Phase 2 will comprise identification of all potential development projects. Complementary investigations regarding a variety of such fields as hydrology, geology and environmental impact survey will be carried out during this Phase. A short term (For the year of 2000) demand and a long-term (For the year of 2015) one in such sectors as electric power generation, irrigation, and industrial and municipal water supply will be estimated. Next step will be to carry out the optimization study of the use of water resources. Finally, priority development projects will be selected out of the potential development projects on the basis of the development strategy set forth in Phase 1.

(3) Phase 3

Phase 3 will comprise the execution of complementary investigation for the priority development projects in order to identify high priority development projects by upgrading the existing data. The complementary field investigation will include the preparation of topographic maps of such major structure sites as dams for the priority development projects with a scale of 1 to 10,000 by the aerial photographic method.

Next the Master Plan will be formulated to synthesize the studies of alternative development scenarios. The Master Plan will state the harmoniously balanced and optimum water resources development plan in the national and regional development without significantly adverse environmental consequences.

Finally, the terms of References of feasibility studies for the high priority development projects will be prepared in order to guide the Master Plan toward the projected target.

3.2 Detailed Scope of work

The detailed Scope of work is itemized by the Phase, although some work will possibly be carried out beyond the Phase.

(1) Phase 1

(a) Data review and assessment of the following issue.

- Previous reports regarding the water resources development,
- Topographic data including topographic map, results of triangulation and leveling surveys,
- Meteorological data including rainfall, humidity, evaporation, sunshine hours, wind velocity, etc.,
- Hydrological data including water level records, low and flood flows, water quality, and sediment load,
- Geological data including geological map and drilling logs,
- Socio-economic data including population, past record of re-settlement and its future program, gross domestic products, governmental and provincial budgets especially for development and social services, institutional set-ups,
- Existing water supply plants and water demands,
- Existing electric power plants and their performance,
- National hydropower supply program and power demand,
- Agro-economic data including farming population, farm household, land tenure, labor forces, marketing, market prices, farmer's financial situations, etc.,
- Agriculture data including soil, land capability, land use, crops, cropping patterns,farming practices, crop yields and productions, species and number of livestocks, etc.,
- Existing irrigation/drainage areas and facilities, agricultural development plans, available water sources and intake of water, etc.,
- Existing industrial development plans, electric power development plan, agricultural development plans and water supply plants,
- Inundation area and flood damages in relation to flood discharge, and existing flood protection works,

- Environmental data concerned and,
- Other necessary data and information.

(b) Formulation of basic water resources development strategy

(2) Phase 2

(a) Study of management of water resources

- Study of the impact of the upstream development on the flooding, flood control requirements and water supply in downstream areas in low flow seasons, associated environmental impacts, and
- Optimization study of the use of water resources.

(b) Meteorological; and hydrological studies

- Collation and statistical analysis of meteorological and hydrological data,
- Flood data analysis (Depth, duration, frequency),
- Analysis of sediment loads and river maintenance flow, and
- Review and assessment of salinity intrusion problem.

(c) Hydropower study

- National electric power supply program and power demand projection,
- Appraisal of proposed and potential hydropower projects from a view point of multi-sectoral optimization of water use,
- Preliminary design and cost estimates of potential hydropower development, and
- Assessment and implication of the alternative development [project on the existing and proposed power generation and distribution system.

(d) Agriculture study

- Land use survey,
- Study of proposed crops and cropping pattern and farming practices,
- Survey on market prices for agricultural products, agricultural inputs and labor costs,
- Survey on marketing system for farm products and inputs,
- price prospect of farm products and inputs,
- Assessment of farm budget, and
- Study on post harvest and agro-industry.

(e) Irrigation and drainage studies

- Inventory surveyor existing major irrigation and drainage facilities and farm roads,
- Preliminary layout and plan of irrigation, drainage and farm roads systems for the preliminary cost estimate,
- Estimate of irrigation water demand for respective irrigation areas and drainage requirement,
- Preliminary design and cost estimate of irrigation, drainage and road systems for new construction and rehabilitation works, and
- Study on operation and maintenance works and water management system.

(f) Flood mitigation study

- Study of the flood and inundation damages,
- Study of alternative solution for flood mitigation,
- Assessment of rehabilitation program of existing flood protection works,
- Identification of potential flood mitigation measures including flood control by proposed reservoir, and
- Preliminary design and cost estimate of proposed flood mitigation works.

(g) Domestic and industrial water supply study

- Present water demand and use,
- Water demand in 2000/2010 for industrial and municipal water supply, and
- Preliminary planning of water supply facilities required.

(h) Soil survey

- Soil sampling and physical and chemical analysis,
- Preparation of soil maps, and
- Preparation of land classification map.

(i) Socio-economic study

- Analysis of existing socio-economic data and preparation of questionnaires for supplementary economic survey, if necessary,
- Study of existing agricultural support systems such as farmer's organization, agricultural cooperatives and agricultural banks,
- Proposal on improvement of agricultural support systems, if required, and
- Study on future re-settlement program in the project area, if required.

(j) Geological survey

- Geological survey,
- Construction material survey for the dams, and
- Determination of design values for preliminary design of water-related structures.

(k) Natural and social environmental impact study

- Study of the environmental impact issues of the overall river basin and particular high priority development

projects.

- Study on mitigation or elimination of any prospect adverse environmental effects arising from the proposed water resources development plan, and
- Study on the displacement problem from the proposed reservoir areas, and measures identified to minimize the disruption of the way of life.
- Study on the identification of replacement area for the people to be displaced, and
- Water shed management study.

(1) Implementation Plan and Cost Estimate

- Preparation of stage-wise implementation plan and schedule,
- Survey for prices of construction material and machinery and transportation cost, and construction costs, and
- Estimate of project implementation cost and O & M cost of the project.

(3) Phase 3

(a) Execution of complementation field investigations

- Preparation of topographic maps of such major structure sites as dams for the priority development projects with a scale of 1 to 10,000 by the aerial photographic method.
- complementation geological survey and environmental impact study, and
- Other necessary field investigations.

(b) Selection of high priority development projects.

(c) Formulation of the Master Plan

- Summary of assessment of present conditions,

- Review of past and present development issues, plans and strategies,
- Identification of a long-term objectives,
- Ranking of various development options,
- Optimum sequence of a long range implementation development program,
- Aggregation of potential development conflicts and constraints, and
- Aggregation of indicative environmental impacts of the proposed program.

(d) Preparation of Terms of References of feasibility studies for high priority development projects

4. Experts Required for the Study

The Consultants will prepare an overall development plan in the study area consistent with the objective and scope of the technical assistance outlined above. The study will require 20 experts and a total of 180 man-months of the experts.

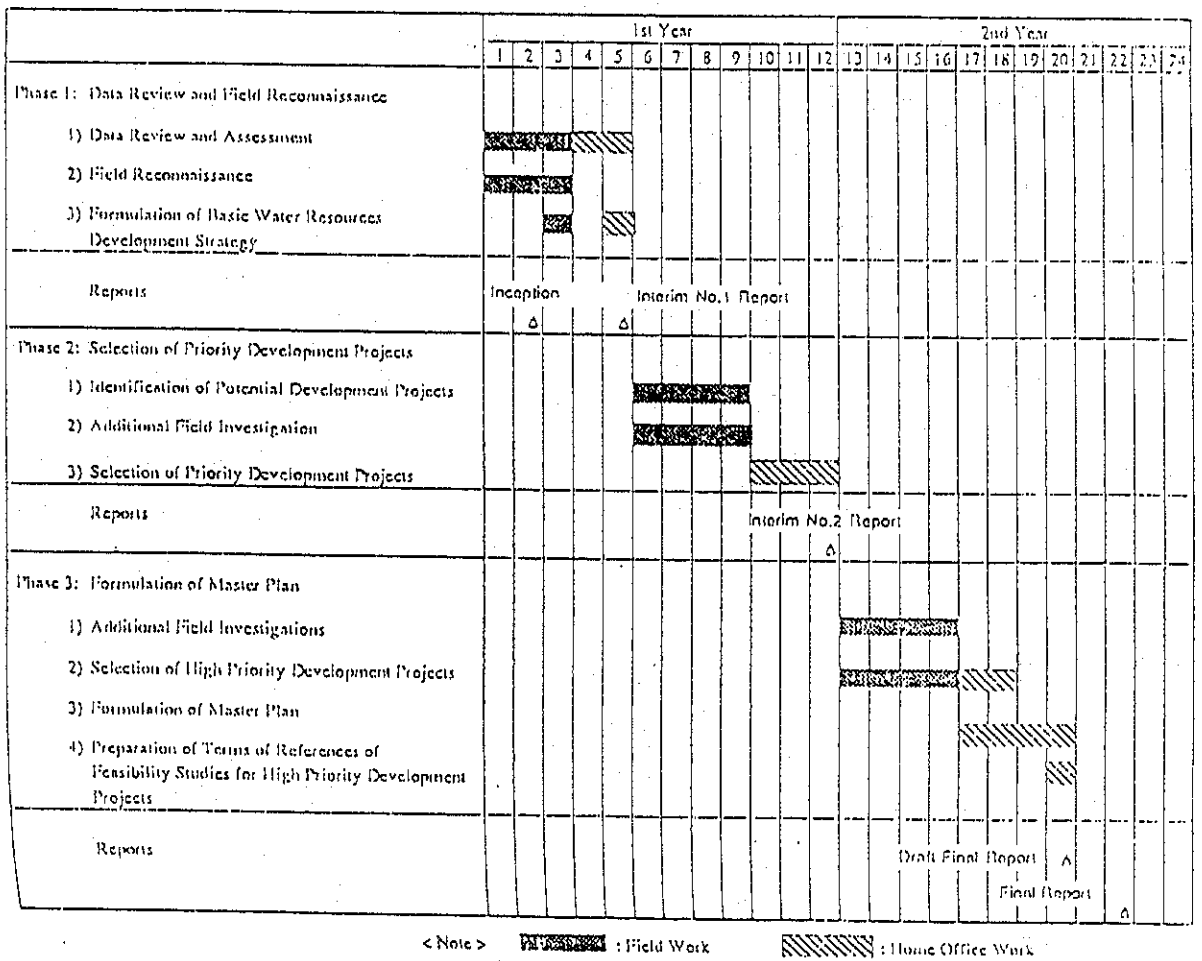
- Team Leader,
- Water Resources Development Planer,
- Regional/Industrial Development Planer,
- Dam expert,
- Hydropower Expert,
- Meteo-hydrologist,
- Mathematical Water Balance Simulation Modeling Expert,
- Irrigation and Drainage Expert,
- River-related Problem Expert,
- Domestic and Industrial Water Supply Expert,
- Agronomist,
- Agro-economist,
- Electrical Expert,
- Mechanical Expert,
- Geologist,

- Soil Mechanics Expert,
- Environmental Expert,
- Watershed Management Expert,
- Construction Planning/cost Estimate Expert, and
- Economist/Project Evaluation Expert.

5. Schedule of the study

The study will be conducted over the period of 22 months in accordance with the tentative work schedule shown in Attachment-3.

PROPOSED WORK SCHEDULE FOR MASTER PLAN STUDY



2．S/W 及び M/M

SCOPE OF WORK

FOR

MASTER PLAN STUDY

ON

DONG NAI RIVER AND SURROUNDING BASINS
WATER RESOURCES DEVELOPMENT
IN
THE SOCIALIST REPUBLIC OF VIET NAM

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES

AND
JAPAN INTERNATIONAL COOPERATION AGENCY

HANOI, 15 MARCH 1994

Dr.NGUYEN DINH THINH
Vice Director
Institute of Water Resources
Planning and Management
Ministry of Water Resources

Mr.PHAN DOANH
Vice Director
Department of Agriculture,
Forestry & Fishery
State Planning Committee

Mr. YOKITO SUGIMURA
Leader
Preparatory Study Team
Japan International
Cooperation Agency

I. INTRODUCTION

In resopnse to the request of the Government of the Socialist Republic of Viet Nam (hereinafter referred to as "Viet Nam"), the Government of Japan has deceided to conduct the Master Plan Study on Dong Nai and Surrounding Basins Water Resources Development (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study, in close cooperation with the authorities concerned of Viet Nam.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are;

1)To formulate a master plan for the Water Resources Development in the Dong Nai river and Surrounding Basins;and

2)To transfer technology of planning and investigation to Vietnamese counterparts through their direct participation in the Study.

III.STUDY AREA

The study area shall cover Dong Nai mainstream,four principle tributaries(Be river,Saigon river,La Nga river,Vam Co river) and adjacent coastal river catchments.

IV. SCOPE OF THE STUDY

The Study shall include the following;

(Phase I)

1. Data collection and analysis
   a. Previous reports regarding the water resources development
   b. Topographic data
   c. Meteological data
   d. Hydrological data
   e. Geological data
   f. Socio-economic data
   g. Existing water supply plants and water demands
   h. Existing electric power plants and their performance
   i. National hydropower supply program and power demand
   j. agro-economic data
   k. Agriculture data
   l. Existing irrigation/drainage areas and facilities, agricultural development plans, available water sources and intake of water,etc.
   m. Existing industrial development plans, electric power development plans and water supply plans
   n. Inundation area and flood damages in relation to flood discharges, and existing flood protection works
   o. Enviromental data
   p. Salinity intrusion
   q. Other necessary data and information
2. Field reconnaissance for review and identification of probelms related to water use and water resources development needs

3. Formulation of basic water resources development strategy

(Phase II)

1. Collection and review of supplemental data and information

2.Study of potential development projects
  a.Hydropower development
  b.Irrigation and agricultual development
  c.Industrial development
  d.Flood control

3.Field surveys and investigation, if necessary
  a.Meteorological and hydrological survey
  b.Topographic survey
  c.Geological survey
  d.Observation of present river conditions
  e.Survey on the condition of actual water use
  f.Flood inundation and damage survey
  g.Survey on the condition of actual land use and assets
  h.Soil survey

4.Water demand projection for the year of 2000 and 2015

5.Evaluation of potential water resources and analysis of water balance

6.Selection of priority projects for a master plan.

(Phase III)

1.Execution of supplemental field surveys, if neccessary
  a.Preparation of topographic maps of such major structure sites as dams for the priority projects with the aerial photographic method.
  b.Other necessary field surveys

2.Formulation of a master plan
  a.Plan for optimum water resources development and use
  b.Facility plan
  c.Estimation of costs for construction, operation and maintenance
  d.Organization and management plan
  e.Implementation program

f.Initial environmental examination

g.Project eavaluation

h.Selection of projects for the feasibility study and preparation of terms of references for them

V. STUDY SCHEDULE

The schedule will be executed in accordance with the attached tentative schedule.

VI. REPORTS

JICA will prepare and submit the following reports in English to the Government of Viet Nam.

(1) Inception Report
Thirty(30) copies at the commencement of the Study in Viet Nam.

(2) Progress Report(1)
Thirty(30) copies within four(4) months after the commencement of the Study.

(3) Interim Report(1)
Thirty(30) copies within six(6) months after the commencement of the Study.

(4) Progress Report(2)
Thirty(30) copies within ten(10) months after the commencement of the Study.

(5) Interim report(2)
Thirty(30) copies within thirteen(13) months after the commencement of the study.

(6) Progress Report(3)
Thirty(30) copies within seventeen(17) months after the commencement of the Study.

(7) Draft final Report
Thirty(30) copies within twenty one(21) months after the commencement of the Study.

(8) Final Report

Fifty(50) copies within two(2) months after the receipt of the written comments on the Draft Final report from the Government of Viet Nam, while these comments are expected to be delivered to JICA within one(1) month after the submission of the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF VIET NAM

1. The Government of Viet Nam shall facilitate the carrying out of the Study in accordance with the prevailing laws and regulations stipulated by the Vietnamese State, as below:

(1) To secure the safety of the Study Team;

(2) To permit the members of the Study Team to enter, leave and stay in Viet Nam for duration of their assignment threrein, and exempt them from foreign registration requirments and consular fees;

(3) To exempt the members of the Study Team from taxes, duties and other charges on equipments, machinery, and other materials brought into and out of Viet Nam for the conduct of the Study;

(4) To exempt the members of the Study Team from income taxes and other charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their survices in connection with the implementation of the Study;

(5) To provide necessary facilities to the Study Team for remittance as well as utilizations of the funds introduced into Viet Nam from Japanese in connections with the implementation of the Study;

(6)To obtain permission for entry into special area for the purpose of implementing the Study;

(7)To secure permission which is considered and issued by the relevant authorities for the Study Team to take out all data and documents including maps and photographs related to the Study out of Viet Nam to Japan; and

(8)To provide medical services as needed and its expense will be chargeable on the members of the Study Team.

2 The Government of Viet Nam shall bear claims, if any arises against members of the Study Team resulting from, occuring in the course of or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arises from gross negligence or willful misconduct on the part of the members of the Study Team.

3 Ministry of Water Resources (hereinafter referred as to "MWR") shall act as a counterpart agency to the Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations for the smooth conduct of the Study.

4 MWR shall, at its own expense, provide the Study Team with the following, in cooperation with other organizations concerned.

(1)Available data and information related to the Study;
(2)Necessary number of counterpart personnel including project coordinator throughout the Study period;
(3)Credentials or identification cards; and
(4)Suitable office space with necessary equipment and clerical services.

VIII.UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures.

1. To dispatch, at its own expense, the Study Team to Viet Nam; and

2. To pursue technology transfer to the Viet Nam counterpart personnel in the course of the Study.

IX. OTHERS

JICA and MWR shall act consult with each other in respect of any matter that may arise from or in connection with the Study.

TENTATIVE WORK SCHEDULE

MONTH DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
WORK IN VIET NAM	—	—	—	—			—	—	—	—				—	—	—	—					
WORK IN JAPAN	—			—	—	—					—	—	—					—	—	—		
REPORT PRESENTATION	▲ IC/R			▲ P/R(1)		▲ IT/R				▲ P/R(2)			▲ IT/R(2)				▲ P/R(3)			▲ DF/R	▲ F/R

NOTE: IC/R = INCEPTION REPORT
P/R = PROGRESS REPORT
IT/R = INTERIM REPORT
DF/R = DRAFT FINAL REPORT
F/R = FINAL REPORT

MINUTES OF MEETINGS

ON

SCOPE OF WORK

MASTER PLAN STUDY

ON

DONG NAI RIVER AND SURROUNDING BASINS
WATER RESOURCES DEVELOPMENT

IN

THE SOCIALIST REPUBLIC OF VIET NAM

AGREED UPON BETWEEN

MINISTRY OF WATER RESOURCES

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

MARCH 15, 1994

HANOI, VIET NAM

Dr. Nguyen Dinh Thinh
Vice Director
Institute of Water Resources
Planning and Management
Ministry of Water Resources

Mr. Yokito Sugimura
Leader
Preparatory Study Team
Japan International
Cooperation Agency

Mr. Phan Doanh
Vice Director
Department of Agriculture,
Forestry and Fishery
State Planning Committee

In response to the request of the Government of the Socialist Republic of Viet Nam (hereinafter referred to as "Viet Nam"), the Government of Japan dispatched the Preparatory Study Team (hereinafter referred to as "the Team"), headed by Mr.Yokito SUGIMURA and organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), from March 2 to March 21, to conduct a preparatory study for the Master Plan Study on Dong Nai River and Surrounding Basins Water Resources Development (hereinafter referred to as "the Study").

The Team carried out the field reconnaissance on the study area and had a series of discussions with the officials of the Ministry of Water Resources (Counterpart agency of Viet Nam side, hereinafter referred to as "MWR") and the other organizations concerned. The meetings were held on March 11,12,14 and 15 at the office of MWR. The list of attendants is attached in the Appendix.

Through those discussions, the Team and MWR agreed on the Scope of work. The main points discussed and agreed by the both sides in the meetings are as follows:

(1) The Team explained the following basic concepts of Japanese side for the Study and MWR agreed to the concepts.

1) The Study shall be done under the cooperation between MWR and the other organizations concerned and JICA.

2) The Study comprises the formulation of the Master Plan and the preparation of Terms of References for the feasibility studies on the high priority projects selected in the Master Plan.

(2) In preparation of the Master Plan, the effect of existing on-going projects should be reflected on the Study. The changes of objectives of these projects would be studied for the effective use of water resources.

(3) MWR will coordinate the organizations concerned for the technical and social cooperation to the Master plan study team dispatched by JICA (hereinafter referred to as "the Study Team"). To support this coordination for the Study, The Vietnamese side will establish the Steering Committee comprising the representatives from the ministries and organizations concerned.

(4) The Team requested MWR to organize the counterpart team corresponding to the Study Team to execute the Study jointly and to achieve the effective technical transfer. MWR agreed to assign the necessary counterparts including the staff of the organizations concerned.

(5) MWR requested the Team to conduct the technology transfer to the counterpart personnel in Japan as well as in Viet Nam. The Team replied that these request would be delivered to JICA Tokyo

(6) The Team requested MWR to prepare the office with sufficient working space in Ho Chi Minh city for not only Japanese Consultants but also the counterparts and the office supporting staff. The office should be equipped with desks, chairs, meeting tables, telephone, lights, etc.
MWR accepted the request of the Team.

(7) Concerning the fields survey and investigation programmed in the Study, the discussions were made between the Team and MWR as follows:

1) Aerial Photo Mapping, Topographical Survey and Geo-technical Survey

MWR requested the Team to undertake, if necessary, a) the aerial photograph survey with mapping to the project areas selected at the Phase I, on the condition that the necessary areas are to be discussed between the Study Team and MWR for obtaining official permission of aerial photograph, b) the topographical survey of river sections at proposed sites selected at Phase I or II, and c) the preliminary geo-technical survey on geology and construction materials for the proposed project areas selected at Phase I or II. The Team replied to MWR that this request would be delivered to JICA Tokyo.

2) Meteo-hydrological Survey and Water Quality Survey

MWR requested the Team that JICA will provide equipment for meteo-hydrological observation and water quality analysis, on condition that MWR will construct the stations and carry out meteo-hydrological observation and water quality survey under the guidance of the Study Team. The Team replied to MWR that this request would be delivered to JICA Tokyo.

3) Transportation Vehicles

MWR requested the Team to provide necessary number of vehicles for the Study. The Team replied that this request would be delivered to JICA Tokyo.

(8) IEE (Initial Environmental Examination) should be done because it is clarified through the screening that some important environmental components might be affected by the implementation of the plans formulated in the Master Plan.

(9) The Study Area shall includes the following areas, but within the territory of Viet Nam.

1) The Dong Nai river basin including the Saigon river basin, the Be river basin, and the La Nga river basin.

2) The Vam Co river basin excluding the west side area of the West Vam Co river.

3) The adjacent coastal areas.

(10) MWR requested to include the whole area of the Vam Co river basin as the Vam Co river is ~~considered to be a tributary of~~ closely linked with the Dong Nai river system and the water balance study should be made including the Vam Co river. However, the Team replied that it would be difficult to include the whole area due to the following reasons.

1) The Vam Co river ~~would be a tributary of~~ is closely linked with the Dong Nai river ~~in a broad sense~~. However it can be considered as a different river system from a different viewpoint as the Vam Co river mouth is located in or close to the estuary.

2) There is no sufficient data of the Vam Co river basin study. That is, the Study Team has to carry out the various and large quantity of survey such as river cross section survey, topographic survey, agricultural survey, soil survey, canal system survey, water quality survey, flood inundation and damage survey, etc.

3) If the whole Vam Co river basin is included, the Study will be complicated especially due to the inter-relation with Mekong Delta. That is, it would be difficult to make a border line of the Study area between the Vam Co river and the Mekong river.

4) The cost of the Study will be remarkably increased if the whole Vam Co river basin is included.

MWR understood the situation, but requested the Team that the Vam Co river basin excluding the west side area of the West Vam Co river should be included in the Study area on the condition that the objective of the Study for the Vam Co river basin is to be limited only for the water balance study, that is, the other objectives such as flooding / inundation study and irrigation development planning are not be included as these studies would be made at the feasibility study stage.

The Team agreed the revised request by MWR on the condition that the Study would be carried out by using the existing data provided by MWR without the field survey by the Study Team, so that the some tentatively assumed conditions for the water requirement for the development of the Vam Co river basin.

(11) The Team suggested MWR that the Cam Ranh area should be included in the Study area as it is considerable that the water supply from the Dong Nai river basin could be diverted to the Cam Ranh area especially for the industrial water use. However, MWR explained that the Cam Ranh should not be included in the adjacent coastal area as there is no future plan of the industrial development of Cam Ranh, and there would be another water source for the Cam Ranh area.

The Team agreed to draw a border line of the Study area along the border line of the Khanh Hoa and Ninh Thuan Provinces.

(12) The name of main river between the river outlet to the estuary and the confluence of the Dong Nai river and Saigon river is called Nha Be river by the local people. However, said river stretch is to be called the Dong Nai river for the Study.

(13) The Team requested MWR that MWR would get the official agreement from the organizations / agencies concerned for the cooperation to the Study Team. MWR agreed to the request.

(14) The target year of the Master Plan should be the year of 2015.

(15) MWR informed the Team that the Study should include the sectors of transportation (including navigation), tourism development, and economic development of the Study area. The Team replied that the Study would consider the influence to such sectors, however can not include them as one of objectives.

(16) The Team informed MWR that the Final reports prepared by the Study Team will be opened to the public at the JICA library in Tokyo after the official submission to the Viet Nam side. MWR replied that no objection would be made to the JICA system, if it is a JICA's common practice with the other JICA projects in Viet Nam.

(17) The Study period will be 22 months in total. However, some change will be occurred due to the unexpected conditions and the other reasons during the Study period.

(18) MWR requested the Team to have seminars during the study period as means of discussion of study progress and results between the Study Team and the organizations concerned as well as technical transfer to the Vietnamese side. The Team replied to MWR that these request would be delivered to JICA Tokyo.

APPENDIX

LIST OF ATTENDANTS

<< Japanese Side (Preparatory Study Team)>>

Mr. Yokito SUGIMURA	Leader/Water Resources Development
Mr. Toshio OKAZUMI	River Planning
Mr. Masato WATANABE	Task Manager
Mr. Hiroshi OKADA	Hydorology
Mr. Hiroshi TANAKA	Environment

<< Vietnamese Side>>

[Ministry of Water Resources]

Mr. Hoang Trong Quang	Director General Dept. International Cooperation
Dr. Le Van Minh	Deputy Director General International Cooperation Dept.
Ms. Dao Minh Loc	Hydroulic Engineer International Cooperation Dept.
Mr. Nguyen Minh Duong	Expert/Planning Dept.
Dr./Prof. Nguyen Dong	Director/Institute of Water Resources, Planning and Management
Dr. Nguyen Dinh Thinh	Vice Director Institute of Water Resources
Dr. Le Truc	Water Resources Planner Head of Highland Planning Div.
Mr. Pham Xuan Su	Chief of Resources and Environmental Bureau
Mr. Le Duc Nam	Hydrology Engineer/Vice Head of Resources and Environmental Bureau
Mr. Nguyen Thai Lai	Master of Engineering Science/Vice Head of Resources and Environmental Bureau
Mr. Dan Hoa Binh	Planning and Management Institute of Water Resources

[State Planning Committee]

Mr. Phan Doanh	Vice Director/Dept. of Agriculture, Forestry & fishery
Mr. Nguyen Tien Trong	Expert/Agriculture,Forestry & Fishery Dept.

[Ministry of Agriculture and Food Industry]

Dr. Tran An Phong	Director General/National Institute for Agricultural Planning and Irrigation
Dr. Nghiem Chung Lan	Vice Director International Cooperation Dept.
Mr. Vu Cong Lan	National Institute for Agricultural Planning and Protection

[Ministry of Energy]

Mr. Dau Duc	Deputy Director, Foreign Cooperation Dept.

[Ministry of science, Technology and Environment]

Dr. Nguyen Dac Hy	Expert/Institute of Ecological Economic, Dept. of Environment

3．面会者リスト

MEETING FOR DONG NAIRIVER AND SURROUNDING BASINS

WATER RESOUURCES DEVELOPMENT

ATTENNDANTLIST（調査団員を除く）

3月4日 (AM 9 : 00)（日本大使館表敬）

(1)佐々木 隆宏　二等書記官

(2)築野 元則　二等書記官

3月4日 (AM10 : 30) (SPC)

(1)Mr.PHAN DOANH	VICE DERECTOR OF DEPERTMENT OF AGRICULTURE	SPC*1
(2)Ms.LE THI THONG	EXPERT OF DEPERTMENT OF AGRICULTURE	SPC
(3)Mr.NGUYEN TIEN TRONG	EXPERT OF DEPERTMENT OF AGRICULTURE	SPC
(5)佐々木 隆宏	二等書記官	日本大使館

3月4日 (PM 1 : 30) (MWR, HANOI)

(1)Mr.HOANG TRONG QUANG	DIRECTOR GENERAL, DEPARTMENT OF INTERNATIONAL COOPORATION/ PERMANENT SECRETARY OF THE VIETNAM NATIONAL MEKONG COMMITTE	MWR*2
(2)Ms.DAO MINHLOC	HYDRAULIC ENGINEER INTERNATIONAL COOPORATION DEPERTMENT	MWR
(3)佐々木 隆宏	二等書記官	日本大使館

*1 SPC STATE PLANNING COMMITTEE（国家計画委員会）

*2 MWR MINISTRY OF WATER RESOURCES（水資源省）

3月4日 (PM 3 : 00) (MINISTRY OF ENERGY)

(1)Mr.DAU DUCDUC	DEPUTY DIRECTOR FOREIGN COOPORATION DEPT.	M.OF ENERGY
(2)Mr.VU VAN THAI	INTERNATATIONAL COOPORATION DEPERTMENT	M.OF ENERGY

3月4日 (PM 4 : 00) (MINISTRY OF AGRICULTUER AND FOOD INDUSTRY)

(1)Mr.NGNYEN QUAC DAT	ECONOMIST DEPERTMENT OF INTERNATIONAL COOPORATION	M.OF AGRI.&FOOD

3月5日 (PM 2 : 00) (MWR, HO CHI MINH)

(1)Mr.VU VAN VINH	DIRECTOR, PLANNING AND MA-NEGEMENT SUB-INSTITUTE OF WATER RESOURCES	MWR
(2)Dr.LE TRUC	WATER RESOURUS PLANNER HEAD OF HIGH LAND PLANNING DIVI. SUB-INSTITUTE OF WATER RESOURCES	MWR
(3)Mr.PHAM VAN THIET	ENGINEER DEPERTMENT OF INTERNATINAL COOPORATION	MWR
(4)Mr.NGUYEN THANH TIN	CHIEF WATER QUALITY LABO. SUB-INSTITUTE OF WATER RESOURCES	MWR

3月9日 (PM 4 : 45) (PIDC2, MINISTRY OF ENERGY)

(1)Mr.LE QUANG	DIRECTOR PIDC2	MINISTRY OF ENERGY
(2)Mr.NIUUEN GUANG TUAN	SECRETARY OF DIRECTOR PIDC2	MINISTRY OF ENERGY

3月10日 (AM 9 : 00) (MWR, HO CHI MING)

(1)Mr.NGUYEN HUIR HANH	ENGINEER, SIWRPM	MWR

(2)Mr.LE TRUC	HEAD OF DONG NAI RIVER PLAN-NING DEPERTMENT SIWRPM	MWR
(3)Mr.VU VAN VINH	DIRECTOR OF SIWRPM	MWR
(4)Mr.NGUYEN THAUH TIN	ENGINEER OF SIWRPM	MWR
(5)Mr.PHAM VAN THIET	ENGINEER DEPERTMENT OF INTERNATIONAL COOPORATION	MWR

3月10日 (AM10 : 30) (MWR, HO CHI MING)

(1)Mr.NGUYEN GIOI	VICE MINISTER	MWR

3月10日 (PM 1 : 30) (HO CHI MING)

(1)Dr.LE VAN NAM	CHIEF ARCHITECT OF HO CHI MINH CITY	PEOPLES COMMITTEE HO CHI MINH CITY
(2)Mr.LE HOANG MINH	SUPERIOR EXPERT	〃
(3)Dr.NGUYEN HONG BINH	VICE DIRECTOR SERVICE OF AGRICURLURE	HO CHI MINH CITY
(4)Mr.VU VAN VINH	DIRECTOR OF SIWRPM	MWR
(5)Mr.PHAM VAN THIET	ENGINEER DEPERTMENT OF INTERNATIONAL COOPORATION	MWR

3月11日 (AM 8 : 30) (MWR, HANOI)

(1)Dr.LE VON MINH	DEPUTY DIRECTOR GENERL INTER-NATIONAL COOPORATION DEPT.	MWR
(2)Dr.PROF.NGUYEN DONG	DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(3)Ms.DAO MINH LOC	HYDRAULIC ENGINEER INTER-NATIONAL COOPERATION DEPT.	MWR
(4)Dr.LE TRUC	WATER RESOURCES PLANER HEAD OF HIGHLAND PLANNING DIRECTER SIWRPM	MWR

(5)Dr.NGOYEN DINH THINH	VICE DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(6)Mr.DAN HOA BINH	ENGINEER,INSTITUTE OF WATER RESOURCES	MWR

3月11日 (PM2 : 00) (MWR, HANOI)

(1)Dr.PROF.NGUYEN DONG	DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(2)Dr.NGOYEN DINH THINH	VICE DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(3)Dr.LE TRUC	WATER RESOURCES PLANER HEAD OF HIGHLAND PLANNING DIRECTER SIWRPM	MWR
(4)Mr.DAN HOA BINH	ENGINEER, INSTITUTE OF WATER RESOURCES	MWR

3月12日 (AM8 : 00) (MWR, HANOI)

(1)Dr.NGOYEN DINH THINH	VICE DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(2)Dr.LE TRUC	WATER RESOURCES PLANER HEAD OF HIGHLAND PLANNING DIRECTER SIWRPM	MWR
(3)Mr.DAN HOA BINH	ENGINEER,INSTITUTE OF WATER RESOURCES	MWR
(4)Mr.DAU DUC DUC	DEPUTY DIRECTOR	MINI.OF ENEGY
(5)Mr.NGUYEN MINT DOUNG	SENIOR EXPECTER PLANNING DEPERTMENT	MWR

3月12日　(PM 2 : 00)　(MWR, M/M協議)

(1)Dr.NGUYEN DACHY	EXPERT	MOSTE
(2)Dr.MGHIEM CHUNG LAN	DEPUTY DIRECTOR INTERNATIONAL COOPORATION DEPT.	MINISTRY OF AGRICULTURE & FOOD INDUSTRY
(3)Dr.TRAN AN PHONG	DIRECTOR GENERAL	NATIONAL INSTITUTE FOR AGRICULTURAL PLANNING AND PRO-JECTION
(4)Dr.NGUYEN DONG	DIRECTOR INSTITUTE FOR W.R. PLANNING AND MANAGEMENT(IWRPM)	MWR
(5)Dr.NGUYEN DINH THINH	DEPUTY DIRECTOR IWRPM	MWR
(6)Mr.PHAN DOANH	DEPUTY DIRECTOR	SPC
(7)Mr.NGUYEN TIEN TRONG	EXPERT OF DEPERTMENT OF AGRICLUTURE	SPC
(8)Dr.LE TRUC	HEAD OF HIGHLAND PLANNING DIRECTOR, IWRPM	MWR
(9)Mr.VU CONGLAN	ASSISTANT	NATIONAL INSTITUTE FOR AGRICULTURAL PLANNING & PROJEC-TION(NIAPP)
(10)Ms.DAO MINH LOC	HYDRAULIC ENGINEER INTERNATIONAL COOPORATION DEPT.	MWR
(11)Mr.DAU DUC DUC	DEPUTY DIRECTOR	MINI.OF ENERGY

3月14日　(AM 8 : 30)　(MWR, M/M協議)

(1)Dr.NGOYEN DINH THINH	VICE DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(2)Mr.DAN HOA BINH	ENGINEER, INSTITUTE OF WATER RESOURCES	MWR

(3)Mr.HOANG TRONG QUANG	DIRECTOR GENERAL, DEPERTMENT OF INTERNATIONAL COOPORATION/ PERMANENT SECRETARY OF THE VIETNAM NATIONAL MOHONG COMMITTE	MWR

3月15日 (AM10 : 20) (MWR, M/M協議)

(1)Dr.NGOYEN DINH THINH	VICE DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(2)Ms.DAO MINH LOC	HYDRAULIC ENGINEER INTERNATIONAL COOPORATION DEPT.	MWR

3月15日 (PM 1 : 00) (MWR, MINUTESサイン)

(1)Mr.PHAN DOANH	VICE DERECTOR OF DEPERTMENT OF AGRICULTURE	SPC
(2)Ms.LE THE THONG	EXPERT OF DEPERTMENT OF AGRICULTURE	SPC
(3)Mr.LE VAN KE	DEPUTY DIRECTOR NORTHEAST ASIAN DEPT.	MINI.OF FOREIGN AFFAIRS
(4)Mr.LE QUANG CONG	JAPANESE DIVISION NORTHEAST ASIAN DEPT.	MINI.OF FOREIGN AFFAIRS
(5)Dr.NGOYEN DINH THINH	VICE DIRECTOR INSTITUTE OF WATER RESOURCES PLANNING AND MANAGEMENT	MWR
(6)Ms.DAO MINH LOC	HYDRAULIC ENGINEER INTERNATIONAL COOPORATION DEPT.	MWR

4．質問状及び回答

・質問状(Questionnaire)
・質問状に対する回答　1
・質問状に対する回答　2

調査団は、ヴィエトナム国側への質問状を準備し、現地出発前（10日程前）に日本大使館を通して現地の担当機関に提出した。

担当機関であるMWRからの回答は、調査団が現地到着後、内容について口頭説明し、改めて回答依頼した後、3月11日にMWRのホーチミン事務所(SIWRPM)が準備した回答（添付の回答1）が得られた。

しかし、この回答は質問の1部に対するものであったため、出来る範囲で、他の部分も回答を準備してほしいと頼んだところ、3月16日に質問状に乱雑に手書き記入した回答が渡された。

読みづらいこともあり、これを整理したのが添付の回答2である。

多くの案件をかかえている状況において、不十分ながらも回答を準備してくれたのは、調査団の熱意もあろうが、MWR側の対応を評価したい。不十分な部分については、関係者の口頭説明や、資料入手により、ある程度補足出来たと思う。

補足資料については、まとまった回答となっていないため、報告書本文の中に、参考となる部分を含めて示すものとした。

質問状　(Questionnaire)

(Prepard by JICA Team)

THE SOCIALIST REPUBLIC OF VIETNUM
DONG NAI AND SURROUNDING BASINS
WATER RESOURCES DEVELOPMENT

QUESTIONNAIRE

CONTENTS

REMARKS

1. The Study area covers all the Dong Nai river system basin and the adjacent coastal river catchment areas.

2. The numbers of answer prepared by the Viet Nam side shall correspond to the numbers of questionnaire prepared by the Japanese side.

3. In case that the data/ information is requested, the general descriptions/ principal features with representative maps/ figures/ tables shall be shown.

4. In case that the availability is requested, the data sources (name, publisher, etc. of report) as well as the availabillity shall be shown.

5. In case that the similar question is found, the answer shall be able to refer to an answer of the other item(s).

6. JICA team already obtained some documents with necessary data in Japan answering to some items of the questionnaire, however it is required for the Vietnam side to prepare the lastest data/ information by themselves.

THE SOCIALIST REPUBLIC OF VIET NAM
DON NAI AND SURROUNDING BASINS
WATER RESOURCES DEVELOPMENT

QUESTIONNAIRE

1. PROJECT IMPLEMENTATION

(1) Executing body (Ministry of Water Resources) and its organization and the other information/ data (such as function, key personnes concerned, interrelationship with the other agencies, etc.)

(2) Organization and general information/data of other agencies/offices related to the project implementation.

a) Council of Ministers
b) State Planning Commission
c) Ministry of Finance
d) Ministry of Energy
e) Ministry of Construction
f) Local Government
g) Public Corporation/Private Company
h) Others

(3) Member of Steering Committe, if established.

(4) National/Regional Budget by Ministry and Sector (General data, especially for Ministry of Water Resources)

(5) Financial plan for the project implementation (Feasibility Study, Detailed Design, and Construction) ,if any. (General Information)

(5) Implementation Schedule of the project after the Master Plan Study, if any. (General Information)

2. SOCIO-ECONOMIC CONDITIONS

(1) Socio-economic information and data which will be remarkable for the project implementation. (The latest general information and the availability of the detailed data , Nationwide and the Study area)

a) GNP/GDP
b) Population and Household
c) Administrative Division
d) Trade
e) Industry
f) Exchange rate
g) Consumers prices of major items
h) Others

(2) Land use in and around the Study area (Availability)

a) Land Use Map
b) Land Use Statistics
c) Land Use Descriptions
d) Agencies/ Organizations for the Data Collection
e) Others (if any)

(3) Land ownership in and around the study area and Land acquisition and compensation problems/ difficulties. (The latest general information and the availability of the detailed data)

(4) Information for Field access etc. of the Study Area

a) Transportation Network and Condition
b) Communication System (Telephone, Telex, Fax, etc.)
c) Lodging Accommodation (except Ho Chi Minh)

(5) Information for Security and Health in Hanoi and the Study Area

a) Security
b) Sanitation
c) Diseases and Hospital

3. ENVIRONMENT

(1) Legislative Matters

a) Environmental Act/ Regulations related to the environmental

conservation and the implementation of development shemes
b) Guidelines on environmental impact assessmenst (EIA)
c) Environmental Quality Standard(s), and it's detail,
e.g. values, penalties

(2) Administrative Matters

a) Responsible Ministry of Agency for Environmental Impact assessment (EIA), and procedure of EIA

(3) International Conventions on Environmental Conservation
a) Affiliated bilateral or multilateral convention(s) concerning environmental conservation, e.g. Ramsar convention, Washington convention

(4) Socio-economic Environment in the Study Area

a) Topographical, geological and metero/ hydrological map and data
b) Experiences of resettlement and compensation in previous projects, if any
c) Population distribution in administrative districts

(5) Natural Environment in the Study Area

a) Vegitation map, forest distribution map
b) History of natural disaster such as landslide, earthquake and flood
c) Present water quality data, if any
d) Location of particular areas officially protected such as national parks, natural parks and game reserves, conservation areas and etc.
e) Location of environmentally valuable areas, such as mangurove forest, wet land and etc.
f) Distribution of important landscape or scenery for tourism and religion

(6) Public Nuisanse in the Study Area

a) Problem cases on public nuisance ,if any

(7) Other Information on Environmental Matters

a) Environmental study/ investigation report and data on previous projects
b) Resent NGOs activitiy trend concerning environmental conservation

aspects

c) Agencies/ Organizsations for the data collection

4. DEVELOPMENT PLANS (Nationwide / Regionalwide)

(1) National Development plan(The latest general information and the availability of the detailed data)

(2) Regional Development plan(The latest general information and the availability of the detailed data)

(3) Power Development Plan(The latest general information and the availability of the detailed data)

(4) Irrigation Development Plan (The latest general information and the availability of the detailed data)

(5) Water Supply Development Plan and Sewerage Plan (The latest general information and the availability of the detailed data)

(6) Environmental Improvement Plan(The latest general information and the availability of the detailed data)

(7) Other Plans on Water Resources, if any. (The latest general information and the availability of the detailed data)

5. WATER RESOURCES DEVELOPMENT PROJECTS

(In the Study Area)

(1) Existing Projects (General features with representative figures and the present status , and the availability of the detailed data)

a) Da Nhim
b) Phan Rang Irrigation
c) Phan Thiet Irrigation
d) Dan Tieng Reservoir
e) Tri An Reservoir

f) Thu Duc Treatment Plant
g) Others

(2) On-going Project (The general features with representative figures and the present status , and the availability of the detailed data)

a) Da Nhim (Rehabilitation ?)
b) Thac Mo Reservoir
c) Others

(3) Future Projects (General features with representative figures and the present status , and the availability of the detailed data)

a) Phan Ri Diversion
b) Upper Dong Nai
c) Dalat
d) Others

6. TOPOGRAPHY, GEOLOGY AND METEO-HYDROLOGY

(In the Study Area)

(1) Availability of Data for Topography (for every kind and scale)

a) Aerial Photographs
b) Orthophoto Maps
c) Topographic Maps
d) Bench Mark System
e) Agencies/ Organizations for the Data Collection
f) Others (if any)

Note: Topographic maps of 1:50,000, 1:100,000, 1:200,000, 1:250,000, and 1:500,000 covering the study area shall be given to the JICA team , if possible.

(2) Availability of Data for Geology (for every kind and scale)

a) Geological Maps
b) Landsat Images
c) Geological Description (including Ground-water)/ Reports
d) Agencies/ Organizations for the Data Collection

e) Others (if any)

(3) Availability of Data for Meteorology and Hydrology (Kind of measurement, Period, Location, Present status, etc. of all the stations)

a) Rainfall Data (including hourly records of storms)
b) Discharge Data (including hourly records of floods)
c) Sediment Data
d) Water Quality Data (including saline water)
e) Rainfall Gauging Stations/ Meteorological Observatories
f) Stream Gauging Stations
g) Agencies/ Organizations for the Data Collection
h) Othe Metheo-Hydrological Data

7. FLOOD AND ITS CONTROL

(1) Flood Records in the Study Area(General information of representative past floods , and the availability of the detailed data)

a) Year and Date
b) Inundation Area and Depth
c) Flood Dischange
d) Flood Water Level
e) Rainfall Data
f) Flood Damage (Item, Condition, Cost, etc.)
g) Other Information

(2) Existing Flood Control Structures/ Facilities in the Basin (Location and General Descriptions , and the availability of the detailed data)

a) Dam/ Reservoir
b) Dike
c) Diversion Channel
d) Others

(3) Flood Damage Mitigation Measures taken in the Study Area (Example/ General Information , and the availability of the detailed data)

(4) Ongoing/ Proposed Flood Control Project/ Works in the Study Area (Location and General Descriptions , and the availability of the detailed

data)

(4) Rivers in the Study Area (General description of present condition and the availability of detailed data/information)

a) Dong Nai main
b) Be river
c) La Nga river
d) Vam Co river
e) Upper Dong Nai
f) Coastal rivers
g) Mekong river (Connection and Influence to Dong Nai river system)

(5) Reports on Flooding/ Flood Control in the Study Area (Availability)

8. POWER AND ENERGY

(1) Power and Energy Status (Nationwide/Regionwide, General Descriptions with general figures and the availability of the detailed data)

a) Power Supply Network (with location maps)
b) Annual Energy Consumption and Production by Source
c) Annual Maximum Power Demand(KW) by Location/Area and Category
d) Power Consumption(KWH) by Location and Category
e) Power Demand Forecast
f) Power Development Program
-Power Source
-Transmission Lines
-Distribution Lines
-Study Report
g) Existing Power Stations in the Study Area
h) Future Plans of Power Station in the Study Area
i) Agencies/ Organizations for the Date Collection

(2) Related Data for Power and Energy (Availability)

a) Current Construction Cost of Power Plant (per KW and KWH)
-Coal-fired Thermal Plant
-Diesel Engine
-Geo-thermal Plant

-Others

b) Current Fuel Cost
-Oil
-Coal
-Others

c) O & M Cost for each Plant

d) Current Electricity Tariff
-Tariff by type of Consumers and Capacity
-Collection of Tariff

9. IRRIGATION AND AGRICULTURE

(In the Study Area)

(1) Agriculture Data such as kinds of Crops, Cropping patterns, Crop Yields, price, etc. (Availability)

(2) Distribution System of Agriculture Products (General Description and the availability of the detailed data)

(3) Existing Irrigation Project (General Description and Maps/ Figures and the availability of the detailed data)

a) Location and Area (Gross/ Net)
b) Major Structures/ Facilities (Intake, Canal, etc.)
c) Water Sources
d) Agency (Agencies) for Operation and Maintenance

(4) On-going/ Proposed Irrigation Project in the Study Area (Location and General Description ,and the availability of the detailed data)

(5) Reports on Irrigation Projects/ Agriculture Development in the Study Area (Availability)

10. WATER SUPPLY AND SEWERAGE

(In the Study Area)

(1) Existing Water Supply System (General Description and maps/ figures, and the availability of the detailed data)

a) Location/ Area and Net work
b) Purpose of Water Use
c) Treatment Facilities
d) Water source
e) Water Use quantity and quality
f) Tariff System
g) Problems

(2) Existing Sewerage System (General Description and maps/ figures ,and the availability of the detailed data)

a) Location/ Area and Network
b) Treatment Facilities and Method
c) Outlet of Treated Water
d) Quantity and Quality of Treated Water
e) Tariff System
f) Problems

(3) On-going/ Proposed Projects of Water Supply/ Sewerage (Location and General Descriptions , and the availability of the detailed data)

(4) Reports on Water Supply and Sewage (Availability of the detailed data)

11. OTHER SECTOR OF WATER RESOURCES

(In the Study Area)

(1) Navigation (Location and General Descriptions , and the availability of the detailed data)

(2) Tourism (Location and General Descriptions , and the availability of the detailed data)

(3) Others, If any

12. UNIT COST AND OTHERS

(1) Information (Examples/ Standards) of Unit Prices for Field Investigation and Test

a) Laboratory Test for Construction Material
b) Laboratory Test for Water Quality
c) Aerial Survey and Mapping
   -Aerial Survey
   -Photogrammetric Mapping (1:10,000 and 1:5,000)
d) Ground survey and Mapping (per Ha)
   -Scale 1: 500, Contour interval 1m
   -Scale 1:1,000, Contour interval 2m
e) Leveling Survey (per Km or m)
f) Drilling (per m)
   -Soil Drilling and Sampling (up to 5m)
   -Core Drilling (by Category)
g) Permeability (Lugion) Test in Bore Hole
h) Seismic Prospectiong (per Km)
i) Test Pitting
j) Exploratory Adit
k) Stream Flow Measurement
m) Others, if any

(2) Local Companies/Agencies/Offices for investigation (Name, Address, Terephone No., Person in charge, Experience, Company Scale, Reliability, etc.)

a) Topographic survey
b) Aerial photo and mapping
c) Geological Survey
d) Soil survey/ Laboratories
e) Environmental investigation
f) Socio-economy
g) Design
h) Others

(3) Design Criteria and Standard to be used in Viet Nam (Availability)

a) Civil Engineering (Dam , River Improvement , etc.)
b) Hydro-Mechanical Engineering
c) Electro-Mechanical Engineering
d) Construction Materials and Equipment
e) Construction cost estimate
f) Others, if any

(4) List and Availability of Past Reports related to the Water Resources in the Study Area

a) Master Plan/ Regional Plan
b) Feasibility Study
c) Design
d) Investigation
e) Annual Report (of Government Agencies)
e) Others, if any

(5) Other Information and Data , if any

質問状に対する回答　1

（MWR のSIWRPMが作成）

MINISTRY OF WATER RESOURCES
SUB-INSTITUTE FOR WATER RESOURCES PLANNING AND MANAGEMENT

WATER RESOURCES INFORMATIONS IN THE DONG NAI BASIN AND SURROUNDING AREAS

(PREPARED DOCUMENT FOR THE DONG NAI BASIN AND SURROUNDING AREAS WATER RESOURCES DEVELOPMENT PROJECT)

HO CHI MINH CITY
MARCH 1994

5. WATER RESOURCES DEVELOPMENT PROJECTS
(In the study area)

5.1 Existing Projects

(a) Da Nhim hydroelectric

Major features of the Da Nhim hydroelectric are as follows :

1/ Location :

Dam site : About one kilometer upstream from Dran village. Altitude approx EL. 1010.

Intake site : On the left bank about one kilometer upstream from the dam site.

Power station site : About 2 kilometers northwest of Kronfa railway station. Altitude approx EL. 240.

2/ Meteor - hydrology (at dam site)

Catchment area		775	Km^2
Annual raifall,	maximum	2014	mm
	minimum	1276	mm
	average	1680	mm
Annual average runoff,	maximum	33.9	m^3/s
	minimum	11.4	m^3/s
	average	22.6	m^3/s
Maximum daily average runoff		2500	m^3/s

3/ Reservoir

Storage capacity	Gross	165000000	m^3
	Net	156000000	m^3
Full reservoir area		9:7	Km^2
Full reservoir water level	EL.	1042	m
Low reservoir water level	EL.	1018	m
Drawdown		24	m
Design flood		4500	m^3/s

4/ Discharge

Maximum dischage	26,4	m^3/s

5/ Head

Maximum gross head	799	m
Maximum net head for maximum discharge	741	m

6/ Power output

Rated maximum power output	160000	Kw
Annual mean energy output	1025.10^6	KWh

TRI AN
HYDRO-POWER PLANT PROJECT

I. NATURAL CONDITIONS

I.1 Location

The Tri An hydro-power plant is located in the Dong Nai river at Tan Dai Phuoc village, Vinh Cuu district, Dong Nai province, with coordinate of 11° 06' N-Latitude and 107° 03' E-Longitude. The plant is far from the confluence of Be river 7 km to downstream, far from Ho Chi Minh city 80 km in the road or 50 km in the fly distance.

The project was constructed in 1985 and have done in 1990.

I.2 Meteo-Hydrological Features

I.2.1 General

The main Dong Nai river generates from the high mountain zone with elevation of 2,000 m belonging to the Liang Bien highland, in the South part of Central Highland Region, and flows to the South China Sea at Xoai Rap river mouth, near Vung Tau. The area of basinwide of Dong Nai river system is amount 43,000 km2, including the main Dong Nai river and 4 large branches as La Nga, Be, Sai Gon and Vaico.

The Sai Gon and Vaico rivers lie in the rather flat plain, so hydro-power potential in these basins is no remarkable. Dau Tieng reservoir is one of the largest water control works in Viet Nam, which was constructed in 1984 in these rivers, but which is used for irrigation only.

The main Dong Nai river and two other branches-La Nga and Be-with upstream in the high mountain zone and downstream in the flat plain one, that have high slop, many falls, and so which are good conditions for hydro-power development. Tri An is one of these cascades.

I.2.2 Meteo-Hydrological Stations

There are many meteo-hydrological stations in the Dong Nai river basin at Tri An, but data series are sort and distribution is irregular.

In the basin, there are 5 rainfall stations of over 50 year data, such as Da Lat, Di Linh, Bao Loc, Tuc Trưng and Xuan Loc, they could be used for estimating precipitation features and lasting flow data.

The Tri An basin also have 5 hydrological stations, they are Dran, Thanh Binh, Dai Nga, Ta Pao and Tri An. After the Tri An reservoir have been operated, two more stations established in

upstream at Phu Dien and Ta Lai for forecasting a flow to the reservoir.

I.2.3 Annual Average Discharge

Annual average discharge is calculated base on the measured data of 7 years at Tri An, from 1978-1984, by SSARR model. The lasted flow data series is 32 years.

The flow features at Tri An are following:

Catchment Area:	14,800	km2
Annual Average Discharge:	477	m3/s
Annual Average Module:	32.7	l/skm2
Annual Average Volume:	15.05	billion m3
Flow Variation Coefficient:	0.22	
Skew Coefficient:	0.44	(2Cv)

Monthly Discharge Distribution for Typical Years

P%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
10	229	140	95.3	51.7	66.4	450	834	1250	1950	1550	546	221	615
50	152	90.2	62.0	39.5	39.5	322	649	970	1520	1210	423	158	470
75	130	77.2	53.1	28.9	33.8	251	564	849	1320	1040	367	121	402
90	105	67.0	41.9	20.9	29.3	226	490	729	1140	904	322	105	349
95	96.0	57.6	38.4	19.2	29.6	211	449	668	1040	833	292	104	320

Remarks:
- P%(10): Frequency of 10%
- P%(50): Frequency of 50%
- P%(75): Frequency of Dry Year of 25%
- P%(90): Frequency of Dry Year of 10%
- P%(95): Frequency of Dry Year of 5%

I.2.4 Flood Design

The result of the designed flood peaks for Tri An reservoir are calculated following:

Frequency (%)		Flood Peak (m3/s)
0.1	(1,000 years)	21,000
1	(100 years)	13,800
5	(20 years)	8,800
10	(10 years)	6,700

I.2.5 Sedimentation

Annual, sediment concentration is higher during from August to October, amount 200-300 ppm. From December to June, sediment load is smaller, average of 6 ppm.

II. TRI AN HYDRO-POWER PROJECT PURPOSES

The Tri An hydro-power plant constructed with the integration purpose, with principle one is electrical generation, adding considering to other purposes, such as irrigation, salt water intrusion, fresh water supply for domestic and industry, fish cultivation and tourism in reservoir area...

III. PROJECT DESCRIPTIONS

III.1 Hydrological Aspects

Catchment Area:	14,800	km2
Annual Average Discharge:	477	m3/s
Annual Average Volume:	15.05 billion	m3
Flood Peak at Frequency of 0.1%:	21,000	m3/s
Flood Peak at Frequency of 1%:	13,800	m3/s
Flood Peak at Frequency of 10%:	6,700	m3/s

III.2 Reservoir

High Water Level (HWL):	62.0	m
Flood Control Water Level (FWL):	63.0	m
Low Water Level (LWL):	50.0	m
Storage Capacity at HWL:	2,757 million	m3
Effective Storage Capacity:	2,542 million	m3
Storage Capacity at LWL:	215 million	m3
Water Surface Area at HWL:	323	km2
Water Surface Area at LWL:	63	km2

III.3 Construction Works

III.3.1 Main Earth Dam

Crest Elevation:	66	m
Crest Width:	6	m
Crest Length:	640	m
Highest:	30	m

III.3.2 Concrete Spillway

Maximum Flood Drainage Capacity:	18,500	m3/s
Spillway Elevation:	49	m
Total Length:	176	m
Number of gates:	11	
Vale:	Curviform Vale	

III.3.3 Suoi Rop Earth Sub-Dam

Crest Length:	2,665	m
Crest Elevation:	65	m

Highest:	45	m
Crest Width:	6	m

III.3.4 Earth Sub-Dam on the Westsouth of Sub-Reservoir

Crest Length:	6,236	m
Crest Elevation:	65	m
Crest Width	4	m
Highest:	26	m

III.3.5 Linking Canal

Maximum Discharge Capacity:	880	m3/s
Length:	3,945	m

III.3.6 Power Plant

Installed Capacity:	400	MW
Minimum Capacity:	99.2	MW
Design Head:	50.0	m
Maximum Head:	59.8	m
Minimum Head:	41.8	m
Average Head:	51.8	m
Maximum Power Discharge:	880	m3/s
Ensured Discharge:	210	m3/s
Annual Average Energy Production:	1,700	GWh
Working Time in Installed Capacity:	4,250	Hours
Number of Generate Units:	4	

III.3.7 Construction Volume

Earthwork:	3.033	million m3
Stonework:	3.582	million m3
Embanking:	4.895	million m3
Rockfill and sand:	4.699	million m3
Concrete:	0.457	million m3
Reinforced cement (meters in length):	64,800	m
Steel Frame and Equipment:	18.5	thousand tons

III.3.8 Construction Cost (in 1984)

Total Cost:	6,899	million VND
Total Cost without Return Cost:	6,808	million VND
Unit Cost per 1 KW of Installed Capacity:	17,900	VND
Unit Cost per 1 KWh:	4,000	VND
Unit Price:	80	VND

IV. OPERATION REGULATION OF TRI AN HYDRO-POWER PLANT

The Tri An hydro-power plant with the installed capacity of

400 MW and annual average energy production of 1,700 GWh, that is the largest energy plant in the South, under only Hoa Binh hydro-power plant in the North. This is the water resources multi-purpose project, in which, mainly duty is electrical generating.

In terms of energy, in the flood season, the plant provides electrical energy for the base generation to take advantage of plentiful water source. In dry season, the plant transfers to provide efficiently the peak generation to meet the regionwide (or nationwide after super-electrical transmission 500 KV completed) increasing demand, thus help stabilizing the region's power system.

Base on the above purposes, the operation of reservoir is to cut or decrease flood water discharge in the rainfall season, increase water discharge to downstream, improving salinity intrusion and fresh water supply conditions in the lower part.

The Tri An reservoir is designed with the annual operation regulation at frequency of 10% dry year. A normal operation regulation of it is following:

- For a inflow equivalence of 10% dry year, the reservoir has to storage fully to HWL (62 m).
- A inflow volume of each year will be used finish in the year.
- The reservoir starts storing from June and fills latest in the end of November or begin of December.
- In dry season, beside the base inflow of catchment, a water volume will be discharge from reservoir to generate and provide for other requirements in the lower. In May, the reservoir has to reduce to LWL for next flood season.

Minimum Discharge in the low flow season (during lowest flow time) for some frequencies as below:

Frequency(%)	10	50	75	90	95
Qmin(m3/s)	270	245	228	217	210

V. EXISTING OPERATION

From 1988- the first year of generation- to the moment, the reservoir and power plant have been operated continuously as

designed. Because of operation in the peak of energy demand in dry season, during from 1988-1991, there were some hours at night, the plant stopped. Therefore, from 1991 to the moment, the plant are operated continuously. In the next time, when the super electrical transmission 500 KV will be done, the Tri An plant would have more comfortable conditions in operation, so that, it would be considered more detail for other benefits.

Data of inflow and outflow (including to power plant and to spillway) are presented in the following tables:

NATURAL MONTHLY DISCHARGE AT TRI AN IN CMS
FROM 1988 TO 1992

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
1988	141.00	86.30	60.50	72.30	101.00	368.00	477.00	590.00	680.00	1163.00	688.00	219.00	387.18
1989	109.00	64.00	77.50	94.80	258.00	451.00	956.00	1145.00	1397.00	1076.00	390.00	168.00	515.53
1990	98.30	63.00	66.20	61.20	78.10	745.00	677.00	1437.00	1737.00	1146.00	775.00	264.00	595.65
1991	115.0	56.0	34.9	56.9	110.6	200.5	772.2	1231.6	1660.4	1181.4	386.6	147.5	496.1
1992	85.4	50.6	34.0	79.6	108.7	461.3	607.5	1374.5	1309.0	973.3	418.9	169.6	472.7

MONTHLY TURBINE DISCHARGE IN CMS
FROM 1988 TO 1992

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
1988	0.00	0.00	0.00	152.00	214.37	217.50	218.00	221.87	213.70	199.00	254.08	285.47	164.67
1989	266.14	175.48	188.00	269.24	334.70	468.27	368.65	575.06	506.28	467.70	362.39	248.45	352.57
1990	261.99	246.22	215.50	220.37	154.03	363.22	571.23	646.34	666.60	668.80	593.50	242.43	404.19
1991	224.65	247.17	268.01	295.70	233.79	232.38	555.86	767.88	767.78	771.45	414.42	309.91	424.08
1992	257.83	253.09	186.84	210.39	138.56	341.77	617.00	716.84	801.26	752.03	399.46	204.43	406.63

MONTHLY SPILLWAY DISCHARGE IN CMS
FROM 1988 TO 1992

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
1988	0.00	0.00	0.00	0.00	0.00	324.29	260.51	209.34	208.62	495.32	308.74	0.00	153.59
1989	0.00	0.00	0.00	0.00	0.00	176.23	0.00	515.05	489.94	529.95	1.53	0.00	145.35
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	442.05	703.26	453.90	126.05	0.00	146.42
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	574.40	338.99	0.00	0.00	77.52
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	303.21	151.63	1.42	0.00	38.72

TOTAL DOWNSTREAM RELEASE DISCHARGE IN CMS
FROM 1988 TO 1992

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
1988	0.00	0.00	0.00	152.00	214.37	541.79	478.51	431.21	422.32	694.32	562.82	285.47	318.26
1989	266.14	175.48	188.00	269.24	334.70	644.50	368.65	1090.11	996.22	997.65	363.92	248.45	497.92
1990	261.99	246.22	215.50	220.37	154.03	363.22	571.23	1088.39	1369.86	1122.70	719.55	242.43	550.61
1991	224.65	247.17	268.01	295.70	233.79	232.38	555.86	767.88	1342.18	1110.44	414.42	309.91	501.60
1992	257.83	253.09	186.84	210.39	138.56	341.77	617.00	716.84	1104.47	903.66	400.88	204.43	445.35

DIFFERENCE BETWEEN INFLOW ANF OUTFLOW OF TRI AN RESERVOIR
FROM 1988 TO 1992

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	MEAN
1988	141.00	86.30	60.50	-79.70	-113.37	-173.79	-1.51	158.79	257.68	468.68	125.18	-66.47	68.91
1989	-157.14	-111.48	-110.50	-174.44	-76.70	-193.50	587.35	54.89	400.78	78.35	26.08	-80.45	17.60
1990	-163.69	-183.22	-149.30	-159.17	-75.93	381.78	105.77	348.61	367.14	23.30	55.45	21.57	45.04
1991	-109.65	-191.17	-233.11	-238.80	-123.19	-31.88	216.34	463.72	318.22	70.96	-27.82	-162.41	-5.50
1992	-172.43	-202.49	-152.84	-130.79	-29.86	119.53	-9.50	657.66	204.53	69.64	18.02	-34.83	27.35

Data source: Tri An Hydro-Power Plant Management Office

DAU TIENG
IRRIGATION SYSTEM PROJECT

I. SUMMARY PROJECT

I.1 Location-Project Structures

The Dau Tieng Project is one of the large Water Resources Development Projects in Viet Nam, with the main purpose for irrigation. The head construction works of project are located in the Dau Tieng river, belonging to Tay Ninh and Song Be provinces. The main dam has coordination at 11° 18' N-Latitude and 106° 20' E-Longitude, far from Ho Chi Minh city 93 km in road or 76 km in fly distance. The irrigated areas lie mainly in Tay Ninh and Ho Chi Minh city.

The Dau Tieng project includes the reservoir with the catchment area of 2,700 kmsq, the head construction works system (main dam, sub-dam, spillway, two sluices), and the intaking canal system (East canal and West canal). According to the project classification, the Dau Tieng project is belongs to the first level.

I.2 Project Purposes

On May, 18, 1979, the project was submitted by the Prime Council of Viet Nam Government with the purposes as following:

- Reservoir is operated with the curry over storage regulation regime.

- Irrigation for 172,000 ha of Tay Ninh, in which:
  + Gravity: 67,000 ha
  + Pumping: 105,000 ha

- Water supplying for domestic and salt water intrusion in the Sai Gon river during 3 months (from February to April) is 100 million cms.

On November 1991, The Ministry of Water Resources was presented the Adjustment Feasibility Project with the purposes follows:

- Reservoir still is operated with the curry over storage regulation regime.

- Irrigation for 158 462 ha of Tay Ninh, Ho Chi Minh city, Long An and Song Be, distributed as following:
  + Direct irrigation: 87,393 ha, in which:
    * Tay ninh : 72,831 ha
    * Ho Chi Minh City: 14,562 ha

  + Indirect irrigation: 71,069 ha, in which:
    * Tay Ninh: 16,639 ha

* Ho Chi Minh city: 28,930 ha
* Long An: 21,500 ha
* Song Be: 4,000 ha

- Fresh water discharge for salinity intrusion in the Sai Gon river during 3 months (from February to April) is 157.8 million m3.

- Fresh water supplying for Ben Than Water Plant in Sai Gon river in 7 months, from January to July, is 92 million cm.

I.3 Project Descriptions

I.3.1 Reservoir

- High Water Level (HWL):	24.40	m
- Low Water Level (LWL):	17.00	m
- Flood Control Water Level (FWL):	25.10	m
- Effective Storage:	1,056	million m3
- Water Surface Area at HWL:	270	km2

I.3.2 Main Dam

- Earth Dam		
- Crest Length:	1,100	m
- Crest Elevation:	27.5	m
- Crest Width:	8	m

- Upstream slop is reinforced by concrete tables and downstream is by rock and grass.

I.3.2 Sub-Dam

- Linked with the main dam on the right.		
- Crest Length:	27,000	m
- Crest Elevation:	27.0	m
- Crest Width:	5	m

- Upstream slop is reinforced by rock and downstream slop is by grass.

I.3.3 Spillway

- Wide Crest Threshold Spillway		
- Maximum Drain Capacity Discharge:	2,800	m3/s
- Total Width:	60	m
- Number of gates:	6	
- Height of gate:	6	m
- Gate is curviform of steel.		
- Threshold Elevation:	14.0	m

- Spilling by injection ditch, flood drain canal is 1,500 m long.

- Sluices: 2
  Sluice I is located on right dam and sluice II is on left dam, with dimension:
  + Threshold Elevation: 13.0 m
  + Number of gates: 3. Each: 3 m wide, 4 m high.

- East Canal: Received water from sluice I, irrigating for Go Dau, Trang Bang (Tay Ninh) and Cu Chi (Ho Chi Minh city).
  + Designed Discharge: 50.17 m3/s
  + Bottom Width: 18 m
  + Water Depth: 3.79 m
  + Bank Width: 2-4 m

- West Canal: Received water from sluice II, irrigating for other areas of Tay Ninh and release to the East Vaico by drainage canal Phuoc Hoi-Ben Dinh.
  + Designed Discharge: 71.90 m3/s
  + Bottom Width: 25 m
  + Water Depth: 3.0 m
  + Bank Width: 4-6 m

I.4 Project Implementation

The project was prepared from 1978 and the sub-dam was constructed first in 1979.

The official opening ceremony was held in 1981. For the dam construction, the first stage was finished in January 1983 and the second one was finished in December 1983.

The reservoir was started storing water from the rainy season in 1984.

The head structure works and the main canals were done from 1985. At the moment, the project have operated 7 years. However, the secondary and tertiary canal system are not completed, therefore, the effective of project is not high.

II. PROJECT HYDROLOGICAL STUDY

The hydrological data in Sai Gon basin at Dau Tieng is very little. There were only 3 years of measured data. The hydrological characteristics were estimated from rainfall data and similar basins, so the results were not very good.

In order to safe for construction works, in designing, they chosen the following features:

- Annual Average Flow: (It was chosen with lower tendency)

+ Annual Average Discharge: 58.5 m3/s
+ Annual Average Module: 21.65 l/skm2
+ Annual Average Volume: 1.844 billion m3

- Flood Design: (It was chosen with higher tendency)
  + Maximum Flood Peak at frequency 1%: 4,800 m3/s

III. PROJECT DEVELOPMENT STAGES

According to the Adjustment Feasibility Study in November 1991, base on the investment capacity to complete and enlarge irrigated areas, the project is divided into 3 development stages as following:

III.1 Stage I: From 1992 to 1995. The project purposes:

- Irrigating to 81,139 ha, in which:
  + Directly: 40,000 ha
  + Indirectly: 41,139 ha
    * Along Sai Gon river: 13,000 ha
    * Along East VaiCo river: 28,139 ha
- Releasing to Sai Gon river downstream:
  + For salinity intrusion during 3 months from January to April: 157 million m3 (20 m3/s)
  + For water supply to Ben Than Water Plant during 7 months, from January to July: 92 million m3 (12 m3/s)

III.2 Stage II: From 1996 to 2005. The project purposes:

- Irrigating to 125,186 ha, in which:
  + Directly: 58,107 ha
  + Indirectly: 67,139 ha
    * Along Sai Gon river: 29,000 ha
    * Along East Vaico river: 28,139 ha
- Releasing to Sai Gon river downstream as stage I.

III.3 Stage III: After 2005 year. The stage is established with condition of the Phuoc Hoa project in Be river which would be done before 2005 year. While, the Dau Tieng would not release water to Sai Gon downstream as stages I and II and would not irrigate to the areas along Sai Gon river (indirect areas, only). In the stage, the project has purposes:

- Irrigating to 125,532 ha, in which:
  + Directly: 87,383 ha
  + Indirectly: 38,139 ha

IV. EXISTING OPERATION

As above, the reservoir started storing water from the rainy season in 1984. The daily recorded data from 1984 to 1990 show that:

IV.1 Reservoir Water Level

- In 1985, stored to water level at 23.51 m on December, 16
- In 1986, stored to water level at 24.00 m on December, 06
- In 1987, stored to water level at 22.65 m on December, 11
- In 1988, stored to water level at 23.59 m on November, 26
- In 1989, stored to water level at 24.11 m on November, 25
- In 1990, stored to water level at 24.37 m.

IV.2 Flood Flow

- October 1984, maximum discharge was 265 m3/s
- October 1985, maximum discharge was 350 m3/s
- June 1988, maximum discharge was 102 m3/s
- June 1989, maximum discharge was 168 m3/s
- June 1990, maximum discharge was 265 m3/s

Except the 1984 flood was released to downstream, others were stored in reservoir.

IV.3 Irrigation and Salinity Intrusion Release in Sai Gon River

The recorded data collected from Dau Tieng Project Management Office are listed as the table following:

RELEASE DISCHARGE OF DAU TIENG RESERVOIR IN CMS
FROM 1988 TO 1991

YEAR	ITEMS	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1988	SPILLWAY	3.87	17.90	20.00	25.50	15.00	11.80	8.71	0.00	0.00	0.00	0.00	0.00
	EAST CANAL												
	WEST CANAL												
1989	SPILLWAY	0.00	0.00	15.50	20.00	20.00	20.00	60.00	45.20	52.00	116.00	0.00	0.00
	EAST CANAL	0.00	0.00	0.00	0.00	13.00	13.00	4.20	2.61	2.00	0.00	0.00	0.08
	WEST CANAL	0.00	0.00	0.00	0.00	13.00	13.00	11.50	0.00	0.21	0.00	0.53	0.00
1990	SPILLWAY	0.00	0.00	20.80	30.00	33.90	30.00	35.30	1.20	125.80	16.80	14.70	0.00
	EAST CANAL	9.80	12.80	18.20	20.00	14.10	12.30	9.80	5.48	4.58	0.00	0.00	
	WEST CANAL	6.68	8.20	11.20	10.10	19.30	9.80	8.70	2.07	4.50	10.70	8.75	4.30
1991	SPILLWAY	0.13	17.90	14.40	32.00	25.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00
	EAST CANAL	22.10	2.52	20.50	4.53	14.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	WEST CANAL	12.40	3.14	20.00	2.90	14.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THAC MO
HYDRO-POWER PLANT PROJECT

I. NATURAL CONDITIONS

I.1 General

The Be river is one of large branches in the Dong Nai river system. It is generated in mountains of the Snaro highland, which is on the South of Dak Lak highland and flows to the confluence with the Dong Nai river, which is far from Tri An 7 km to upstream. It's principle direction is North-South. Almost of the Be basin is in Song Be province.

The Be river has the catchment area of 7,635 kmsq and the length of 370 km.

Because it is generated from the high mountains with remarkable variations in elevation, the Be river is one of three rivers that have hydro-power potential, after the main Dong Nai and La Nga. Thac Mo is the first step in the hydro-power cascade system of Be river. The Thac Mo hydro-power plant has been constructed since 1990 and it will be operated a first generation unit in 1994.

I.2 Project Location

The Thac Mo hydro-power plant is located in the Be river upstream, belonging to Phuoc Long district, Song Be province, lies in a Ba Ra mountain foot on the North-East.

The head works has coordinate of 11° 47' - 11° 52' N-Latitude and 107° 01' - 107° 03' E-Longitude, next to Phuoc Binh village on the right of the main river, that is far from Ho Chi Minh city 160 km in road and 125 km in fly bird.

I.3 Meteo-Hydrological Conditions

The Thac Mo Basin lies in the monsoon tropical region. The average annual temperature is 25 °C and the wind velocity 3-4 m/s.

Annual, the rainfall is divided into two seasons:

- The rainy season begins May to ends November, occupies 85-90% of the total annual rainfall.
- The dry season lasts from December to April, with the remainder of 10-15%.

Annual average rainfall in the basin is about 2,530 mm, higher from August to September and lower from January to February.

Flow in the river is direct production of the rainfall

regime, thus, it also is distinguished into two seasons.

The flood season begins from June (later than rainy season one month), and ends in November. The highest flow usually occur from August to September.

The dry season lasts from December to May. The lowest flow usually appear from March to April.

The hydrological features of the project were estimated from the data of the Phuoc Long hydrological station, which is located at downstream of the main dam some kilometre (15 years of measured data and was lasted to 34 years by TANK model).

II. PROJECT PURPOSES

The Thac Mo project is the integration water resources development project, in which, the principle purpose is electrical generation of capacity of 150 MW and annual average energy of 600 GWh, it will contribute to strengthen the power source of electrical system in the South. Thanks to the large effective with 1.220 billion cm, the Thac Mo reservoir is the carry over storage one. Therefore, in operation, Thac Mo, Tri An and Da Nhim plants will provide efficiently the peak generation of power demand.

Beside of electrical generation, with ensured flow of 59.0 cms, the project will contribute to increase flow in the low flow season in the main Dong Nai river in downstream of Tri An, making more perfectly conditions in salinity intrusion and fresh water supply for downstream areas, when Phuoc Hoa project is not constructed yet. In the case of Phuoc Hoa constructed, thanks to the large storage capacity, Phuoc Hoa project's dimensions would be reduced but it still ensure designed capacity with the irrigation area of 40,000 ha in Song Be province, intaking water to Sai Gon river to irrigate 33,000 ha, and water supply 7 m3/s for Ho Chi Minh city from Ben Than refinery water plant.

With the water surface of 106 kmsq at HWL (218 m), the reservoir will make good conditions for fish cultivation and tourism.

III. PROJECT DESCRIPTIONS

III.1 Hydrological Features

- Catchment Area:	2,200	km2
- Annual Average Discharge:	85.7	m3/s
- Annual Average Module:	38.95	l/skm2
- Annual Average Run-off:	1,231	mm
- Annual Average Volume:	2,720	million m3

- Designed Flood Peak at 0.5%:	4,900	m3/s
- Designed Flood Peak at 1%:	4,180	m3/s
- Designed Flood Peak at 10%:	2,100	m3/s
- Low Flow Season Average Discharge:	18.6	m3/s
- Daily Measured Lowest Flow Discharge:	1.31	m3/s

III.2 Reservoir

- High Water Level (HWL):	218	m
- Flood Control Water Level (FWL) at 0.5%:	220	m
- Low Water level (LWL):	197	m
- Reservoir Capacity:	1.370	billion m3
- Storage Capacity at LWL:	150	million m3
- Effective Storage Capacity:	1.220	billion m3
In which:		
+ Yearly Capacity:	717.5	million m3
+ Carry Over Capacity:	502.5	million m3
- Water Surface Area at HWL:	106	km2
- Water Surface Area at LWL:	15	km2

III.3 Structure Works

III.3.1 Dam

a. Main Dam

- Crest Elevation:	223	m
- Crest Length:	444	m
- Highest:	45	m
- Crest Width:	6	m

b. Sub-Dam

- Crest Elevation:	222.5	m
- Crest Length:	3,000	m
- Highest:	49	m
- Crest Width:	6	m

c. Concrete Spillway

- Width:	44	m
- Number of gates:	4	
- Threshold Elevation:	207	m
- Drain Capacity of 0.5% flood:	3,000	m3/s

III.3.2 Linking Canal (from Main Dam to Sub-Dam)

- Maximum Canal Discharge:	196	m3/s

- Canal Length:	1,354	m

III.3.3 Water Intaking Structures

- Dimensions of sluice:	2 (7 x 6.6)	m2
- Threshold Elevation:	185	m
- Diameter of Pressure Pipes:	4.6	m
- Length of Pressure Pipes:	276	m
- Number of Pressure Pipes:	2	

III.4 Power Station

- Maximum Power Flow Capacity:	196	m3/s
- Ensured Flow:	59	m3/s
- Maximum Generation Head:	105.5	m
- Minimum Generation Head:	82.0	m
- Average Generation Head:	97.7	m
- Designed Generation Head:	90.0	m
- Installed Capacity:	150	MW
- Annual Average Energy Production:	600	GWh
- Energy Production for Dry Year:	470	GWh
- Number of Generation Units:	2	
- Working Time with Installed Capacity:	4,000	Hours

III.5 Construction Volume

- Earthworks:	13.326	million m3
- Stoneworks:	0.544	million m3
- Rockfill:	0.229	million m3
- Concrete:	0.136	million m3
- Rock Masonry	0.259	million m3
- Injection of Cement (in length):	13,200	m
- Steel Frame and Equipments:	7.012	thousand ton
- Construction Steel:	10.429	thousand ton

III.6 Investment Cost

- Total Cost:	633.569	billion VND
- Total Cost Includes Transmission:	684.372	billion VND
- Annual Maintenance:	9.606	billion VND
- Capacity Unit Cost:	4.224	million VND
- Energy Unit Cost:	1,056	VND/KWh
- Internal of Return Rate IRR:	20	%
- B/C Rate:	2.02	
- NPV:	623.345	billion VND
- Energy Price:	144	VND/KWh

IV. OPERATION REGULATION

The operation regulation of Thac Mo Power-Hydro Plant has similar points with Tri An plant.

Thanks to the carry over storage regulation of Thac Mo reservoir, in operation, the plant usually participate in the peak generation in the energy load system.

Annual, the reservoir operates mainly of yearly storage (717.5 million cm), with water level from 204.9 m to 218 m (HWL). In the case of dry year, according to existing conditions, the reservoir would be operated to dead water level (LWL). In the case of 90% designed year, water level in reservoir would be decreased to LWL to ensure power flow of 55.0 cms.

According to operation regulation, annual, the reservoir begins storing in July and at the end of November it has to be filled at HWL. From December to June, flow for generation would include the natural inflow and reservoir.

The operation calculation results with typical dry years as following:

Frequencies	Dec.	Jan.	Feb.	Mar.	Apr.	May
50%	63.0	59.0	59.0	59.0	64.0	70.6
75%	59.0	59.0	59.0	59.0	59.0	63.8
90%	59.0	59.0	59.0	59.0	59.0	59.0
95%	59.0	59.0	59.0	59.0	59.0	59.0

Remarks:

- 75% year is equivalence with 25% dry year.
- 90% year is equivalence with 10% dry year.
- 95% year is equivalence with 5% dry year.

5.3 Proposed Projets

b) Upper Dong Nai

The proposed Upper Dongnai to divert water to Song Luy irrigation is the Bon Ron hydro-power plant.

Its main features are :

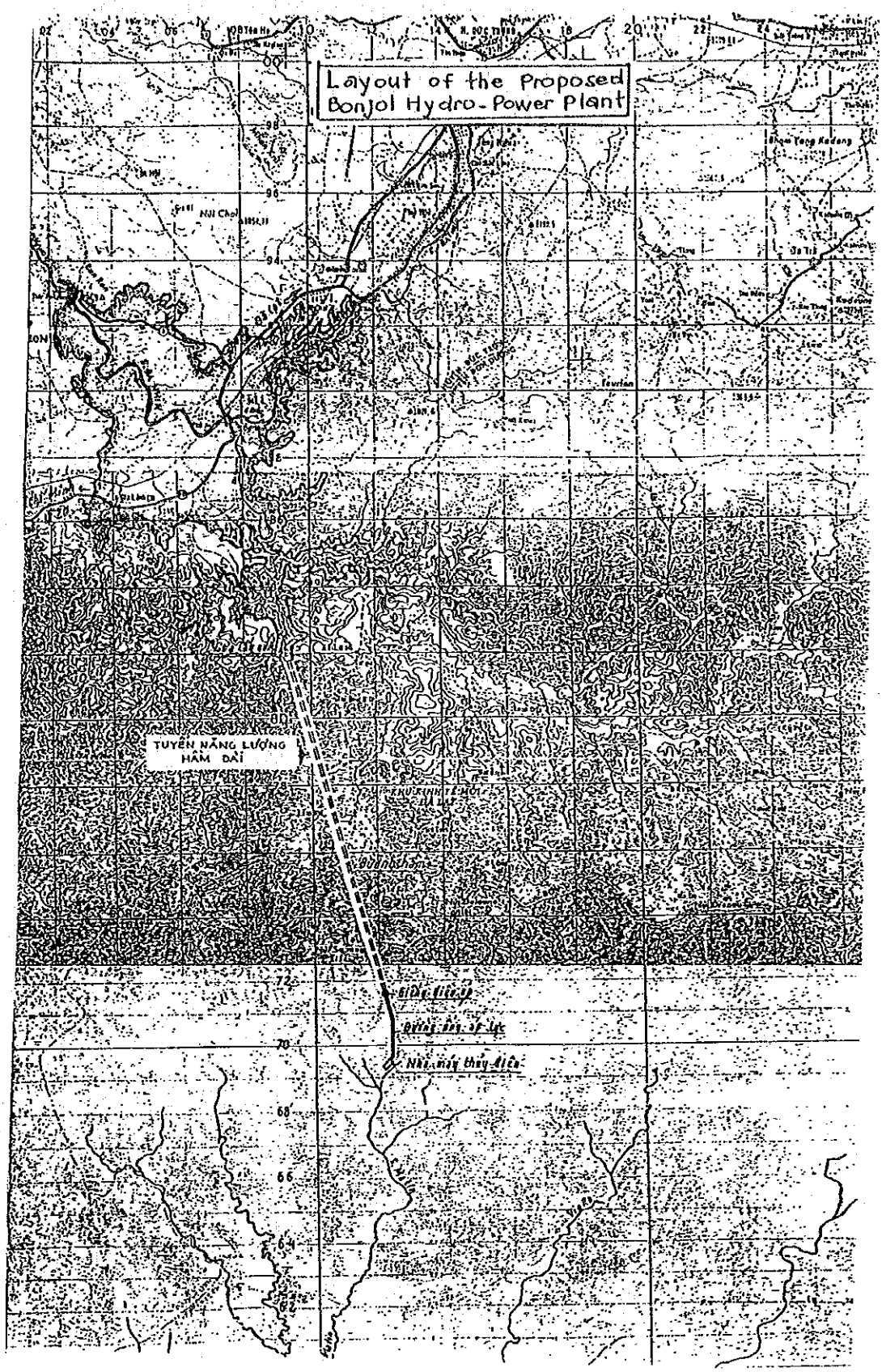
1. Location :

1.1 Dam site : On the Da Nhim river, 1 km upstream the Pongour water fall , including the earth dam and the concrete spillway.

1.2 Power Water Way : First, the Intake is located at the Ta In village (Duc Trong district, Lam Dong province) connected with the 11 km pressure tunnel lying under the Annamite range (the diameter is 4.5m). Next is the 2 km penstock line with 2.5 m average diameter . Finally the power plant is located at the upper of Song Luy with the tailwater level of about 200 m.

2. Technical parameters :

- Catchment area (excluding Dran)	1,224 km2
- Annual average discharge Qo	28 m3/s
- Q 95%	16 m3/s
- Annual average volume Wo	885 million m3
Reservoir :	
- High water level	865 m
- Low water level	850 m
- Water surface area at HWL	30.9 km2
- Storage capacity	
. Gross	486 million m3
. Net	331 million m3
- Tailwater level	197 m
- Maximum net head	668 m
- Minimum net head	595 m
- Calculated net head	596 m
- Maximum discharge	60 m3/s
- Installed Capacity	300 Mw
- Firm Capacity	80 Mw
- Annual energy output	1,200 Gwh
- Irrigation aera (Song Luy Irrigation)	20,000 ha


Layout of the Proposed
Bonjol Hydro-Power Plant
TUYẾN NĂNG LƯỢNG
HẦM DÀI

6.a

No	Station	Coordination	Period of observations	Status	Ri (mm)											
			year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
1	AN LOC	107.12'D-10.56'B	1915-1944; 1949-1974	Stop	15.1	8.6	27.9	94.2	226.3	298.6	355.4	370.7	394.8	300.0	115.7	41.3	2248.
2	BAO LOC	107.12'D-10.56'B	1929;1933-1944;1950-1992	Continue	60.3	48.9	109.0	186.0	235.4	310.3	419.0	463.0	411.9	313.5	168.8	79.3	2805.
3	BEN CAT	106.35'D-11.09'B	1928-1941;1952-1966;1980-1992	"	11.8	6.8	24.7	78.8	230.8	248.8	306.6	305.4	324.4	286.6	123.5	26.4	1974.
4	BEN CUI	106.20'D-11.16'B	1927-1944;1950-1966;1973-1974	Stop	33.2	8.2	30.9	97.9	256.8	273.9	276.4	445.9	366.8	308.0	113.4	35.6	2247.
5	BEN LUC		1982-1992	Continue	2.6	1.3	6.0	59.2	140.6	239.4	217.5	241.1	277.0	247.2	100.2	14.7	1546.
6	BIEN HOA	106.49'D-10.57'B	1907-1944;1958-1992	"	6.5	4.2	12.9	47.9	165.0	239.4	278.7	279.4	289.8	237.8	96.6	28.0	1686.
7	BINH BA	107.14'D-10.37'B	1926-1944;1946-1974;1978-1992	"	4.0	0.6	6.3	37.4	228.1	298.0	345.6	322.8	342.6	240.5	84.7	27.5	1938.
8	BINH LOC		1929-1944;1948-1974	Stop	17.2	14.9	29.9	92.9	239.7	286.3	362.1	364.9	380.3	300.3	98.1	50.6	2237.
9	BINH LONG	106.36'D-11.38'B	1914-1916;1920-1943;1955-1956;1960-1974;1977-1992	Continue	9.6	3.1	22.6	89.9	202.4	265.0	312.8	342.4	388.7	262.7	99.5	25.3	2024.
10	BOBLA	108.01'D-11.35'B	1931-1944;1957-1968;1977-1992	"	18.9	15.0	51.8	93.1	157.2	154.0	186.2	203.5	246.9	229.2	121.0	61.3	1538.
11	CA NA	108.47'D-11.18'B	1939-1944;1953-1968;1977-1979-1984-1992	"	7.9	1.2	4.6	23.0	103.7	85.8	58.8	60.0	158.7	176.2	135.1	56.5	871.
12	CAN TAM	107.09'D-10.51'B (185m	1926-1944;1948-1974	Stop	13.6	6.3	14.1	76.9	213.3	311.1	370.8	381.4	383.6	293.2	98.7	37.0	2200.
13	CAN DANG	106.00'D-11.30'B	1977-1992	Continue	13.7	6.3	17.7	76.7	177.1	230.9	239.8	255.8	267.4	254.4	97.6	12.2	1649.
14	CAN GIO	106.59'D-10.24'B	1978-1992	"	0.0	0.0	2.9	11.3	95.7	151.6	167.0	180.8	157.0	155.8	29.8	4.4	956.
15	CAT TIEN		1985-1992	"	11.7	11.8	44.4	115.1	218.9	397.5	416.3	538.0	479.0	338.4	126.1	34.4	2731.
16	CHON THANH	106.37'D-11.24'B	1979-1992	"	7.7	2.7	13.6	68.5	142.4	843.3	224.8	290.2	359.1	223.0	110.8	2.4	2288.
17	CON SON	Dao Con Son	1907-1908;1933-1939;1948-1992	"	12.3	5.2	8.7	35.1	216.9	315.7	261.5	311.5	326.6	341.9	199.5	55.5	2090.
18	DA AN PIN	107.53'D-11.32'B	1961-1972	Stop	30.5	38.8	84.6	167.7	207.7	211.8	368.4	256.6	343.3	279.9	129.9	60.3	2179.
19	DA LAT	108.26'D-11.57'B	1910-1911;1918;1921-1944;1954-1974;1977-1992	Continue	7.1	18.2	59.4	162.1	206.9	191.2	231.3	236.4	310.2	256.0	90.2	26.3	1795.
20	DA TEH		1979;1982-1992	"	2.4	1.0	35.1	127.2	271.7	407.3	467.5	617.5	370.3	329.4	165.4	52.1	2846.
21	DAI NGA	107.52'D-11.32'B (800m	1973-1974;1978-1992	"	26.4	31.5	79.8	153.0	215.9	282.5	257.1	381.5	292.3	285.0	154.1	70.9	2228.
22	DAM'RONG	107.50'D-11.31'B (800m	1957-1974;1987	Stop	34.7	36.6	98.7	158.9	220.7	265.8	365.1	370.0	363.4	288.0	142.7	78.0	2422.
23	DAU GIAY		1920-1944;1948-1974	"	16.2	12.2	24.0	90.6	231.5	297.7	361.5	353.9	395.1	287.1	104.9	44.2	2218.9
24	DAU TIENG	106.20'D-11.18'B	1927-1944;1951-1992	Continue	11.9	8.0	25.4	98.7	227.7	251.0	299.9	285.2	348.7	301.3	127.6	39.9	2025.
25	DI LINH	108.05'D-11.35'B	1907-1907;1911;1928-1944;1950-1974;1978-1992	"	20.4	23.7	52.8	130.6	194.3	234.4	271.1	285.1	304.3	245.7	90.9	39.1	1892.
26	DJIRAMOUR	107.57'D-11.32'B (800m	1933-1943;1957-1974	Stop	28.8	28.7	75.1	143.8	210.1	206.9	301.6	288.3	316.3	279.3	110.5	58.8	2048.
27	DJIRATO	107.58'D-11.33'B (960m	1960-1970	"	27.2	13.2	74.9	113.6	214.6	220.1	305.3	288.2	316.9	266.2	126.7	73.2	2060.
28	DON DUONG		1949-1973;1984-1986	"	12.2	6.9	20.9	62.6	212.9	170.0	161.1	191.8	297.9	321.3	160.0	61.8	1679.
29	DONG ME	108.32'D-11.40'B	1960-1974	"	9.5	0.0	7.2	13.3	100.8	99.3	100.3	83.3	174.7	154.7	66.1	52.5	861.
30	DONG MOI	108.25'D-11.12'B	1959-1963	"	0.3	0.0	0.0	18.5	118.0	170.7	136.2	167.9	151.0	219.7	40.0	4.1	1026.
31	DONG PHU	106.54'D-11.32'B	1980;1984-1992	Continue	11.8	6.3	23.6	139.1	262.0	361.9	330.1	459.5	451.0	357.6	121.7	11.3	2535.
32	GO DAU		1979-1992	"	7.3	3.7	18.7	82.5	187.7	200.8	215.4	179.4	277.6	429.6	112.8	21.5	1737.
33	HAN TAN	107.45'D-10.41'B	1927-1941;1959-1974;1978-1992	"	0.2	1.0	6.8	39.0	190.6	231.3	299.7	269.2	285.0	208.9	53.3	11.9	1597.
34	HOC MON	106.36'D-10.53'B	1977-1992	"	11.5	1.2	12.0	49.5	158.5	215.1	237.6	230.1	247.8	214.1	112.6	21.0	1510.
35	LA BUONG		1978-1992	"	4.0	11.4	8.4	66.3	182.6	255.0	294.2	300.9	311.4	243.3	144.7	45.9	1868.
36	LIEN KHUONG	108.23'D-11.45'B (760m	1949-1974;1978-1992	"	4.7	17.2	38.8	105.1	217.2	196.5	223.2	216.5	288.8	238.3	90.2	27.5	1666.

37	LOC MINH (SB)	106.35'D-11.49'B	1912-1943;1963-1971;1979-1992	"	8.5	11.7	28.2	107.0	239.0	298.8	335.9	364.6	390.9	278.9	96.6	32.1	2192.3
38	LOC MINH (TN)	Tren Rach Sanh Doi	1976-1983	Stop	1.2	11.3	7.0	98.7	228.8	257.4	282.0	312.8	401.7	259.6	115.1	13.8	1989.3
39	LONG THANH	106.56'D-10.45'B	1929-1944;1949-1975;1979;1985-1992	Continue	15.0	6.5	14.7	65.6	216.1	288.2	324.3	298.6	350.2	275.0	105.9	42.3	2002.5
40	MADAGUI		1978-1992	"	16.4	3.7	22.9	63.2	259.4	457.7	505.2	622.2	435.8	310.5	131.2	41.4	2869.8
41	MINH RONG	107.49'D-11.36'B (850m	1952-1975	Stop	45.9	54.3	134.7	182.8	269.0	268.2	315.5	399.0	358.2	292.9	122.9	67.7	2511.1
42	NHA BE		1960-1968;1979-1992	Continue	7.2	0.1	5.1	21.6	175.0	257.4	223.2	214.0	246.5	172.7	64.7	13.9	1401.4
43	NHA HO	108.54'D-11.40'B	1961-1967;1980-1992	"	8.8	2.3	6.4	22.3	93.5	55.8	67.9	63.7	142.1	135.0	106.3	79.4	783.7
44	PHAN LY CHAM		1928-1941;1960-1974;1979	Stop	2.0	0.8	0.9	20.8	110.4	79.6	73.3	68.3	129.7	127.1	49.1	21.4	683.3
45	PHAN RANG	109.00'D-11.40'B	1927-1944;1958-1974;1979-1992	Continue	5.8	1.1	6.2	13.9	58.0	48.1	41.0	47.8	126.1	164.1	145.2	54.4	711.8
46	PHAN THIET	108.06'D-10.56'B	1925-1943;1957-1974;1976-1992	"	0.9	0.4	5.0	29.1	138.7	148.2	174.6	175.2	194.5	181.1	50.5	12.8	1110.9
47	PHU DIEN	X.Phu Dien - H.Tan Phu	1987-1992	"	3.1	14.1	29.6	48.4	195.3	434.4	291.7	457.4	432.8	220.5	142.3	7.9	2277.4
48	PHU HIEP	108.30'D-11.43'B (990m	1928-1944;1950-1972;1978;1982-1992	"	5.9	14.6	37.8	97.9	183.2	162.1	180.5	182.6	263.4	240.1	82.8	35.5	1486.4
49	PHUOC HOA	106.46'D-11.14'B	1976-1992	"	3.8	8.3	20.6	69.4	189.6	299.4	296.9	362.6	351.0	248.5	114.9	16.6	1981.4
50	PHUOC LE	107.10'D-10.29'B	1914-1944;1960-1970;1978-1992	"	1.3	1.0	7.1	28.0	175.4	259.3	291.5	248.4	275.0	219.6	66.4	21.0	1594.1
51	PHUOC LONG	106.59'D-11.50'B	1978-1992	"	6.4	12.2	30.7	100.7	269.7	385.9	381.0	482.1	435.6	290.3	116.3	15.7	2526.6
52	SO SAO	X.Tan Dinh - H.Ben Cat	1914-1944;1959-1973;1977-1983	"	13.9	2.3	22.1	47.4	216.9	273.9	285.3	284.7	322.8	245.7	125.4	41.7	1882.3
53	SONG LUY	108.21'D-11.12'B	1963;1978-1992	"	0.0	0.0	23.6	14.7	100.4	159.1	121.0	135.3	160.6	187.1	64.6	4.2	970.7
54	SONG MAO	108.30'D-11.15'B	1961-1966;1972;1984-1992	"	0.0	0.0	5.4	9.4	116.6	115.5	108.5	98.8	162.1	115.5	45.1	6.4	783.2
55	SONG PHA	108.42'D-11.50'B	1962;1965-1966;1974-1982;1992	"	3.8	2.2	15.7	54.9	131.7	138.1	163.5	225.1	328.8	375.0	251.6	50.2	1740.6
56	SUOI VANG	108.22'D-11.59'B	1979-1985	Stop	21.9	34.2	85.2	225.8	260.1	306.0	251.3	312.6	314.2	328.2	108.6	13.8	2261.9
57	TA LAI	107.22'D-11.22'B	1978-1980;1985-1992	Continue	8.8	14.5	47.6	105.3	251.0	427.5	392.6	542.6	437.5	332.6	144.0	38.6	2742.7
58	TA PAO	107.43'D-11.08'B	1976-1992	"	5.9	5.8	32.4	56.3	229.8	403.8	436.6	551.0	378.7	261.0	90.8	11.8	2453.9
59	TAN MY	108.49'D-11.23'B	1978-1992	"	1.6	2.7	20.2	30.8	92.2	100.6	106.2	111.9	178.7	194.4	135.2	30.9	1005.4
60	TAN RAI		1978-1992	"	25.2	40.2	81.8	207.8	223.6	361.3	316.3	590.2	388.3	255.4	121.1	24.3	2635.4
61	TAN SON NHAT	106.42'D-10.47'B	1907-1944;1947-1992	"	13.0	4.0	11.0	49.0	209.9	305.9	296.6	271.1	326.0	272.0	119.7	46.7	1925.0
62	TAN UYEN	106.48'D-11.03'B	1981-1992	"	0.0	0.5	3.0	25.7	151.3	175.3	265.1	279.1	286.0	167.2	109.6	11.6	1472.3
63	TAY NINH	106.10'D-11.01'B	1913-1941;1959-1974;1978-1992	"	6.3	4.9	25.7	80.8	202.8	232.0	252.0	222.2	318.1	295.2	122.9	33.1	1795.9
64	THAC CAN	108.17'D-11.42'B	1978-1992	"	3.1	13.6	28.3	69.4	152.6	197.0	193.3	225.9	264.6	193.0	93.3	9.2	1443.1
65	THANH BINH	108.18'D-11.47'B	1978-1992	"	5.8	17.1	63.1	187.7	169.7	175.4	171.5	195.3	266.2	244.0	75.4	12.3	1583.5
66	THONG NHAT	107.02'D-10.57'B	1928-1941;1958-1968;1978-1992	"	9.7	6.7	17.5	77.3	224.3	273.8	312.9	327.3	378.2	269.3	109.4	35.9	2042.3
67	THU DUC	106.45'D-10.50'B	1963-1974;1977-1992	"	3.4	1.5	4.7	37.8	169.6	255.3	286.2	241.8	271.7	247.4	97.1	23.9	1640.3
68	THUAN LOI		1930-1944;1951-1964	Stop	12.3	8.3	33.9	121.0	313.0	300.1	373.7	381.9	472.9	324.6	138.1	45.3	2525.2
69	TRI AN	107.05'D-11.05'B (50m	1928-1944;1948-1965;1978-1992	Continue	13.9	11.8	29.9	96.6	245.3	281.0	333.4	369.3	409.7	277.2	120.4	44.5	2233.1
70	TUC TRUNG	107.12'D-11.05'B	1929-1944;1948-1974;1978-1992	"	12.7	11.6	38.9	91.3	244.7	300.4	382.0	379.9	393.0	311.8	114.9	39.5	2320.7
71	VO XU		1984-1987	Stop	0.0	16.6	0.0	35.6	348.1	394.7	496.4	810.9	331.5	291.8	166.4	66.8	2958.8
72	VUNG TAU	107.05'D-10.20'B	1907-1944;1949-1992	Continue	1.8	1.0	4.9	33.7	191.4	208.7	219.4	186.3	216.8	218.3	68.0	20.6	1370.9
73	XUAN LOC	107.14'D-10.51'B	1931-1941;1948-1973;1978-1992	"	10.1	13.5	20.3	83.7	225.0	280.0	337.7	381.5	364.4	321.7	107.5	28.9	2174.2

6.f

DISCHARGE STATIONS IN DONG NAI RIVER BASIN

Station	River	Catchment Area	Period of observations	Status	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
		km2	year														
1.CAN DANG	Vam Co Dong	617	1974-1992	Continue	3.78	2.41	1.75	1.81	3.31	7.75	12.80	17.20	23.20	35.50	19.00	6.46	11.20
2.DAI NGA	La Nga	373	1974-1992	"	3.88	2.49	2.21	3.11	6.62	18.20	24.50	40.00	38.60	35.20	17.50	7.40	16.70
3.DAU TIENG	Sai Gon	2700	1977-1980	Stop	28.10	24.90	20.50	19.60	27.80	46.20	62.60	99.50	134.00	140.00	99.50	38.40	61.80
4.DON DUONG	Da Nhim	775	1934-1944; 1949-1992	Continue	13.50	8.00	6.29	8.46	15.50	17.60	18.50	20.10	31.20	49.80	45.10	28.80	21.90
5.LA BUONG	La Buong	264	1978-1990	"	3.11	2.28	1.79	1.84	3.54	6.78	11.10	15.00	16.10	16.00	9.03	4.66	7.60
6.LOC NINH	Sai Gon	500	1974-1983	Stop	6.08	4.24	3.19	3.04	4.91	7.65	13.40	17.50	21.90	27.50	20.40	9.68	11.60
7.PHU DIEN	La Nga	3060	1987-1992	Continue	26.00	16.30	15.00	14.80	30.00	122.00	192.00	275.00	332.00	277.00	131.00	47.10	123.00
8.PHUOC HOA	Be	5765	1974-1992	"	49.80	26.80	16.00	15.50	38.40	128.00	249.00	512.00	566.00	473.00	258.00	111.00	204.00
9.PHUOC LONG	Be	2215	1974-1992	"	18.00	9.80	5.96	5.97	14.40	61.00	122.00	269.00	276.00	223.00	109.00	42.00	96.40
10.SONG LUY	Luy	982	1978-1992	"	2.26	1.07	0.96	1.27	5.92	7.14	10.80	12.00	30.50	56.60	17.80	4.69	12.60
11.TA LAI	Dong Nai	8850	1987-1992	"	79.70	47.30	41.90	45.60	78.30	276.00	428.00	650.00	774.00	664.00	384.00	149.00	301.00
12.TA PAO	La Nga	2000	1960-1964; 1973-1992	"	21.30	12.80	9.80	11.60	25.00	66.80	104.00	189.00	174.00	168.00	85.40	42.20	75.80
13.THANH BINH	Da Dung	294	1980-1991	"	3.61	2.81	2.79	4.54	5.48	8.05	9.03	12.30	16.90	21.50	11.20	5.47	8.65
14.TRI AN	Dong Nai	14025	1974-1986	stop	112.00	68.70	51.60	59.20	137.00	402.00	708.00	1204.00	1290.00	1149.00	568.00	240.00	499.00

6.h

KT.XLS

Period of Observations of Other Metheo-Hydrological Data

(Available data)

Station		Temperature			Humidity		Sunshine Duration			Evaporation			Surface Wind	
	Tmean	Tmax	Tmin	Umean	Umax	Umin	SDmean	SDmax	Emean	Emax	Emin	Direction	Wmean	Wmax
Bao Loc	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92
Di Linh	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62	57-62
Da Lat	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92	76-92
Lien Khuong	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92
Sai Gon	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92
Bien Hoa	78-83			78-83					78-83			78-83	78-83	
Dong Xoai	79-80	79-80	79-80	79-80		79-80			79-80			79-80	79-80	
Loc Ninh	79-80	79-80	79-80	79-80		79-80			79-80			79-80	79-80	
Long Thanh	86-82	86-92	86-92	86-92	86-92	86-92	86-92	86-92	86-92	86-92	86-92	86-92	86-92	86-92
Phuoc Long	79-80	79-80	79-80	79-80		79-80			79-80			79-80	79-80	
	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92	84-92
Phan Thiet	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92
So Sao	79-80	79-80	79-80	79-80		79-80			79-80			79-80	79-80	
Tay Ninh	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92
Vung Tau	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92	81-92

7. FLOOD AND ITS CONTROL

7.1 Flood records in the Study Area

We investigated the historical flood data on the whole of the Dong Nai river basin in 1952 .

We also have the flood data on the lower La Nga river basin in 1978.

Except Dran, there are hourly or bi-hourly frequent flood records including date, flood discharge, flood water river, and rainfall data at each discharge station in the study area. So we have 13 flood discharge stations in the study area : Can Dang, Dai Nga, Dau Tieng, La Buong, Loc Ninh, Phu Dien, Phuoc Hoa, Phuoc Long, Song Luy, Ta Lai, Ta Pao, Thanh Binh, and Tri An.

7.2 Existing Flood Control Structure in the Basin

In the basin, there are some multi-purpose reservoirs such as Da Nhim, Tri An, Dau Tieng, Thac Mo. And Flood control is one of the purposes of these reservoirs.
In addition, there are some levees on the La Nga river, the Sai Gon river and the Dong Nai river to protect the plains from the flood discharge.

7.3 On going / Proposed Flood Control Project in the Study Area

So far, there is only the Ham Thuan project which takes flood control as a secondary effect.

15 RIVER CONDITIONS

The total area of the Dong Nai basin is amount 40,000 kmsq, including Dong Nai main river and 4 branches are La Nga, Be, Sai Gon and Vaico (with East Vaico and West Vaico).

a. Dong Nai river is generated from the high mountains with elevation of 2,000 meters in the Liangbien plateau, belonging to the South Truong Son Range. The main flow direction of the river is from the North-East to the South-West. Mean elevation of the basin changes from 1,000-1,500 m in the upstream to the 500-900 m in the Di Linh, Bao Loc, Xnaro plateaus..., 100-300 m in Phuong Lam, Ma Da, Loc Ninh...and 1-10 m in the downstream. The main river flows to the South China Seas at the Xoai Rap mouth.

The main Dong Nai river has the length of 628 km, from Da Nhim upstream to the mouth. The area basin is 14,800 kmsq at Tri An, 23,200 at Bien Hoa, 28,200 at Nha Be and 40,000 kmsq at the mouth. The average river slop is 0.0032. In the upstream, the Dong Nai river has many falls. The tide can affects to Dong Nai river at Tri An.

b. La Nga river is the largest branch in the left of the Dong Nai. It is oriented from the high areas around Di Linh and Bao Loc, with elevation of 1,300-1,600 m, flowing along the West of Binh Thuan province and discharge to the Dong Nai river at the point 38 km to Tri An in downstream. The length of La Nga is 290 km and with the area of 4,100 kmsq. The average river slop is 0.005. The mean basin elevation is 600-1,200 m in the upstream to 100 m in the downstream.

c. Be river is the first of the large branches in the right of Dong Nai. Generating from the mountains with the elevation of 850-950 m in the Xnaro plateau and flowing to the Dong Nai at the point far from Tri An 6 km to the upstream, the Be river has the length of 350 km and the area of 7,650 kmsq. The Be upstream is formed from 3 branches Da R'Lap, Dak Glun and Dak Huyot. The average river slop is 0.0032. The Be river is affected by tide about 10 km at the mouth.

d. Sai Gon river has the source from the hill areas in the Loc Ninh and along the Viet Nam-Cambodia boundary, with the elevation about 200 m. With the low river slop (0.0013), the tide affects vary far to upstream at Dau Tieng, 148 km from the mouth and 206 km from the sea. The mean elevation of basin is 5-20 m.

e. Vaico river includes East Vaico and west Vaico. Almost of the Vaico basin lies in the strong tidal area. The East Vaico has the length of 283 km and the area of 6,300 kmsq. The West Vaico has the length of 235 km and the area of 6,000 kmsq. After the confluence, the Vaico flows 36 km more to the mouth in the Dong Nai river at the point being far from the Xoai Rap mouth 13 km. Both of

them have the river slop very low (0.00005-0.0001). Therefore, the tide affects to the upstream very far, 190 km and 240 km in the East Vaico and 170 km and 220 km in the West Vaico from the mouth and from the sea, respectively.

g. The surrounding areas which lie along the seashore having the very small rivers with a sort lengths, narrow areas and independently sources.

g.1- Cai river:2 This is the largest river in the seashore area, with 105 km in length and 3,430 kmsq in area. It is supplemented by the source from Da Nhim and flowing to the Phan Rang Town.

g.2- Luy river: Luy river lies in the driest area in the whole Dong Nai basin and surrounding areas. Therefore, it plays important role in the area with many purposed projects of dam and reservoir. The Luy river has the length of 87 km and the area of 1,700 kmsq, flowing to Phan Ri mouth. The large branches are Mao, Ca Giay and Ca Tot.

g.3- Quao/Ca Ty river system: The Quao/Ca Ty system is the large river in the seashore, with the Quao river in the North and Caty river in the South of Phan Thiet Town. The Quao river has the length of 87 km and the area of 800 kmsq. The Ca Ty river has the length of 48 km and the area of 775 kmsq.

g.4- Phan river: Phan river has the length of 53 km and the area of 500 kmsq.

g.5- Dinh river: Dinh river flows to Ham Tan with the length of 54 km and the area of 862 kmsq.

g.6- Ray river: Ray has the length of 91 km and the area of 1,050 kmsq with the plentifully water source.

g.7- Xoai river: Xoai (Dinh) river flows to the Vung Tau City with the length of 45 km and the area of 862 kmsq.

g.8- La Buong river: La Buong river flows to the Dong Nai river at Long Thanh. The it's length is 41 km and area of 465 kmsq.

h. The Mekong river flows into Viet Nam by two branches which are Mekong and Bassac. They are linked each other by Vam Nao and some canals. The Mekong river has the closely relationship with the West Vaico river and downstream of main Vaico river. In the low flow season, the Mekong supplies fresh water to the Plain of Reeds for cultivation by Hong Ngu, Dong Tien, Nguyen Van Tiep... canals. These canal also link with the West Vaico river, and therefore, the Vaico is received from Mekong. However, the salt water from the West Vaico affects directly to the Plain of Reeds. In the food season, the flood water from Cambodia flows to the Plain of Reeds and discharges to the West vaico river with the discharge of some thousands m3/s.

SALINITY INTRUSION CONDITION

Salinity Intrusion is the considerable and important phenomena in the Dong Nai river downstream.

With the bed river very deep and slope very low, the tide from the sea with high amplitude, the salt water from the sea is brought to the upstream of rivers in the Dong Nai system very far, especially during the months in the middle of low flow season (March-April).

Before Tri An and Dau Tieng are constructed, in the natural condition, the salinity limits of 1 ppt and 4 ppt in the rivers of Dong Nai as the following table:

Average Salinity Limits of 1 ppt and 4 ppt in the rivers of Dong Nai system

River	1 ppt		4 g/l	
	Limits	Distance (km)	Limits	Distance (km)
Dong Nai	Dong Nai Bridge	117	Long Dai	107
Sai Gon	Tuong Binh Hiep	123	Rach Tra	113
East Vaico	Trang Bang C.	138	Hiep Hoa	123

Salinity Duration over 4 ppt in some sites

Site	Rivers	Start	Finish	Duration(months)
Cat Lai	Dong Nai	01 Jan.	30 May	5
Nha Be	Dong Nai	15 Dec.	20 June	6
Phu An	Sai Gon	20 Feb.	20 May	3
Can Giuoc	Rach Cat	20 Dec.	30 June	6
Cho Dem	Cho Dem	10 Jan.	20 June	5
Ben Luc	East Vaico	10 Feb.	10 June	4

After Dau Tieng and Tri An constructed, the salinity intrusion condition have been improved remarkable.

The existing limits of salinity intrusion of 4 ppt are pushed to the sea 7-10 km in the Dong Nai (about Phu Huu), 4-6 km in Sai Gon (Lai Thieu) and some km in the East Vaico river.

8. Power and Energy

8.1 Power and Energy Status

Nowadays, the power network in the whole of the South Vietnam has a total installed capacity of about 1,000 Mw and an annual energy output of about 3,700 Gwh (data in 1991)

According to the energy development strategy, in the years of 2000 - 2005 , the power network of South Vietnam needs about 11,000 - 12,000 Gwh with the source capacity of about 2,800 - 3,000 Mw.

* Installed capacity at the existing power plant in the South of Vietnam :

Power station	Inst. Capa. (Mw)
- Thermal power station of Thu duc	165
- Thermal power station of Tra Noc	33
- Water power station of Tri An	400
- Water power station of Da Nhim	160
- Water power station of Thac Mo	150
- Other diesel and gas turbines	200
Total	1,108

* Istalled capacity at the proposed power plant in the South of Vietnam in the year of 2,000

- expanded thermal power station of Tra Noc 150
- Thermal power station of Phu My (Ba Ria) 600
- Water power station of Ham Thuan 300
- Water power station of Da Mi 172

* Organization for the data collection : The Ministry of Energy and Electric Company 2.

9.THE IRRIGATION AND DRAINAGE IN THE AGRICULTURE :

9.3. THE IRRIGATION AND DRAINAGE PROJECTS INTHE PRESENT :

1. Nha Trinh - Lam Cam irrigation system :
- Location : on the Song Cai river, Ninh Thuan province .
- Main structures :
. Head structure : including 2 dams , Nha Trinh and Lam Cam.

Nha Trinh dam is built by cocret, Lam Cam by rockfill and in the downstream of Nha Trinh dam .

. At Nha Trinh,there are 2 main canals and 2 control sluices. At Lam Cam,there is only a canal on the left of dam.

- Irrigated area : 12 800 ha .
- Water resources : including the resource Of Song Cai Phan Rang river (the catchment area: 2140 Km2) and the drainage water after the Da Nhim powerelectric plant .
- Management : The Nha Trinh irrigating company, Ninh Thuan province .

2. Dong Moi dam :
- Location : on the main stream of Song Luy river, Bac Binh district - Binh Thuan province
- Main structures : including a dam and a main canal on the left (a sluice at the head of canal).
- Irrigation area : 1200 ha.
- Supply water resource : the basic resource of the song Luy river with the catchment area at the site :1090 Km2 .
- Management : The Bac Binh irrigating company .

3. Da Bang reservoir :
- Location : on the DaBang stream (a right branch of song Ray), Long Dat,Ba Ria- Vung Tau province .
- Main structures : a earth dam, a spillway and a irrigating sluice at the head of main canal .
- Irrigated area :900 ha.
- Water resource from the reservoir :

4. Song May reservoir :
- Location : onthe song May (a left branch of the Dong Nai river).
- Main structures: a earth dam,spillway and a sluice at the head of canal .
- Irrigated area : 1300 ha .
- Water resource : the reservoir with the catchment area 40 Km2 .

5. Da Ton reservoir :

- Location : on the Da Ton stream (a branch fo the La Nga river).
- Main structures: a earth dam, a spillway and a sluice.
- Irrigated area : 1400 ha .

6. Suoi Vong reservoir :
- Location : on the Vong stream (a right branch of the Song Ray).
- Irrigated area : 1050 ha .

7. Suoi Giai reservoir :
- Location : On the Giai stream (a left branch of the song Be), Dong Phu district ,Song Be province .
- Irrigated area : 1600 ha .

8. Tuyen Lam reservoir : On the Da Tan La stream (the upstream of DaTam),Da Lat city, Lam Dong province.
Irrigated area : 1400 ha .

9. Dai Don dam : On the Da Dung river,Lam Ha district, Lam Dong province .
Irrigated area : 1600 ha .

2.4. THE IRRIGATION AND DRAINAGE PROJECTS ARE BEEN CARRYING.

1. Song Quao reservoir :
- Location : on the song Quao, Ham Thuan Bac district, Binh Thuan province .
- Main structures : a earth main dam, a sub-dam, a spillway, a sluice at the head of canal .
- Design irrigated area : 8120 ha .
- Water resource : the reservoir with the catchment area 280 Km2, besides there is a transfer strucrure from the Dan Sach stream(a brach of the La Nga) with the catchment area 120 Km2 .
- Parameters :
  High water level : 89 m
  Dead water level : 72 m
  Active storage : 76.3 million m3 .

2. DaTe reservoir : On the Da Te stream (a left branch of the Dong Nai river), Da Te district ,Lam Dong province .
Irrigated area : 1900 ha

3. Suoi Giau reservoir : On the Giau stream, Long Dat district ,Dong Nai province . Irrigated area : 1300 ha .

4. Ong Keo dike-sluice system: On the side of the downstream of Dong Nai river , Long Thang ,Dong Nai province .
Its duty is the defend the salinity intrusion and irrigating the area 6400 ha .

5. Hoc Mon - Bac Binh Chanh irrigating and drainage and defending the salinity intrusion system .

This system is on the surburb of Ho Chi Minh city (in the districts : Hoc Mon ,Binh Chanh, a part of Duc hoa- Long An).

Its duty is the defend the salinity,irrigating , acid drainage ,drainage the area 20 000 ha.

In the present, the An Ha sluice was built (width : 10 m , sluice top : -3.0), the Kenh C is built (width : 15 m , sluice top : -3.0).

9.5. THE STRUCTURES ARE PROPOSED

1. Tan Giang reservoir : Ninh Phuoc district,Ninh Thuan province . Irrigated area :2300 ha .

2. Ca Giay reservoir : Bac Binh district,Binh Thuan province . Irrigated area : 4200 ha .

3. Da Den reservoir : Chau Thanh district,Ba Ria -Vung Tau province. Irrigated area : 1400 ha, supply water : 1.5 m3/s to Vung Tau city .

4. Suoi Ca reservoir : Long Thanh district,Dong Nai province . Irrigated area : 2800 ha

5. DaKlo reservoir: Cat Tien district,Lam Dong province . Irrigated area : 800 ha .

6. Ba Bau dam : Ham Thuan Nam district,Binh Thuan province . Irrigatedarea : 1600 ha .

7. Loc Quang reservoir : Loc Ninh ,Song Be province .

8. Phuoc Hoa reservoir : On the Song Be river (Song Be province. It Irrigates 35 000 ha and diverts water to the Sai Gon river - 40 m3/s .

10. Water Supply and Sewerage

10.1 Existing water supply system

Existing water supply system in Ho chi Minh city

***Water treatment plant :**

- The pumping station of Hoa An , 6.5 km upstream the Dong Nai bridge, diverts water from the Dong Nai river.

- The 11km concrete piped line with the diameter of 1.8 m conducts water to the water treatment of Thu Duc.

- At the water treatment plant, water is treated with the average water volume of about 650,000 m3 per day.

- From the water plant, the treated water is pumped into the 12 km concrete penstock pipe with the diameter of 2m , crossing the Sai Gon river and connecting to the water supply system of Ho Chi Minh City. The pumping head is 48m.

In addition, The Saigon water supply company also operates 17 wells to supply a total volume of 20.000 m3 per day (0.23 m3/s).

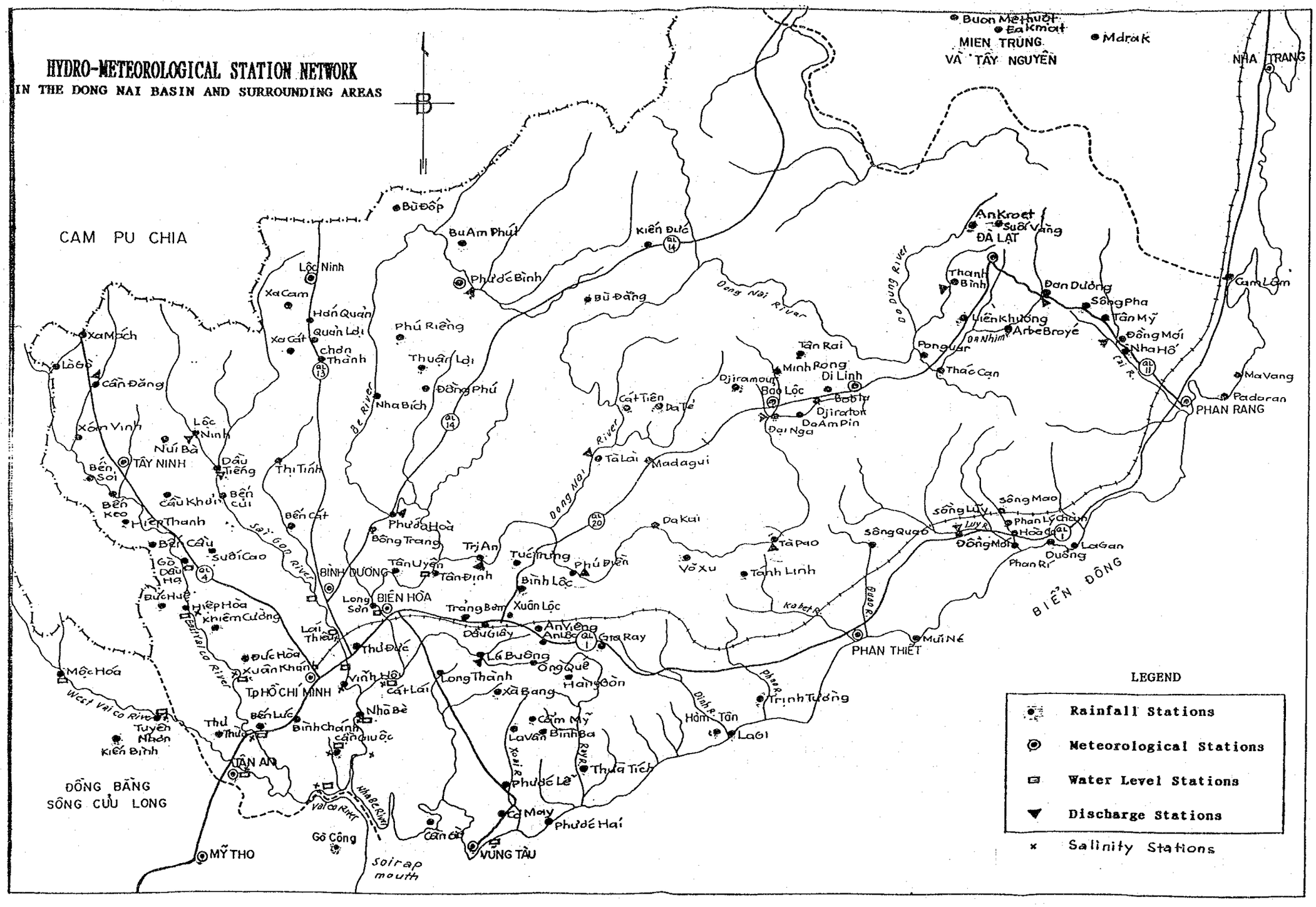
10.3 Proposed project of extending the existing water treatment plant from 7.5 m3/s to 10m3/s (in the year of 2,000) and to 17.5 m3/s (in the year of 2,005)

- At Thien Tan on the Dong Nai river, a pumping station will be builded to supply water for the industrial area along the road of 51 with the capacity of 5 m3/s.

- At Ben Than on the Sai Gon river, a pumping station will be builded to supply water for Ho Chi Minh city with the capacity of 3.5 m3/s in the year of 2,000 anf of 7.0 m3/s in the year of 2,005.

- The Nhieu Loc-Thi Nghe Project and the Tan Hoa- Lo Gom project aim at resolving the environmental pollution for Ho Chi Minh City.

HYDRO-METEOROLOGICAL STATION NETWORK
IN THE DONG NAI BASIN AND SURROUNDING AREAS



質問状に対する回答　2

（MWR/ HANOI の手書き回答を整理）

ANSWERS TO QUESTIONNAIRE

(PREPARED BY MWR/HANOI)

1. PROJECT IMPLEMENTATION

(1) THE INSTITUTE OF WATER RESOURCES, PLANNING AND MANAGEMENT

(2) a) V 7

b) A.F. AND FISHERY DEPT.

c) ENVIRONMENT DEPT.

d) NOT APPOINTED YET.

e) .....

f) SONG BE, LAM DONG, DONG NAI, BINH THUAN, NINH THUAN, LONG AN,? HCM CITY

g) NOT APPOINTED YET.

h) 〃

(3) WILL BE ESTABLISHED

(4) BUDGET BY THE GOVERNMENT

(5) SUBMITTED BY MWR,APPROVAL BY SPC

(6) NOT YET

2. SOCIO-ECONOMIC CONDITIONS

(1) WILL BE SUPPLIED WHEN SURVERY TEAM COMING TO DO THE PROJECT.

a)～h) AVAILABLE

(2) MINISTRY OF AGRICULTURE

a) 1/250,000

b) UNTIL 1980

c) 〃

d)

e) NATIONAL INSTITUTE FOR AGRICULTURAL PLANNING AND PROJECTION(NIAPP)

(3) MINISTRY OF ARRICULTURE

(4) PEOPLE COMMETTEE OF THE PROVINCES.

a)～c) AVAILABLE

(5) MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT. (Dr.HY)

3. ENVIRONMENT

MINISTRY OF S.T. ENVIRONMENT, ENVIRONMENT DEPT., 39TRANHUNG DAO STREET(HANOI CITY)

(1) a) AVAILABLE(GIVEN TO Mr.TANAKA)

4. DEVELOPMENT PLANS(NATIONWIDE/REGIONALWIDE)

THE AGRICULTURE, FORESTRY, FISHERT DEPT. OF SPC

5. WATER RESOURCES DEVELOPMENT PROJECTS

(IN THE STUDY AREA)

THE INSTITUTE OF W.R PLANNING AND MANAGEMENT OF M.W.R

(1) a)～e) MINISTRY OF W.R.

f) MINISTRY OF CONSTRUCTION

(2) a) O.K.

b) UNDER CONSTRUCTED BY M.ENERGY

(3) a)～d) MINISTRY OF W.R.

6. TOPOGRAPHY, GEOLOGYAND METEO-HYDROLOGY

(IN THE STUDY AREA)

NATIONAL MAPPIMG DEP.

(1) a) YES(ITS SCALES WILL BE GIVEN LATE)

b) NO

c) 1/50,000, 1/100,000

d) YES

(2) a) 1/500,000

b) 1/250,000

c) NO

(3) THE INSTITUTE OF W.R PLANNING AND MANAGEMENT OF M.W.R.

a)～h) YES(BUT NOT ENOUGH)

7. FLOOD AND ITS CONTROL

(1) THE INSTITUTE OF W.R PLANNING AND MANAGEMENT OF M.W.R.

a)～g) YES(INITIAL STEP)

(2) a)～d) YES(INITIAL STEP)

(3) YES

(4) YES

(5) YES(INITIAL STEP)

(6) NOT YET

8. POWER AND ENERGY

INTERNATIONAL COOPORATION DEPT., MINISTRY OF ENERGY

(1) POWER DESIGN AND SURVERY COMPANY NO.1

9. IRRIGATION AND AGRICULTURE

(IN THE STUDY AREA)

MINISTRY OF AGRICULTURE, NATIONAL INSTITUTE FOR AGRICULTURAL PLANNING AND PROJECT, 91 HANG CHIO STREET HANOI

10. WATER SUPPLY AND SEWERAGE

(IN THE STUDY AREA)

PEOPLE COMMETTEES, FROM THE PROVINCES IN THE STUDY AREA

(1) AVAILABLE BUT NOT ENOUGH

11. OTHER SECTOR OF WATER RESOURCES

(IN THE STUDY AREA)

PEOPLE COMMITTEES OF THE PROVINCES IN THE STUDY AREA

12. UNIT COST AND OTHERS

(1) a) RESOURCES INSTITUTE OF M.W.R IN HO CHI MINH CITY

b) INSTITUTE OF W.R PLANNING AND MANAGEMENT IN HO CHI MINH CITY

c) NO

d) NO

e) NO

f) NO

g) THAC MO, TRI AN, HAM THUAN

h) 1/100,000

i)～m) NO

(2) a)～h) WILL BE GIVEN LATE.

(3) a)～f) AVAILABLE

(4) a)～f) NO.

5．収集資料リスト

1．日本にて参考とした資料

下記資料は、調査団が現地へ出発前に、㈱アイエヌエーの資料室（棚）、JICAの図書館、及びその他からの借用等により、収集し参考としたものである。但し、借用したものの多くは、一部のコピーをとった後、返却済である。

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社団法人　海外農業開発コンサルタント協会　　作成

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2．現地（ベトナム）にて収集した資料

下記資料は、調査団が現地にて収集したものである。

ドンナイ事前調査収集資料

番号	資料の名称	形態	版型	ページ数	オリジナル?	部数	収集先名称又は発行機関	寄贈／購入
1	SOCIALIST REPUBLIC OF VIETNAM. THE CONSTITUTION OF 1992	製本	B7	79	オリジナル	1	書店, The gioi Publishers	購入
2	VIETNAM, SOCIO-ECONOMY 1991-1992 AND THE FIRST HALF OF THE 1993	製本	B5	122	オリジナル	1	書店, Statistical Publishing House	購入
3	VIETNAM IN 1993 AND SOCIO-ECONOMIC PROSPECTS FOR 1994-1995	製本	B5	76	オリジナル	1	書店, The gioi Publishers	購入
4	GEOGRAPHY OF VIETNAM	製本	B5	184	オリジナル	1	書店, Foreign Lauagages Publishing House	購入
5	LAW IN VIETNAM THE FRAMEWORK FOR FOREIGN INVESTMENT	製本	B5	160	オリジナル	1	書店, International Bar Association	購入
6	VIETNAM, ECONOMY AND FINANCE OF VIETNAM 1985-1992	製本	A4	343	オリジナル	1	書店, Statistical Publishing House	購入
7	VIETNAM. A DEVELOPMENT PERSECTIVE (SEPTEMBER, 1993)	製本	A4	109	オリジナル	1	書店, socialist Republic of VIETNAM	購入
8	ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT (STRATEGY AND ACTION PLAN)	製本	A4	17	オリジナル	1	書店, UNDP. HANOI.	購入
9	VIETNAM NGO DIRECTORY 1992. 1993	製本	A4	285	オリジナル	1	書店, The gioi publishers	購入
10	VIETNAM. NATIONAL PLAN FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT 1991-2000	製本	A4	129	オリジナル	1	書店, IUCN, SCS, UNEP, SIDA, UNED	購入
11	VIETNAM, TRANSITION TO THE MARKET (WORLD BANK, SEPT. 1993)	製本	A4	270	オリジナル	1	書店, East Asia & Pacific Region	購入
12	FOREIGN DIRECT INVESTMENT IN VEITNAM (JUNE. 1993)	製本	A4	27	オリジナル	1	書店, OFFICE OF SCC!	購入
13	BRIEFING NOTE. SOCIALIST REPUBLIC OF VIETNAM (UNDP. VIETNAM, July 1993)	製本	A4	27	オリジナル	1	書店, UNDP. Hanoi.	購入

ドンナイ事前調査収集資料

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14	COUNTRY PROGRAMME, MANAGEMENT PLAN, VIETNAM (UNDP July 1993)	製本	A4	69	オリジナル	1	書店, UNDP.	購入
15	VIETNAM, ENEGY SECTOR INVESTMENT AND POLICY REVIEW VOLUME I MAIN REPORT July	製本	A4	119	オリジナル	1	書店, East Asia & Pacific Region	購入
16	VIETNAM, ENEGY SECTOR INVESTMENT AND POLICY REVIEW VOLUME 2 ANNEXES	製本	A4	179	オリジナル	1	書店, East Asia & Pacific Region	購入
17	SUMMERY OF FEASIBILITY STUDY ON PHUOC HOA IRRIGATION PROJECT (HO CHI MINH CITY)	製本	A4	45	コピー	1	MWR.	(オリジナルを) 借用
18	MASTER PLAN FOR THE MEKONG DELTA, MAIN REPORT (NEDECO, OCT. 1993)	仮ドジ	A4	190	コピー	1	MWR	(オリジナルを) 借用
19	MASTER PLAN FOR THE MEKONG DELTA, SUMMERY REPORT (NEDEC, OCT. 1993)	仮ドジ	A4	25	コピー	1	MWR	借用
20	PROCEEDINGS OF THE INTERNATIONAL WORKSHOP ON Flood Mitigation, Emergency preparedness and Flood Disaster Management, 22-25 June	製本	A4	115	オリジナル	1	MWR	寄贈
21	STRATEGY AND ACTION PLAN FOR MITIGATING WATER DISASTERS IN VIET NAM	製本	A4	166	オリジナル	1	MWR	寄贈
22	PREFEASIBILITY PROJECT OF THE FLOOD CONTROL SYSTEM OF LA NGA RIPARIAN AREA TAN PHU DISTRICT DONG NAI PROVINCE	仮ドジ	A4	20	コピー	1	MWR	寄贈
23	BRIEF INTRODUCTION ON ACTIVITIES OF POWER INVESTIGATION AND DESIGN COMPANY No2 MINISTRY OF ENEGY	仮ドジ	A4	6	コピー	1	MWR	寄贈
24	HOC MON - NORTH BINH CHANH IRRIGATION PROJECT PREPARATION, INCEPTION REPORT (MWR, ELECTROCONSULT. S.P.A. ITALY DEC. 1993)	仮ドジ	A4	53	コピー	1	MWR	(オリジナルを) 借用
25	ENERGY IN VIETNAM (MINISTRY OF ENEGY)	製本	A4	22	オリジナル	1	M, of Energy	寄贈
26	REPORT OF THE ESTABLISHMENT DATABASE MANAGEMENT AT SOUTHERN REGION HYDRO-METEOROLOGICAL CENTER IN HO CHI MINH CITY	仮ドジ	A4	16	コピー	1	MWR	寄贈

ドンナイ事前調査収集資料

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27	LIST OF HYDROMETEOROLOGICAL STATIONS	仮ドジ	A4	14	コピー	1	MWR	寄贈
28	LEGEND ON THE AGRO-ECOLOGICAL MAP OF MEKONG DELTA —英語版—	製本	A4	41	オリジナル	1	VUGC	購入
29	〃 —ベトナム語版—	〃	A4		〃	1	〃	購入
30	WATER RESOURCES DEVELOPMENT Planning in the Dong Nai Basin	バラ	A0(MAP)	1	オリジナル	1	MWR	寄贈

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31	LAW ON ENVIRONMENTAL PROTECTION	バラ.	A4.	14	コピー	1	MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT. (MOSTE)	寄贈.
32	PROVISIONAL ENVIRONMENTAL CRITERIAS	製本	A5	195	オリジナル	1	MOSTE	寄贈.
33	ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT, Strategy and Action Plan For UNDP Viet Nam	製本	A4.	11	オリジナル	1.	UNDP, HANOI	書店購入.
34	FUNDAMENTAL LAWS AND REGULATIONS OF VIETNAM	製本	A5	535	オリジナル	1	THE GIOI Publishers	書店購入.
35	DIRECTORY OF THE INSTITUTIONS AND GOVERNMENT OFFICIALS OF THE SOCIALIST REPUBLIC OF VIETNAM	製本	A4	63	オリジナル	1	UNDP. HANOI.	書店購入.
36	VIETNAM: A DEVELOPMENT PERSPECTIVE Prepared for the Donor Conference	製本	A4	99.	オリジナル	1.	SOCIALIST REPUBLIC OF VIETNAM.	書店購入.
37	NATIONAL TRANSPORTATION, SECTOR REVIEW. FINAL REPORT. VOL.V. Inland Waterways	製本	A4	85.	コピー	1.	MINISTRY OF TRANSPORT, COMMUNICATION AND POST. U.N.	書店購入.
38	NATIONAL TRANSPORTATION, SECTOR REVIEW. FINAL REPORT. VOL.VII. Maritime Transport.	製本	A4.	41.	コピー	1.	MINISTRY OF TRANSPORT, COMMUNICATION. AND PORT. U.N.	書店購入.
39	ENVIRONMENTAL PROTECTION CENTRE.	製本	B4	10	オリジナル	2	EPC	寄贈
40	ATLAS, VIETNAM POPULATION	製本	A4.	111	オリジナル	1.	CENTRAL CENSUS STEERING COMMITTEE.	書店購入.
41	STATISTICAL DATA OF AGRICULTURE, FORESTRY AND FISHERY	製本	A4.	195.	オリジナル	1.	GENERAL STATISTICAL OFFICE DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERY.	書店購入.
42	ASSESSMENT OF WATER RESOURCES AND WATER USES, IN THE SOCIALIST REPUBLIC OF VIETNAM.	製本	A5	61.	オリジナル	1.	HIP_ Vietnam National Committee	書店購入.
43.	VIET-NHAT, TIEU TU DIEN 越日小辞典.	製本	B6.	857	コピー	1.	大学書林.	書店購入.

MAPS

ドンナイ事前調査収集資料

番号	資料の名称	形態	版型	ページ数	オリジナル?	部数	収集先名称又は発行機関	寄贈／購入
M.1	MAPS, 1/500.000 STUDY AREA (1 SET: 5 SHEETS)	バラ	A1 (MAP)	5	オリジナル	1	VUGC	購入
M.2	MAPS, 1/250.000 (TYPE A) STUDY AREA (1 SET: 7 SHEETS)	バラ	A1 (MAP)	7	オリジナル	1	VUGC	〃
M.3	MAPS, 1/100.000 (TYPE A) A PART OF STUDY AREA (4 SHEETS)	バラ	A1 (MAP)	4	オリジナル	1	VUGC	〃
M.4	MAPS, 1/50.000 HO CHI MINH AREA (4 SHEETS)	バラ	A1 (MAP)	4	オリジナル	1	VUGC	〃
M.5	MAPS, SOIL MAP OF MEKONG DELTA (1 SET: 6 SHEETS)	バラ	A1 (MAP)	5	オリジナル	1	VUGC	〃
M.6	AGRO ECOLOGICAL MAP OF MEKONG DELTA 1/250.000 (4 SHEETS)	バラ	A1 (MAP)	4	オリジナル	1	VUGC	〃
M.7	METEO-HYDRO LOGICAL MAP OF HO CHI MINH AREA 1/100.000	バラ	A2 (MAP)	1	オリジナル	1	VUGC	〃
M.8	HEALTH-CARE ACTIVITIES CULTURE-SPORTS	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.9	NEO TECTONICS	バラ	A2 (MAP)	1	オリジナル	1	VUGC	〃
M.10	KARST	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.11	LABOUR, EQUIPMENT-MATERIALS AND IMPLEMENTS OF AGRICULTURE - MAKE-UP LAND USE	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.12	-INDUSTRY OF BUILDING MATERIALS - LIGHT INDUSTRY	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.13	-SEX, AGE GROUP AND EDUCATIONAL LEVEL OF POPULATION - LABOUR FORCE	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃

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M.14	DEMOGRAPHIC DISTRIBUTION	バラ	A2 (MAP)	1	オリジナル	1	VUGC	購入
M.15	DESTRUCTIVE INSECTS	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.16	·MAMMALIANS - BIRDS ·AMPHIBIANS, REPTILANS, IMPORTANT ECONOMIC TREES TRIAL VERTEBATES	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.17	·HEAVY INDUSTRY ·INDUSTRY OF FOODSTUFF AND RICE-HUSKING	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.18	·MAIN INDICATORS OF AGRICULTURAL ECONOMY ·CROPS	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.19	·POPULATION DENSITY 1989 ·DEMOGRAPHIC VARIATIONS	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.20	GROUPS OF PRINCIPAL FOREST TYPE	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃
M.21	IMPORTANT ECONOMIC WILD PLANTS : MEDICAL PLANTS -TYPICAL THREATENED PLANT SPECIES	バラ	A1 (MAP)	1	オリジナル	1	VUGC	〃

3．その他の資料

現地関係機関との打ち合せ協議及び現地調査を実施する間に、資料収集したが、短期間の調査と諸条件を考えると比較的多くの資料と情報を入手出来たと考える。

関連資料は、その他にも多くあり、資料ばかり集めても無駄が多くなるが、本格調査団は、今回入手した以外の資料入手が必要となろう。

ヴィエトナムでは、もちろん機密保持の目的もあるだろうが、一部で、資料、情報は金になると考えて、出渋るケースがよく見られる。

例えば、こんな資料があると見せびらかすだけで結局貸してもくれないケースや、我々JICA調査団よりも日本の民間会社の方に情報資料をより多く提供するケースも見られる。

そのような場合、個人的な親交関係を利用したり築くことにより入手しやすくなることも多いようで、調査団の努力と工夫が期待される。

又、ヴィエトナム語の資料も多いことにも留意する必要があろう。

本格調査団の資料入手に当たって、その一部は今回入手しているが、次のリストを添付しておく。

VUGCのMAPのリスト（但し、このリスト以外のものも多少ある。）

OFFER SHEET No. 1 : MAP OF LAOS AND CAMBODIA

No	DESIGNATION	SCALE	NOTE	PUBL. YEAR	UNIT PRICE (CIF-USD)
1	Topog.Map of Laos	1/100,000	175 sheets	1987	875.00
2	Topog.Map of Laos	1/250,000	28 sheets		140.00
3	Topog.Map of Cambodia	1/50,000	284 sheets		1,420.00
4	Topog.Map of Cambodia	1/100,000	87 sheets		435.00
5	Topog.Map of Cambodia	1/250,000	19 sheets		95.00
6	Administrative Map of Laos	1/1,750,000		1991	5.00
7	City Map of Luangphabang	1/10,000		1990	5.00
8	Administrative Map of Vientiane	1/125,000		1990	5.00
9	Tourist Map of Vientiane	Both sides		1993	8.00
10	Topo.Map of Laos	1/500,000	11 sheets	1987	100.00

OFFER SHEET No. 2 : THEMATIC MAP OF VIETNAM

No.	DESIGNATION	SCALE	NOTES	PUBL. YEAR	UNIT PRICE (CIF - USD)
1	Land Use Map	1/1,000,000	6 sheets	1981	50.00
2	Soil Map of the NorthVietnam	1/500,000	6 sheets	1975	50.00
3	Communication Map of Indochina	1/500,000	18 sheets	1986	80.00
4	Geological Map of Vietnam	1/1,500,000		1985	60.00
5	Geological Map of Vietnam Laos and Cambodia	1/1,000,000	6 sheets	1988	180.00
6	Agri-ecological Map of the Mekong Delta	1/250,000	3 sheets	1988	60.00
7	Soil Map of the Mekong Delta	1/250,000	6 sheets	1990	60.00
8	Geological Map of Vietnam	1/500,000	28 sheets	1989	250.00
9	Structural and Formational Map of Vietnam	1/1,500,000	3 sheets	1992	120.00
10	Atlas Vietnam Population		100 pages	1991	100.00
11	Vietnam Administrative Map	1/2,500,000		1993	10.00
12	Vietnam Administrative Map	1/1,000,00	6 sheets	1991	30.00
13	Vietnam Physical Map	1/1,500,000	4 sheets	1989	20.00
14	Vietnam Road Map	1/1,000,000	4 sheets	1989	20.00
15	Vietnam Road Map	1/2,000,000		1990	10.00
16	Vietnam Physical Map	1/2,000,000		1989	10.00
17	Small Atlas of Vietnam			1989	10.00
18	Atlas of Laichau Province			1975	50.00
19	Agricultural Atlas of Thaibinh Province			1975	50.00
20	Tourist Map of Hanoi		Both sides	1991	7.00
21	Tourist Map of Vietnam and Hochiminh City		Both sides	1992	10.00
22	Tourist Map of Vietnam and Vungtau Province		Both sides	1990	10.00
23	Tourist Map of Vietnam and some major tourist Centres		Both sides	1992	10.00
24	Tourist Map of Nhatrang			1990	7.00
25	Administrative Map of Haiphong	1/50,000	6 sheets	1986	30.00
26	Tourist Map of Haiphong			1987	7.00
27	Economical Map of Haiphong	1/125,000		1989	7.00
28	Tourist Map of Hue			1992	7.00
29	Tourist Map of Danang			1991	7.00
30	City Map of Vinh			1993	7.00
31	Metalogenic Map of Vietnam	1/1,000,000	4 sheets	1991	120.00
32	Hydro-geological Map of Vietnam	1/500,000	26 sheets		250.00
33	Atlas of Plain of Reeds	1/250,000	26 pages	1990	250.00

(See attached sheet)

OFFER SHEET No. 3 : TOPOGRAPHIC MAP OF VIETNAM

No	DESIGNATION	SCALE	NOTES	PUBL. YEAR	UNIT PRICE (CIF - USD)
1	Topomap of Vietnam	1/1,000,000	12 sheets	1990	60.00
2	Topomap of Vietnam	1/500,000	24 sheets	1970-75	120.00
3	Topomap of Vietnam	1/250,000	40 sheets	1982-83	200.00
4	Topomap of whole Vietnam (published by USA)	1/50,000		19 5	5.00/sh.
5	Topomap of Red River and Mekong Delta	1/5,000		1980-90	3.00/sh.
6	Topomap of Hanoi and Ho Chi Minh City	1/2,000		1980-90	3.00/sh.
7	Topomap of Cuulong province	1/100,000	4 sheets	1983	20.00
8	Topomap of Hauglang province	1/100,000	6 sheets	1980	30.00
9	Topomap of Daclac province	1/100,000	12 sheets	1981	60.00
10	Topomap of Benire province	1/100,000	2 sheets	1983	10.00
11	Topomap of Kienglang province	1/100,000	8 sheets	1983	40.00
12	Topomap of Dongnai province	1/100,000	4 sheets	1983	20.00
13	Topomap of Nghiabinh province	1/100,000	10 sheets	1981	50.00
14	Topomap of Danang province	1/100,000	8 sheets	1981	40.00
15	Topomap of Minhhai province	1/100,000	6 sheets	1980	30.00
16	Topomap of Songbe province	1/100,000	8 sheets	1980	40.00
17	Topomap of Lamdong province	1/100,000	8 sheets	1981	40.00
18	Topomap of Longan province	1/100,000	4 sheets	1980	20.00
19	Topomap of Thuanhai province	1/100,000	12 sheets	1980	60.00
20	Topomap of Gialai-Kontum province	1/100,000	15 sheets	1983	75.00
21	Topomap of Phukhanh province	1/100,000	8 sheets	1981	40.00
22	Topomap of Anglang province	1/100,000	4 sheets	1980	20.00
23	Topomap of Dongthap province	1/100,000	4 sheets	1980	20.00
24	Topomap of Laichau province	1/100,000	15 sheets	1983	75.00
25	Topomap of Hoatgllenson province	1/100,000	9 sheets	1983	45.00
26	Topomap of Hatuyen province	1/100,000	8 sheets	1983	40.00
27	Topomap of Caobang province	1/100,000	6 sheets	1982	30.00
28	Topomap of Langson province	1/100,000	6 sheets	1983	30.00
29	Topomap of Bacthai province	1/100,000	4 sheets	1983	20.00
30	Topomap of Quangninh province	1/100,000	6 sheets	1983	30.00
31	Topomap of Vinhphu province	1/100,000	4 sheets	1983	20.00
32	Topomap of Sonla province	1/100,000	12 sheets	1983	60.00
33	Topomap of Hasonbinh province	1/100,000	4 sheets	1983	20.00
34	Topomap of Haihung province	1/100,000	2 sheets	1983	10.00
35	Topomap of Thaibinh province	1/100,000	1 sheet	1983	5.00
36	Topomap of Hanamninh province	1/100,000	4 sheets	1983	20.00
37	Topomap of Thanhhoa province	1/100,000	9 sheets	1983	45.00