.8	24.4	26.9	28.9	29.0	28.9	27.1	24.2	21.2	19.1	23.5
1987	19.1	20.3	21.7	24.0	28.7	29.6	29.4	28.8	27.7	25.7	21.4	16.2	24.4
1988	17.8	16.3	17.3	22.4	28.2	29.3	29.5	28.4	28.0	24.0	20.2	18.9	23.4
1989	15.2	16.7	19.6	23.7	26.5	28.6	29.1	27.8	28.1	25.7	21.9	18.4	23.4
1990	17.3	17.6	20.0	24.3	26.1	28.9	28.7	30.2	28.2	25.1	22.6	19.6	24.1
1991	17.5	19.0	21.7	23.4	27.4	28.8	29.3	29.1	28.6	25.8	21.1	19.4	24.3
1992	15.8	16.5	19.8	24.1	27.3	28.9	28.5	29.6	28.1	24.4	20.2	19.6	23.6
AVERAGE	16.3	17.1	20.0	23.7	27.4	28.8	29.1	28.5	27.4	24.8	21.3	18.0	23.5
MIN	13.1	12.0	17.0	21.8	26.1	27.5	27.9	27.0	26.4	22.9	18.6	15.3	21.3
MAX	19.1	20.7	22.5	25.9	28.9	29.8	30.4	30.2	28.3	26.3	23.6	22.2	25.7

Table B-1.8 (8) MONTHLY AVERAGE MAXIMUM TEMPERATURE AT HANOI STATION (Unit: °C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1960	28.2	27.2	30.6	32.4	39.3	39.3	36.5	35.3	33.5	32.5	30.7	26.2	32.6
1961	25.5	26.5	29.9	32.7	36.9	37.5	37.7	34.8	33.9	31.9	30.2	28.2	32.1
1962	25.8	27.7	29.0	30.0	37.5	35.6	36.4	34.3	33.8	33.1	33.1	26.9	31.9
1963	22.5	25.5	26.5	30.6	35.6	35.2	36.1	35.9	34.7	32.5	29.7	25.7	30.9
1964	29.3	27.4	27.3	31.3	35.1	36.0	36.7	36.1	32.9	32.0	28.0	24.5	31.4
1965	26.7	28.5	27.7	33.0	35.0	33.5	36.1	34.9	34.5	32.3	30.8	26.3	31.6
1966	27.2	28.9	32.4	34.7	39.2	36.5	35.6	35.3	34.0	33.1	29.6	28.9	33.0
1967	26.0	25.0	27.6	35.1	38.7	37.8	36.7	36.8	32.6	30.5	30.6	24.4	32.0
1968	26.1	22.7	27.8	27.8	36.3	35.2	37.3	36.7	34.7	34.3	30.1	28.9	31.5
1969	30.3	28.4	28.9	30.2	38.0	36.5	36.7	36.1	34.0	32.2	31.4	26.2	32.4
1970	24.5	27.0	25.8	30.8	37.6	34.8	36.4	34.6	34.4	32.5	28.4	28.0	31.2
1971	26.3	27.8	27.7	32.2	35.9	36.7	37.1	34.5	33.6	32.5	31.3	26.9	31.9
1972	26.3	27.8	27.7	32.2	35.9	36.7	37.1	34.5	33.6	32.5	31.3	26.9	31.9
1973	30.7	32.5	30.2	31.8	37.4	37.5	37.0	34.8	32.8	31.5	28.4	25.4	32.5
1974	27.0	30.1	31.2	32.0	36.5	36.5	36.0	35.0	33.2	30.1	28.0	27.2	31.9
1975	23.8	27.9	28.3	33.5	35.8	35.0	36.8	36.6	33.7	23.2	27.6	29.2	31.0
1976	24.0	27.8	27.6	30.3	35.8	36.7	37.5	34.5	33.5	32.7	28.2	28.7	31.4
1977	22.2	24.3	27.4	30.2	38.7	37.1	36.7	35.7	33.2	32.3	30.4	27.2	31.3
1978	27.3	28.1	29.8	33.4	34.7	37.8	35.9	35.8	32.3	32.3	28.0	27.9	31.9
1979	27.2	34.1	30.4	32.1	35.0	34.6	37.8	34.5	33.3	31.5	30.3	27.5	32.4
1980	31.5	24.3	35.6	32.8	36.0	34.0	36.2	34.6	32.6	32.0	30.0	29.0	32.4
1981	26.0	28.5	31.2	32.4	36.0	35.8	35.8	37.8	34.1	32.0	29.5	25.7	32.1
1982	25.6	28.1	27.1	32.0	38.8	38.1	37.7	36.7	33.6	32.4	30.6	27.7	32.4
1983	25.3	29.6	31.0	36.1	37.8	40.0	38.2	34.9	34.9	32.1	28.6	26.3	32.9
1984	23.9	23.6	27.4	30.5	34.9	36.8	38.2	36.7	35.0	31.3	29.9	27.7	31.3
1985	23.2	29.2	26.8	30.4	37.0	37.4	37.2	35.1	35.8	32.6	30.6	29.7	32.1
1986	26.2	27.2	33.7	31.7	36.2	37.7	38.2	35.2	34.7	33.3	30.0	27.0	32.6
1987	27.2	28.4	33.6	34.8	37.2	39.3	36.4	35.8	34.3	33.8	32.1	26.2	33.3
1988	26.0	26.5	29.4	33.8	38.8	38.7	36.2	35.2	36.5	31.7	28.4	26.0	32.3
1989	28.5	27.6	28.0	32.4	36.2	36.7	36.4	36.2	35.2	33.1	31.1	25.6	32.3
1990	26.5	29.3	30.6	37.2	32.5	38.0	36.7	37.9	35.8	31.7	30.6	27.8	32.9
1991	27.0	30.5	27.5	31.5	37.5	36.0	36.4	36.0	36.2	33.3	30.4	28.5	32.6
1992	26.1	27.6	28.4	34.7	36.5	37.2	37.8	36.4	36.5	32.8	30.1	29.6	32.8
AVERAGE	26.4	27.7	29.2	32.3	36.7	36.7	36.9	35.6	34.2	32.0	29.9	27.2	32.1
MIN	22.2	22.7	25.8	27.8	32.5	33.5	35.6	34.3	32.3	23.2	27.6	24.4	28.5
MAX	31.5	34.1	35.6	37.2	39.3	40.0	38.7	37.9	36.5	34.3	33.1	29.7	35.7

Table B-1.9 (9) MONTHLY AVERAGE MINIMUM TEMPERATURE AT HANOI STATION (Unit:°C)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1960	7.9	11.2	15.3	15.3	17.6	23.3	22.9	24.5	20.2	17.7	11.8	10.6	16.5
1961	6.4	10.9	13.5	18.0	20.5	22.6	23.0	22.2	22.8	19.8	14.6	10.9	17.1
1962	8.5	9.4	13.1	15.3	21.9	22.8	23.3	23.0	22.2	18.2	12.7	9.1	16.6
1963	6.3	9.1	10.2	13.4	20.0	22.6	23.5	24.0	21.9	17.2	15.6	11.7	16.3
1964	8.7	8.1	14.7	19.2	20.6	20.0	22.9	23.7	21.3	19.1	13.7	8.8	16.7
1965	11.4	11.0	12.5	18.4	19.2	22.9	22.6	22.5	21.8	19.6	13.9	8.7	17.0
1966	9.0	9.8	15.1	19.3	17.3	21.5	24.0	24.3	20.4	18.3	14.0	7.6	16.7
1967	6.2	8.8	11.1	16.6	22.4	21.2	23.4	24.3	20.5	17.7	13.0	9.0	16.2
1968	9.3	5.0	11.9	16.6	20.3	23.6	23.1	23.8	21.4	19.0	17.9	11.8	17.0
1969	9.5	9.3	13.2	14.4	22.0	21.8	24.6	23.3	21.2	19.8	10.6	8.9	16.6
1970	10.2	10.6	12.0	14.3	19.2	22.8	23.2	23.4	16.1	14.8	13.5	11.9	16.0
1971	7.0	9.5	12.2	18.6	19.9	24.4	22.3	23.1	21.2	15.2	10.9	12.6	16.4
1972	9.3	8.5	10.3	14.9	21.9	27.7	21.0	23.4	20.1	17.9	14.8	9.8	16.6
1973	9.5	13.7	14.3	17.7	22.7	24.2	24.1	23.3	22.7	19.9	13.4	6.5	17.7
1974	6.1	8.4	11.4	15.6	20.7	22.9	23.3	21.8	23.1	19.5	15.7	11.6	16.7
1975	11.3	12.4	14.6	18.4	22.2	23.7	23.5	23.0	21.8	17.0	10.7	5.1	17.0
1976	8.0	11.3	11.2	14.6	18.5	21.2	24.1	22.8	20.3	20.4	11.5	8.3	16.0
1977	5.4	6.0	11.7	18.7	23.2	22.7	23.5	22.7	20.7	20.3	12.4	12.4	16.6
1978	9.6	10.1	12.5	16.6	20.6	22.5	22.5	23.2	21.5	13.9	14.2	11.5	16.6
1979	9.2	10.9	14.0	13.9	20.8	22.1	23.2	23.5	23.4	18.0	10.6	11.1	16.7
1980	10.2	8.2	14.2	14.5	20.2	22.8	23.2	23.7	22.9	16.1	18.4	11.1	17.1
1981	9.0	10.4	14.7	19.6	17.5	22.3	23.9	23.0	24.1	16.3	11.3	8.7	16.7
1982	10.7	9.5	13.0	16.2	19.6	22.6	23.9	24.0	21.4	21.6	16.3	7.0	17.2
1983	7.3	11.1	11.3	17.2	18.1	22.0	23.9	24.1	23.7	17.6	10.6	7.2	16.2
1984	8.3	9.5	12.0	19.9	19.7	22.6	23.6	23.7	21.6	17.0	16.9	8.9	17.0
1985	9.5	11.7	10.9	13.2	22.9	23.8	23.5	24.4	22.9	16.8	13.8	9.4	16.9
1986	7.9	9.7	7.0	17.3	20.6	23.8	23.9	22.5	20.7	18.0	12.7	12.5	16.4
1987	9.8	13.6	14.8	14.9	22.5	22.7	23.4	23.8	21.8	17.0	12.7	8.9	17.2
1988	9.9	7.1	10.2	15.4	23.0	22.8	23.5	23.7	19.9	15.9	13.1	10.8	16.3
1989	8.7	9.5	13.9	17.8	20.6	23.7	23.4	24.2	23.7	17.8	13.2	12.1	17.4
1990	11.4	9.3	12.2	15.1	17.6	21.9	23.7	24.4	23.2	20.1	14.8	10.8	17.0
1991	11.6	12.4	14.9	14.8	18.4	23.2	23.9	23.8	23.7	17.5	14.9	8.4	17.3
1992	10.7	11.2	13.9	17.9	20.6	23.6	23.4	24.8	22.6	18.0	13.6	10.4	17.6
AVERAGE	8.9	9.9	12.7	16.5	20.4	22.9	23.4	23.5	21.7	18.0	13.6	9.8	16.8
MIN	5.4	5.0	7.0	13.2	17.3	20.0	21.0	21.8	16.1	13.9	10.6	5.1	13.0
MAX	11.6	13.7	15.3	19.9	23.2	27.7	24.6	24.8	24.1	21.6	18.4	12.6	19.8

B-1.2 Typhoon Records in Viet Nam

Table B-1.10 Typhoon Records in Viet Nam

YEAR	NAME	OCCURRENCE	OCEAN	LANDING
1954	ATND	8/6	BD	9/6
	IDA	24/6	TBD	30/8
	ANTD	16/9	BD	18/9
	NANCY	5/10	TBD	11/10
1955	KATE	23/6	BD	27/6
		18/9	TBD	26/9
		4/10	BD	8/10
	ATND	14/10	BD	15/11
1956	ATND	10/4	BD	14/4
	ATND	5/6	BD	6/6
		5/7	TBD	8/7
	ATND	8/7	TBD	11/7
		9/8	BD	13/8
		28/8	TBD	1/9
1957	ATND	1/7	BD	5/7
		8/10	TBD	12/10
1958	ATND	28/5	BD	4/6
		6/8	BD	10/8
		23/8	BD	28/8
		7/9	BD	7/9
1959	ATND	28/7	BD	30/7
		18/8	BD	20/8
		21/8	Vinh BB	21/8
1960	OLIVE	25/6	TBD	1/7
	HAD	30/9	BD	1/10
	KIT	4/10	TBD	13/10
	LOLA	9/10	Bac TBD	17/10
1961	CORA	22/6	BD	25/6
	ATND	19/8	BD	21/8
	WILDA	11/10	BD	13/10
	RUBY	21/9	TBD	24/9
	ANITA	19/10	BD	20/10
1962	ANITA	23/5	BD	24/5
		10/7	BD	11/7
	BABS	13/9	BD	16/9
	CARLA	19/9	BD	22/9
		23/9	TBD	28/9
1963	AGNES	17/7	TBD	23/7
		29/7	BD	1/8
	FAYE	2/8	TBD	9/8
	CARMEN	11/8	TBD	17/8
		20/8	BD	23/8
		28/8	BD	31/8
1964	WINNIE	28/6	TBD	3/7
	OLGA	22/6	Vinh BB	24/8
	VIOLET	13/9	BD	15/9
	TILDA	13/9	TBD	22/9
	ANITA	25/9	BD	27/9
	BILLE	28/9	TBD	1/10
	CLARA	4/10	TBD	8/10
	GEOGIA	20/10	TBD	24/10
	IRIS	3/11	BD	4/11
	JOAN	6/11	TBD	8/11
	KATE	13/11	BD	16/11

1965	KATE	10/6	BD	12/6
	FREDA	12/7	TBD	15/7
	GILDA	18/7	TBD	23/7
	MARINE	17/7	BD	18/7
		25/8	Nam BD	27/8
	ROLLY	31/8	BD	2/9
	ROSE	1/9	TBD	6/9
1966	PHYLLIS	30/7	BD	2/8
	PAMERA	25/12	TBD	31/12
1967	PAMERA	25/8	BD	27/8
	PASTY	4/9	Bac TBD	7/9
		7/10	BD	9/10
	FREDA	6/11	TBD	10/11
1968	ROSE	8/8	TBD	14/8
	BESS	31/8	BD	5/9
	WENDY	2/9	Bac TBD	9/9
	HESTER	17/10	BD	19/10
	MAMIE	13/11	TBD	23/11
	NINA	21/11	TBD	27/11
1969	TESS	9/7	BD	11/7
		22/7	BD	25/7
	DORIS	1/9	BD	2/9
1970	ATND	22/6	BD	24/6
	ATND	16/8	BD	18/8
	ATND	2/9	Vinh BB	5/9
		17/10	Nam TBD	25/10
	LOUISE	25/10	TBD	29/10
		17/10	TBD	21/10
	RUTH	26/11	Nam BD	28/11
1971	WANDA	23/4	TBD	1/5
	HARIET	2/7	TBD	6/7
	KIM	10/7	BD	13/7
	JEAN	13/7	TBD	18/7
	DELLA	23/9	TBD	30/9
	ELAEN	30/10	TBD	8/10
	HESTER	20/10	TBD	23/10
1972	MAMIE	1/10	BD	3/6
	CORA	24/6	BD	29/8
	ELISIE	30/8	TBD	4/9
	FLOSSIE	8/9	TBD	15/9
	LORNA	27/9	TBD	3/10
	THERESE	2/12	Nam TBD	10/12
1973	ANITA	4/7	BD	8/7
	KATE	21/8	TBD	26/8
		21/8	BD	23/8
		29/8	BD	2/9
	LOUISE	30/8	TBD	7/9
	MARGE	10/9	TBD	14/9
	ATND	20/9	BD	25/9
	OPAN	9/10	BD	8/10
		12/10	TBD	15/10
	RUTH	12/10	TBD	19/10
	THELMA	13/11	TBD	17/11
	SARAN	10/11	BD	11/11

1974	SARAN	8/6	TBD	14/6
		14/8	BD	15/8
	BESS	9/10	TBD	14/10
	DELLA	21/10	TBD	27/10
	FAYE	31/10	TBD	4/11
	HESTES	14/11	BD	15/11
	JUDY	17/12	BD	19/12
	KIT	18/12	TBD	24/12
1975	KIT	17/6	BD	19/6
		28/8	BD	30/8
	AUCE	16/9	TBD	20/9
	Gio xoay	9/9	BD	9/9
	HELEN	3/11	BD	4/11
1977	SARAH	16/7	TBD	27/7
	CARLA	31/8	TBD	5/9
	DINAH	13/9	TBD	24/9
		26/9	Nam Vinh	27/9
1978	SHIRLEY	27/6	TBD	30/6
		9/8	BD	12/8
	ELAINE	23/8	TBD	27/8
		10/9	BD	15/9
	ATND	17/9	BD	
	KIT	23/9	BD	26/9
		17/9	TBD	20/9
	LOLA	27/9	BD	3/10
		21/10	BD	23/10
		31/10	TBD	3/11
		10/11	Nam BD	11/11
1979	LOLA	16/6	BD	20/6
		21/6	BD	23/6
	GORDON	28/7	TBD	29/7
		6/8	BD	8/8
		9/8	BD	11/8
	NANCY	11/9	BD	21/9
	SARAH	5/10	BD	14/10
1980	HERBERT	22/6	TBD	28/6
	JOE	10/7	TBD	23/7
	RUTH	13/9	BD	16/9
	CARY	28/10	TBD	2/11
	ATND	30/8	BD	31/8
		15/8	TBD	19/8
	ATND	4/9	BD	6/9
		23/9	BD	26/9
		26/10	BD	28/10
		13/11	BD	16/11
1981	KELLY	20/6	TBD	5/7
	ROY	4/8	BD	10/8
	WARREN	17/8	BD	20/8
	FABIAN	12/10	TBD	15/10
		30/10	Nam BD	1/11
	ATND	9/11	Nam BD	11/11
1982	ATND	19/3	TBD	24/3
	HOPE	5/9	BD	7/9
	IRVING	6/9	TBD	16/9
	NANCY	13/10	TBD	18/10

1983	SARAH	24/6	BD	26/6
	VERA	13/7	TBD	18/7
	GEORGIA	29/9	BD	1/10
	HERBERT	7/10	BD	9/10
	ATND	2/10	BD	4/10
	KIM	16/10	BD	17/10
	LEX	21/10	TBD	26/10
	ATND	28/10	BD	29/10
1984	VERNON	8/6	BD	10/6
	ATND	19/6	BD	21/6
	WYNNE	20/6	TBD	26/6
	ATND	30/7	BD	31/7
		25/9	BD	27/9
		12/10	Nam BD	12/10
	WARREN	23/10	BD	1/11
	AGNES	1/11	TBD	7/11
1985	AGNES	14/6	BD	21/6
		20/8	Bac BD	28/8
	ATND	9/9	BD	10/9
		14/9	BD	15/9
	ANDY	26/9	TBD	1/10
	ATND	10/10	Nam BD	12/10
	CECIL	11/10	nam TBD	16/10
	DOT	16/10	TBD	22/10
	GORDON	19/11	Nam BD	25/11
	IRVING	18/12	Nam BD	21/12
1986	IRVING	17/5	BD	29/5
			TBD	11/7
		21/7	BD	21/7
		10/8	BD	12/8
	WAYNE	18/8	BD	5/9
	DOM	8/10	TBD	11/10
	GEORGIA	19/10	TBD	22/10
	HERBERT	7/11	TBD	12/11
	ATND	1/12	BD	2/12
	MARGE	20/12	TBD	25/12
1987	BETTY	9/8	TBD	16/8
	CARY	13/8	TBD	22/8
	MAURY	12/11	TBD	19/11
	ATND	3/9	BD	5/9
		23/11	BD	25/11
1988		29/9	BD	3/10
		8/10	BD	10/10
	PAT	20/10	TBD	24/10
	TESS	3/11	BD	6/11
	ATND	15/10	BD	15/10
1989	CECIL	22/5	BD	25/5
	DOT	5/6	TBD	10/6
	ATND	25/6	BD	26/6
	FAYE	6/7	TBD	11/7
	IRVING	20/7	BD	23/7
	ATND	21/8	BD	24/8
	BRIAN	29/9	BD	3/10
	ANGELA	3/10	TBD	10/10
	DAN	9/10	TBD	13/10

	ELSIE	17/10	TBD	22/10
1990	NATHAN	15/6	BD	19/6
	ATND	21/7	BD	23/7
	BECKY	25/8	TBD	29/8
	ED	13/9	TBD	20/9
		2/10	Nam BD	3/10
		17/10	Nam BD	18/10
	ATND	12/10	Nam BD	14/10
		11/11	Nam BD	12/11
	MIKE	12/11	Nam TBD	18/11

B-2 Hydrology

B-2.1 Hydrological Observation Stations

(1) Rainfall Observation Stations

Within and in vicinity of the study area, six (6) rainfall observation stations are located, which have only daily rainfall records observed at 7:00 a.m. every day. The general information and location of the said 6 stations are shown in Table B-2.1, Figure B-2.1 and Figure B-2.2.

Table B-2.1 General Information of Rainfall Stations

NO	Station	Location	Agencies	Observation Period
1	YEN PHONG	HA BAC		1960~1992 1982:Missing
2	DONG ANH	HA BAC		1962~1992 1965~1969:Missing
3	YEN VIEN	HA NOI		1962~1992 1990: Missing
4	BAC NINH	HA BAC		1960~1992
5	QUE YO	HA BAC		1960~1992
6	TU SON	HA BAC		1960~1981

Figure B-2.1 Location of Rainfall Station

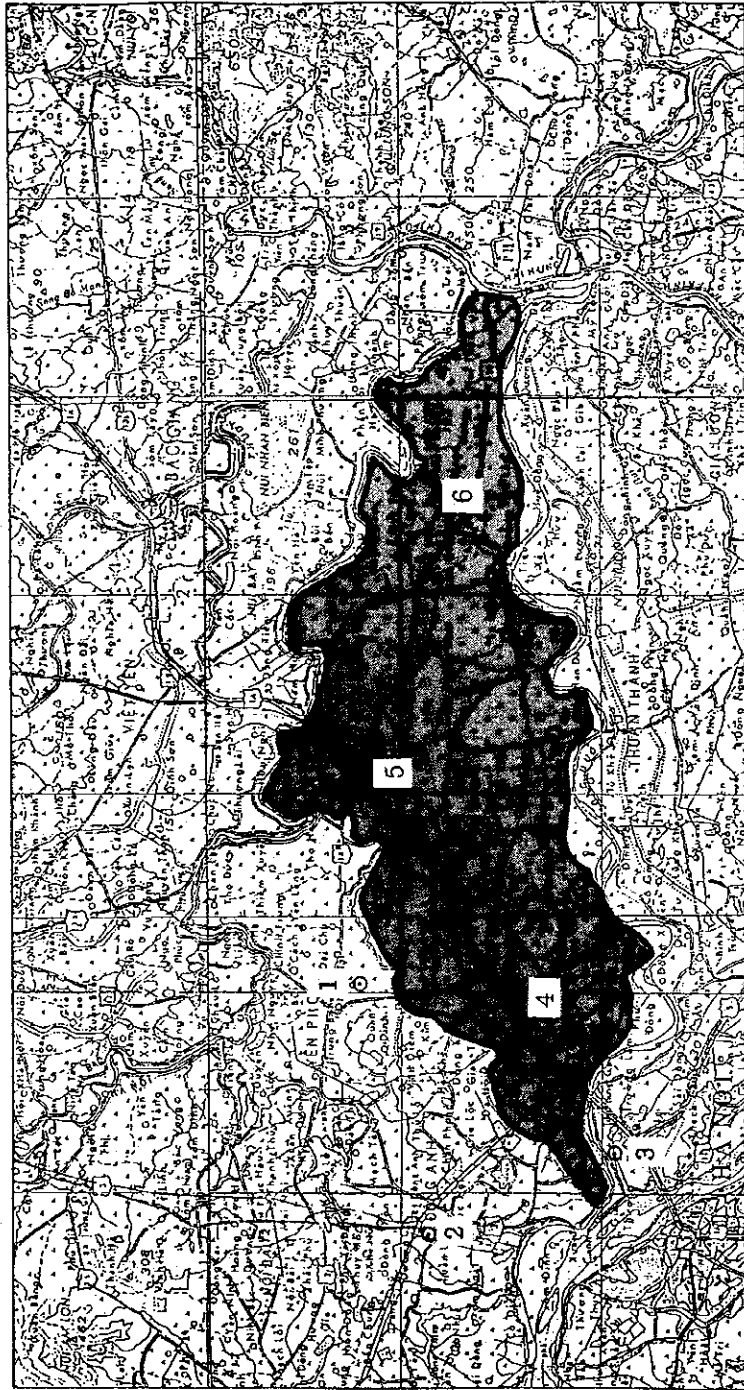


FIGURE B-2.2 Period of Rainfall Record at Study Area

STATION	1960	1970	1980	1990	NOTE
YEN PHONG	1960		1983		1960 ~ 1992 (1982 : Missing)
DONG ANH	1962	1970	1981	1992	1962 ~ 1992 (1965 ~ 1969 : Missing)
YEN VIEN	1962		1991	1989 1992	1962 ~ 1992 (1990 : Missing)
BAC NINH	1960			1992	1960 ~ 1992
QUE VO	1960			1992	1960 ~ 1992
TU SON	1960		1981		1960 ~ 1981

(2) Water Level Gauging Station

The gauging stations, two stations for the Duong river, two stations for the Cau river and one station for Pha Lai river are established and operated since the early 1900's as shown in Table B-2.2 for the general information and Figure B-2.3, Figure B-2.4 or the location.

Table B-2.2 General Information of Gauging Station

No	Name of Station	Location	River	Observation Period
1	THUONG CAT	HA BAC 21° 04' N ; 105° 52' E	DUONG RIVER	1917-1960 1991-Present
2	BEN HO	HA BAC 21° 04' N ; 106° 04' E		1959-Present
3	PHUC LOC PHONG	HA BAC 21° 14' N ; 105° 52' E	CAU RIVER	1960-Present
4	DAP CAU	HA BAC 21° 12' N ; 106° 04' E		1902-Present
5	THANG CUONG	HA BAC 21° 09' N ; 106° 12' E		1955-1978
6	PHA LAI	HA BAC 21° 06' N ; 106° 17' E	PHA LAI RIVER	1905-1956 1990-Present

Figure B-2.3 Location of Water Level Gauging Station

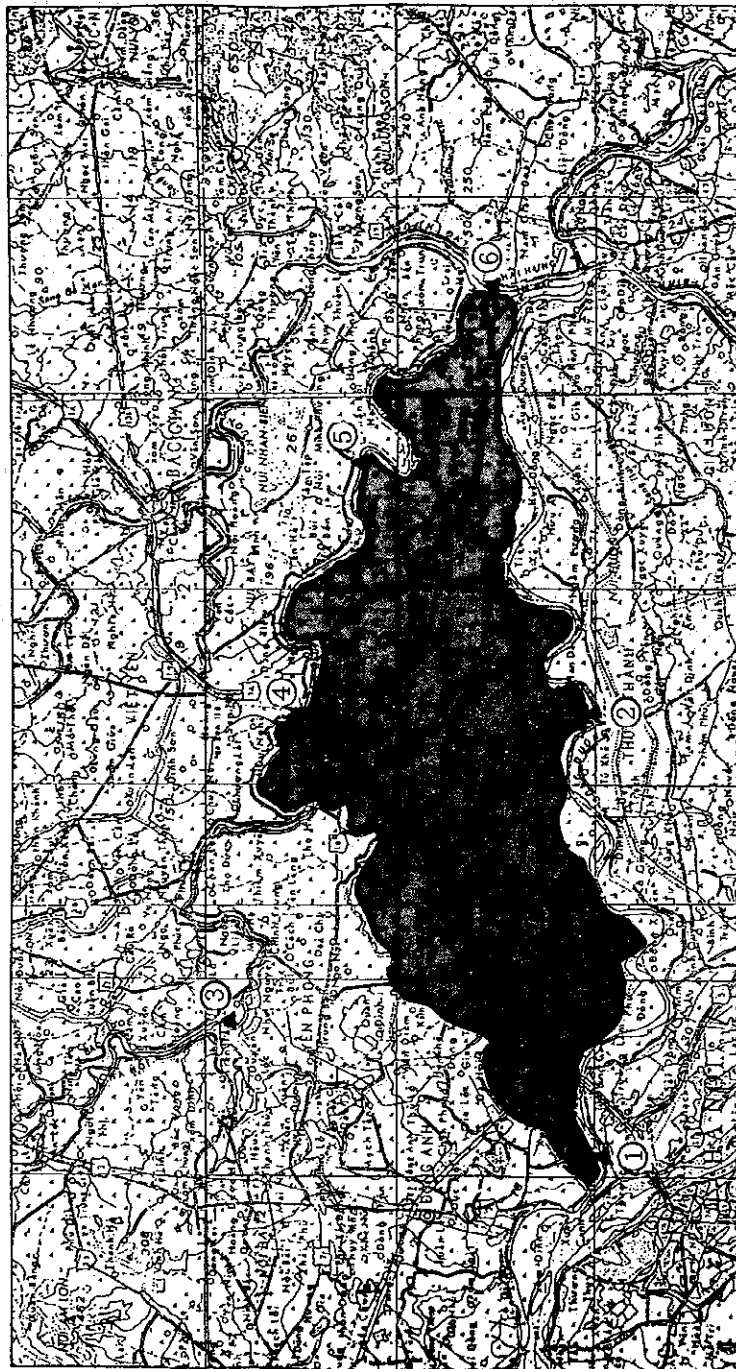
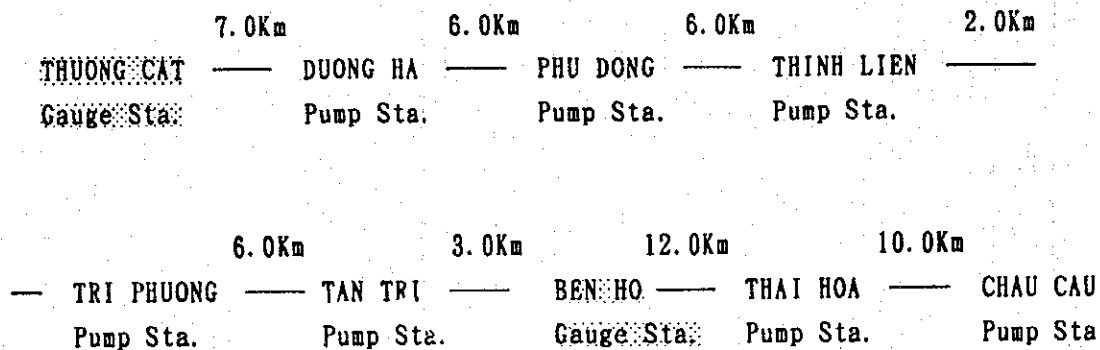


FIGURE B-2.4 Period of Water Level / Discharge Record at Study Area

STATION	1960	1970	1980	1990	NOTE
THUONG CAT Duong River	1958			1992	1958 ~ 1992 (1991 : Missing)
	1960			1991 1992	
BEN HO				1992	1960 ~ 1992 (Discharge Record)
	1959	1972			
DAP CAU Cau River		1969		1992	1959 ~ 1992 (1970, 1971 : Missing)
			1978		
PHA LAI	1963			1992	1978 ~ 1992
					1963 ~ 1992

Figure B-2.5 Correlation among Pumping Stations and Gauging Stations in Distance

(DUONG RIVER)



(CAU RIVER)

