No.

MINISTRY OF NATURAL RESOURCES AND
ENVIRONMENT (MONRE)
SOCIALIST REPUBLIC OF VIETNAM

THE STUDY
FOR
WATER ENVIRONMENT MANAGEMENT
ON RIVER BASINS
IN VIETNAM

FINAL REPORT

January 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD

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The State Bank of Vietnam

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PREFACE

In response to a request from Vietnam, the Government of Japan decided to conduct a study for Water Environment Management on River Basin in Vietnam and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr.IWAI of NIPPON KOEI Co., LTD. and consists of NIPPON KOEI Co., between May, 2008 and February, 2010.

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

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

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

January 2010

Izumi Takashima,
Vice-President
Japan International Cooperation Agency

January 2010

Mr. Izumi Takashima
Vice President
Japan International Cooperation Agency
Tokyo

Dear Sir,

LETTER OF TRANSMITTAL

We are pleased to submit herewith the Final Report on the Study for Water Environment Management on River Basins in Vietnam. The Study aimed at supporting the government agencies concerned to develop their capacity to promote river basin management focused by the Decree 120/2008/HD-CP. The Study was implemented over 22 months from May 2008 to February 2010.

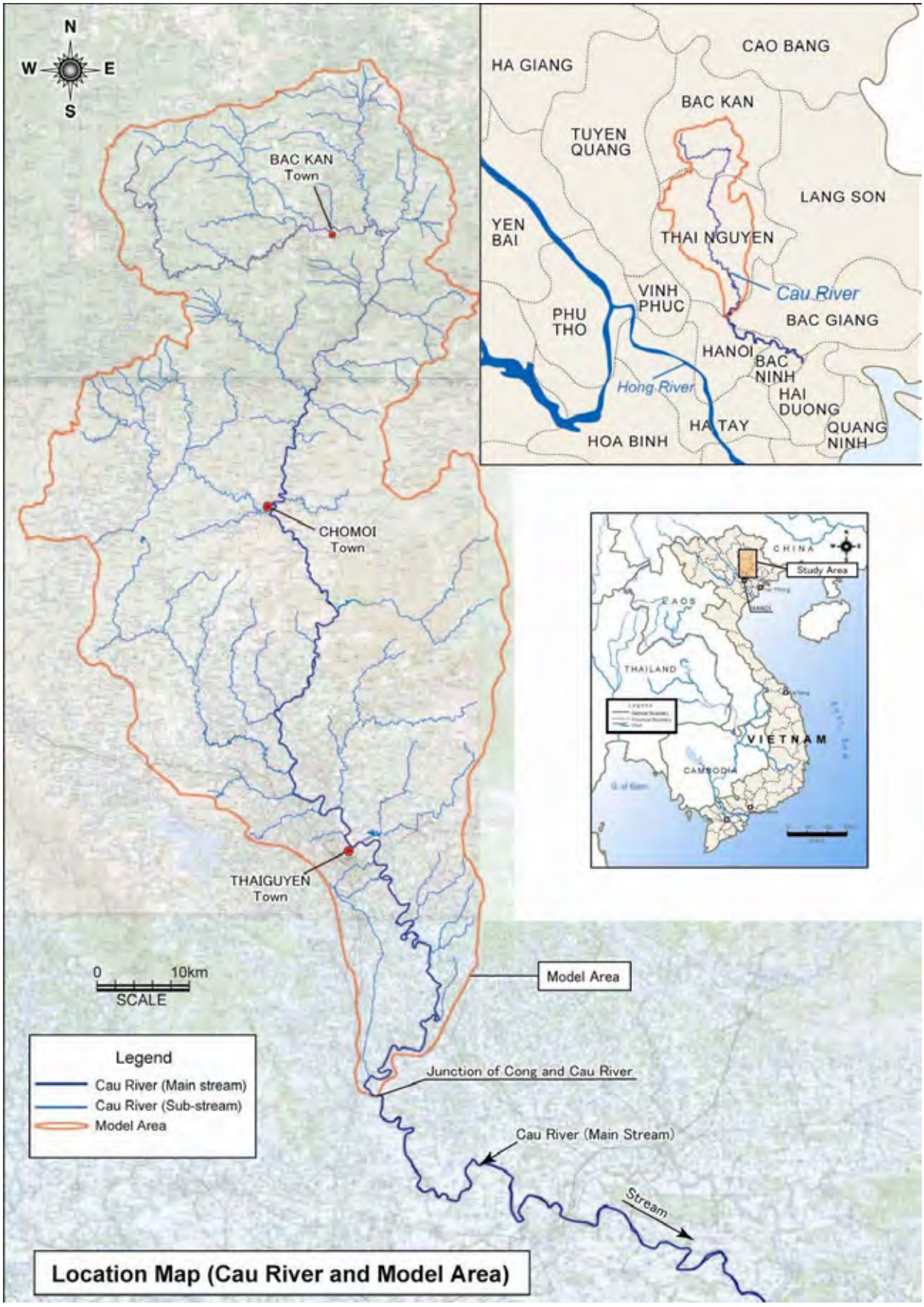
The study generated useful outcomes for river water environment management in Vietnams, such as monitoring and inventory guidelines, a report on pollution control approach and an example of water environment management plan. These outcomes were prepared by co-working of Vietnamese Study Team and JICA Study Team with local experts and concerned stakeholders. A part of outcomes like the monitoring and inventory guidelines have been started to be applied for actual rive water environment management activities.

We do hope that the outcomes of the study will be trialed continuously and be upgraded to enhance their applicability in Vietnam for succeeding river basin management under Decree 120/2008/HD-CP.

Finally, we would like to express our deep appreciation and sincere gratitude to all the officials who extended their assistance and cooperation to the JICA Study Team, in particular Vietnamese Environment Administration, Department of Natural Resource and Environment of Bac Kan and Thai Nguyen Provinces. We also acknowledge the official of your agency and Embassy of Japan in Vietnam for their support and valuable advices in the course of the Study.

Very truly yours,

Yoichi Iwai
Team Leader
Study for Water Environment Management on River Basins in Vietnam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CHINA
Study Area
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VIETNAM
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10km
SCALE
Model Area
Legend
Cau River (Main stream)
Cau River (Sub-stream)
Model Area
Junction of Cong and Cau River
Cau River (Main Stream)
Stream
Location Map (Cau River and Model Area)

The Study for Water Environment Management on River Basins in Vietnam Final Report

Table of Contents

Page

List of Tables

List of Figures

List of Boxes

Abbreviations

ADB	Asian Development Bank	GRDP	Gross Regional Domestic Product
APHA	American Public Association	ICD (MONRE)	International Cooperation Department
BOD	Biochemical Oxygen Demand	Ic/R	Inception Report
CD	Capacity Development	IDF	International Development Fund
CEM (VEA)	Center for Environmental Monitoring	IET (VAST)	Institute of Environmental Technology
CEMDI (VEA)	Center for Environmental Monitoring, Data and Information	IP/IZ	Industrial Park/Industrial Zone
CIDA	Canadian International Development Agency	ISO	International Standard Organization
COD	Chemical Oxygen Demand	It/R	Interim Report
CP	Cleaner Production	JFY	Japanese Fiscal Year
C/P	Counterpart	JICA	Japan International Cooperation Agency
CRB M/P	Cau River Basin Master Plan	JST	JICA Study Team
CRC	Environmental Protection Committee for Cau River Basin	LEP	Law on Environmental Protection
CRCO	Cau River Committee Office	LFA	Logical Framework Analysis
CTC	Center for Consultancy and Technology Transfer on Safe Water and Environment	LLDA	Lagna Lake Development Authority
DANIDA	Danish International Development Assistance	LWR	Law on Water Resource
DARD	Department of Agriculture and Rural Development	MARD	Ministry of Agriculture and Rural Development
dF/R	Draft Final Report	M/M	Minutes of Meeting
DOC	Department of Construction	MOIT	Ministry of Industry and Trade
DOIT	Department of Industry and Trade	MONRE	Ministry of Natural Resources and Environment
DONRE (PPC)	Department of Natural Resources and Environment	MOST	Ministry of Science and Technology
DR	Discussion Record	MOSTE	Ministry of Science, Technology and Environment
DWMEA (VEA)	Department of Waste Management and Environment Amelioration	M/P	Master Plan
DWRM (MONRE)	Department of Water Resource Management	MPI	Ministry of Planning and Investment
EIA	Environmental Impact Assessment	NGO	Non Governmental Organization
EMBIZ	Environmental, Management Board of Industrial Park and Zone	NRE	Natural Resource and Environment
EMS	Environmental Management System	O/M	Operation and Maintenance
EPC	Environmental Protection Commitment	OJT	On the Job Training
EPP	Environmental Protection Project	PCD	Pollution Control Department
F/R	Final Report	PCU	Project Coordination Unit
GDP	Gross Domestic Product	PDCA	Plan-Do-Check-Action
GIS-DB	Geographic Information System Database	PMU	Project Management Unit

PO	Plan of Operation	UNIDO	United Nations Industrial Development Organizations
PPC	Provincial People's Committee	USD	United State Dollar
PPP	Polluter Pay Principle	USEPA	United States Environmental Protection Agency
PSI	Pollution Source Inventory	VAST	Vietnam Academy of Science and Technology
QA/QC	Quality Assurance and Quality Control	VCEP	Vietnam Canada Environmental Project
QCVN	Vietnamese National Technical Regulation	VCPC	Vietnamese Cleaner Production Center
RBC	River Basin Committee	VEA	Vietnam Environmental Administration
RBCO	River Basin Committee Office	VEPA	Vietnamese Environmental Protection Agency
RBMD	Department of River Basin Management	VEPF	Vietnam Environmental Protection Fund
SEMRA	Program on Strengthening Environmental Management and Land Administration	VND	Vietnamese Dong
SIDA	Swedish International Development Cooperation Agency	VST	Vietnamese Study Team
SOP	Standard Operation Procedure	WB	World Bank
SS	Suspended Solid	WEMP	Water Environment Management Plan
S/W	Scope of Work	WHO	World Health Organization
TCVN	Vietnamese National Standard	WQM	Water Quality Monitoring
TISCO	Thai Nguyen Iron and Steel Company	WS	Workshop

Summary

1. General

(1) Objectives and Scope of the Study

The long-term objective of the Study for Water Environment Management on River Basins in Vietnam (the Study) is to strengthen the overall capacities of the governmental institutions to ensure the effective water environment management for river basins focusing on successful implementation of "the Master Plan on the Protection and Sustainable Development of the Landscape and Ecological Environment of Cau River Basin (Cau River Basin Master Plan) and master plans for other river basins in the future. The main study area is Cau river basin. The Cau river model area is selected the upstream basin of Cau river (upstream area from Con river confluence point).

The Study covers the following 6 items.

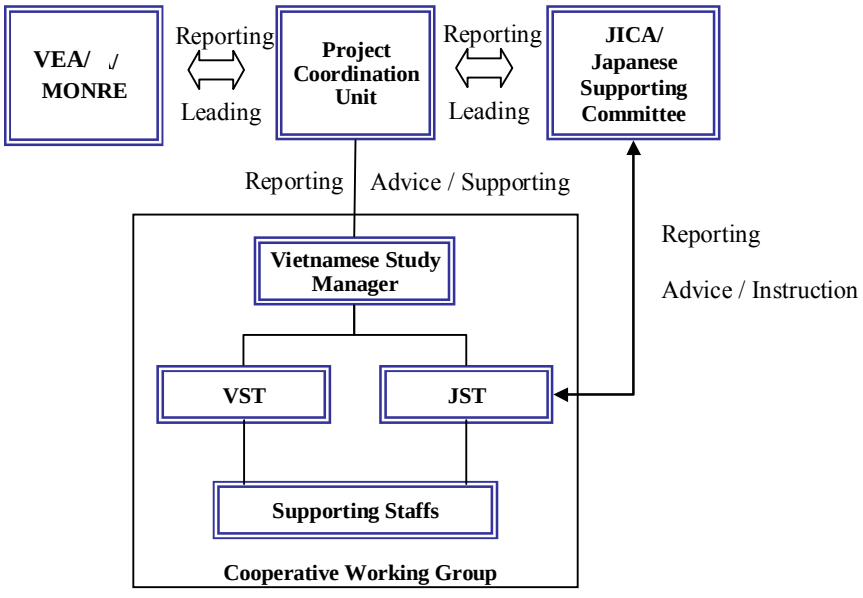
1) Output-1: Development of Guidelines with a technical manual for designing water quality monitoring system at river basin level

2) Output-2: Development of Guidelines for pollution sources inventory
3) Output-3: Consideration of regulatory approaches for water environment management in river basin
4) Output-4: Development of the Water Environment Management Plan for the model area in Cau river basin
5) Output-5: Development of a Handbook on the formulation of water environment management plan for river basin

6) Output-6: Recommendations for the improvement of legal framework and coordination mechanisms for environmental protection in river basins

(2) Organization of the Study

The organization structure of the Study is shown below.



Source: JICA Study Team

Organization of the Study

(3) Project Coordination Unit (PCU)

The PCU is the highest decision making organization for smooth implementation of the Study, and its major roles are to support smooth implementation of the Study and to promote active use and dissemination of the outcomes of the Study. Based on the discussion with the Vietnamese side, the members of PCU are listed below. In total, nine (9) PCU meetings have been held so far.

Member List of PCU

In charge	Name	Organization	Major Items to be Discussed
Chairman	1. Dr. Bui Cach Tuyen	Director General of Vietnam Environment Administration (VEA/MONRE)	1) Items of direction, organization, methodology, contents, and condition of the Study 2) Items of implementation, evaluation, approval, and dissemination of the Study outputs 3) Coordination and support of inter-ministrial matters 4) Items of information disclosure and public relations
Member	2. Mr. Nguyen Xuan Bao Tam	Deputy Director of ICD/MONRE	
	3. Dr. Nguyen Thai Lai	Director General of DWRM	
	4. Dr. Nguyen Minh Son	Vice Director of VAST/IET	
	5. Mr. Nguyen Xuan Tien	Deputy Director of Department of Foreign Economic, MPI	
	6. Mr. Duong Van Khanh	Director of DONRE in Thai Nguyen Province	
	7. Mr. Tran Nguyen	Vice Director of DONRE in Bac Kan Province	
	8. to be named	Cau River Committee Office	
	9. Mr. Phung Van Vui and Dr. Do Nam Thang	Team Leader of VST (VEA)	
	10. Mr. Yoichi Iwai	Team Leader of JICA Study Team (JST)	
	11. Mr. Motonori Tuno	Cheif Representative of JICA Vietnam Office	
	12. Ms. Nguyen Thi Kim Quy	Officer of ICD/MONRE	
Observer	13. Mr. Yosuke Tomizawa	Embassy of Japan	
	14. Mr. Yutaka Matsuzawa	JICA Expert (MONRE)	

Source: JICA Study Team

(4) Study Team

The Vietnam Study Team (VST) and the JICA Study Team (JST) are listed Tables below.

Member List of VST

Position	Major Roles	VEA/MONRE	DONRE
1. Director of the Study	-Overall management and operation of the Study as a Director -Report to PCU	Mr. Phung Van Vui (Director of Department of Biodiversity Protection, VEA) up to Sept. 2009 and Dr. Do Nam Thang from Oct. 2009 (Institute of Environmental Science and Management, VEA)	-
2. Study Manager (Team Leader of VST)	-Management and operation of VST -Implementation and cooperation of the Study with JST -Chairman of the weekly regular meeting	Dr. Do Nam Thang (Institute of Environmental Science and Management, VEA)	-
3. Member	-In charge for output-1 and co-working	Mr. Nguyen Huu Thang (Center for Environmental Monitoring, VEA)	Mr. Nguyen The Giang and Ms. Tran Thi Huong (Thai Nguyen DONRE/ CRCO member) Mr. Luong Phuong Nam (Bac Kan DONRE/CRCO member)
	-In charge for output-2 and co-working	Mr. Ho Kiem Trung (Waste Management and Environmental Protection Agency, VEA)	
	-In charge for output-3, 4, 5 and co-working	Ms. Nguyen Lan Huoung (Waste Management and Environmental Protection Agency, VEA)	
		Ms. Nguyen Minh Phuong (Waste Management and Environmental Protection Agency, VEA/CRCO member)	
	-In charge for planning and financing matters of the Water Environment Management Plan (WEMP)	Mr. Cao Minh Tuan (Department of Planning and Finance, VEA)	
4. Coordinator	- Coordination of relevant stakeholders	Ms. Nguyen My Hoang (Department of Pollution Control, VEA)	-

Source: JICA Study Team

Member List of JST

Position	Name
1. Team Leader/ Water Environment Management Policy/ Assistance Coordination	Yoichi Iwai
2. River Basin Water Environment Management Plan	Kengo Naganuma
3. Administrative Enforcement of Water Environment Management	Tadashi Shoji
4. Environmental Monitoring/ System Analysis	Shunsuke Hieda
5. Integrated River Basin Environmental Management	Takashi Kaji
6. Pollution Control Measure and Technology	Shinsuke Sato
7. Hydro-meteorological Analysis	Masahito Miyagawa
8. Coordination/ Simulation and GIS	Yoshiki Yamamoto

Source: JICA Study Team

2. Current Situation of the Model Area of Cau River

(1) Socio-economic Conditions of Bac Kan and Thai Ngyuen Provinces

The Bac Kan and Thai Nguyen provinces are located in the inland center of the northeast region of Vietnam with area of 486,841 ha and 353,435 ha, and population of 308,798 persons and 1,150,018 persons in 2008, respectively. The GRDP of in Bac Kan province was 997,146 million VND (app. 55 million US$) in 2008. Growth rates of total GRDP from 2001 to 2005 were relatively high, 11.85% per year. The GRDP of Thai Nguyen province was 5,257,300 million VND (app. 292 million US$) in 2008. Average growth rate of GRDP from 2000 to 2008 was 9.78% per year, and recent average from 2006 to 2008 was 11.69%.

(2) Natural Condition of Cau River

The climate of the basin area is tropical with the average annual temperature is approximately 18 ℃. The average annual rainfall in the basin varies from 1,500 mm to 2,700 mm. The rainy season is from May to October and the dry season is from November to April. During the rainy season, 80-85% of rainfall is recorded. The annual discharge is approximately 4.2 $x10^9$ m^3 (133 m3/s in average) of which Cong river and Ca Lo river account for 19.8% and 19.5%, respectively.

(3) River Water Quality

Although all BOD analytical results exceeded Class A-1 surface water quality standard (QCVN 08: 2008/BTNMT) 4.0 mg/L, from upper reach to Back Kan city, water quality conditions were relatively good comparing with the conditions around Thai Nguyen city. BOD was 19.2 mg/L, and COD was 42.7 mg/L at the Gia Bay Bridge.

3. Water Environmental Management Activities

(1) Administrative Conditions

The administrative body on environmental management in provincial level is the Department of Natural Resources and Environment (DONRE) under PPC. The Sub-Department of Environmental Protection and the Division of Inspection are mainly in charge of pollution control. Only Thai Nguyen DONRE runs its own laboratory.

(2) Water Environment Management Activities in the Model Area

At provincial level, DONRE is in charge of appraising EIA and EPP from enterprises under their authority. According to the survey conducted by VEA in 2008, 3 out of 10 in Bac Kan province, and 7 out of 37 enterprises in Thai Nguyen province did not obtain EIA or EPP approval. In terms of EPP approval, 2 are waiting for issuance of EPP approvals as of September 2009 in Bac Kan province, and only one enterprise has obtained in Thai Nguyen province as of September 2009. In terms of EPC register from relatively small-scale enterprises, the District DONRE is responsible for appraising.

(3) Water Quality Monitoring

Currently, the Center for Environmental Monitoring (CEM) of VEA, Bac Kan DONRE, and Thai Nguyen DONRE monitor in the model area. CEM and Thai Nguyen carried out 6 times of water quality sampling, and Bac Kan DONRE implement 2 times of sampling in a year. Several monitoring points of CEM and Thai Nguyen DONRE are very closed or overlapped. The monitored parameters are not unified in the model area. CEM and Thai Nguyen DONRE monitor various parameters including heavy metals and organo-chloric pesticides. Bac Kan DONRE monitors basic parameters such as BOD and COD, and inorganic nutrients. Both Bac Kan and Thai Nguyen provinces have not stipulated which class, A 1 to B 2, of QCVN 08:2008/BTNMT is applied to the model area. In terms of discharged industrial wastewater standard QCVN 24: 2009/BTNMT, they have not decided which class, A to C, is used in the model area either.

(4) Pollution Control at Sources

Around 50% of enterprises in Bac Kan and 80% in Thai Nguyen province have installed a wastewater treatment plant. However, it is not clear whether the enterprises operate their plants properly because of insufficient monitoring and inspection data. According to Bac Kan DONRE, some of them usually stop operating a treatment plant, and run it only when DONRE inspects the facility.

4. Development of Guidelines with Technical Manuals for Designing of Water Quality Monitoring System at River Basin Level (Output-1)

(1) Evaluation of Current Water Quality Monitoring System

The Thai Nguyen province applies Class A of surface water quality standards of TCVN 5942:1995, but Bac Kan DONRE applies Class B. In the beginning of 2009, the surface water quality standard was replaced from TCVN 5942 to QCVN 08:2008/BTNMT. In the QCVN 08:2008/BTNMT, surface water quality standards classified as four categories depending on the objectives of water usage. Currently, several monitoring points of CEM and Thai Nguyen DONRE are very closed or overlapped. So the overlapped monitoring points are to be unified, and one organization, CEM or Thai Nguyen DONRE should implement water quality monitoring. Water quality monitoring parameters are not unified in river basin level among CEM and relevant DONREs in Cau river basin. For all actors, CEM and Thai Nguyen DONRE carry out water quality monitoring on various parameters including heavy metals and organo-chloric pesticides. Other DONREs carry out the monitoring on basic parameters such as BOD and COD, and inorganic nutrients. To grasp water quality condition at river basin level from upper to lower reach, water quality parameters should be unified at referential sampling points.

(2) Selection of Water Quality Monitoring Points

The water quality monitoring points can be classified into 3 categories.

1) Reference Points to Obtain Baseline and Trend of Water Quality,

2) Pollution Control Points, and

3) Water Usage Control Points.

(3) Selection of Water Quality Monitoring Parameter

The parameters from basic physical-chemical components, nutrients related to nitrogen and phosphorous, index of organic pollutants such as BOD and COD are listed targeting industrial, mining, hospital, leachate from solid waste disposal site, domestic sewerage, and irrigation wastewater. These are basic components of the parameters to identify baseline and trend of water quality in river basin level. At all reference points, once in the dry season when water flow is low and stable, water discharge measurement should be carried out.

(4) Setting Water Quality Monitoring Period and Frequency

The water quality monitoring periods and frequency are planned as follows.

1) In each water quality monitoring point, sampling should be carried out at least 4 times a year to watch yearly trend of water quality.

2) Depending on the resources for water quality monitoring, and water usage condition, monitoring frequency should be increased to 12 times a year.

(5) Capacity Development Conditions of Output-1

The comparison results of capacity assessment between initial and final phase of Output-1 based on the questionnaire surveys to CEM/VEA, Thai Nguyen DONRE, and Bac Kan DONRE revealed the following trends.

1) Officers in Thai Nguyen DONRE and Bac Kan DONRE considered that their capacity for preparing and reviewing water quality plan has been improved.
2) On the other hand, officers in Thai Nguyen DONRE and Bac Kan DONRE considered that their capacity for training new staffs has not been improved.
3) Based on the questionnaire survey, significant improvement was not found on capacities of officers in CEM/VEA.

After the Study, it is recommended to implement i) Continue trial activity to reflect the Monitoring Guideline to design water quality monitoring system, and revise the Monitoring Guideline as necessary, and ii) Prepare trainers training program to improve the capacity to train new officers.

5. Development of Pollution Source Inventory (PSI) Guideline (Output-2)

(1) Development of Inventory Formats

The PSI survey formats, i.e. questionnaires for source survey, were finalized based on the progress of the regular PSI survey. The formats for 6 types of pollution sources were finalized. Types of pollution source formats are given below.

1) Factory,	2) Mining area,	3) Craft village,
4) Livestock,	5) Hospital, and	6) Solid waste dumping site

(2) Implementation of PSI Survey

In order to collect data and information from point pollution facilities, the PSI survey was conducted experimentally under the Study. The objectives of PSI survey are:

1) To collect data and information of pollution sources for planning and implementation of a water environment management plan at river basin level, and
2) To find lessons on the PSI survey.

(3) Lessons Obtained through Survey

Through the PSI survey, the following lessons were obtained.

1) Through the survey, not-cooperative targets were found. To implement it smoothly, a legal-base requirement should be clarified to target facilities.
2) Most target facilities did not provide wastewater quality monitoring data. Additionally, the craft villages did not have information on amount of water use. To collect required information, both direct and indirect measures should be adopted at the same time, such as usage of existing reports, and indirect information collecting measures introduced in page 13 of this guideline.
3) The list of factories and other pollution sources issued officially did not exactly provide latest information of name and contact address of the target facilities. To prepare a long list of the target facilities, it was necessary to interview to DONRE.
4) Low awareness of interviewees on pollution control hindered to collect reliable information. An awareness raising on environmental managers of pollution sources should be carried out.

(4) Pollution Load Analysis

Through collection and consideration of pollution load analysis methods applied in Vietnam, VST and JST decided that the pollution load unit system on point source developed by the Center for Consultancy and Technology Transfer on Safe Water and Environment (CTC) could be suitable for applying in the Cau river model area. The calculation of the released pollution loads from a certain source is based on the use of appropriate pollution load units, which reflect the existing relevant experiences from the measured performance of similar sources. Each pollution load unit is defined as the normalized released pollutant load expressed in kg per unit of activity of the particular source under consideration.

(5) GIS Database and Preparation of Experimental Pollution Load Map

Although the existing GIS database operated by VEA is to be revised in Ic/R, the GIS database on pollution sources in the Cau river basin was not found. So the preliminary database of pollution sources confirmed by the PSI survey was prepared. For preparation of the database, existing database application software, Microsoft Access was used. The input data on the database can be exported to Microsoft Excel, and utilized by the GIS application software, Ark-GIS. Based on the PSI survey results stored in the database, an experimental pollution load map was prepared which has the following information:

1) Location of water pollution sources designated as highest priority in the PSI survey,
2) Location of provisional critical areas identified by the location of pollution sources, and
3) Area having a risk on water utilization considering river water flow condition.

(6) Development of Pollution Source Inventory Guideline

The first task to be conducted in the PSI development procedure is to define and clarify the scope of the inventory including its end use. The collection of data and information plays a key role in developing the river basin PSI. Since it is to contain large amount and various kinds of data and information, the collection of data and information should be conducted effectively and smoothly. Therefore, suitable collection methods should be selected taking into account the type of pollution sources targeted, end use of inventory, and available resources. Sources of data and information can be divided into two categories; direct collection at pollution sources and indirect collection. Data/information needed for developing PSI are to be gathered through sources mentioned above. Normally, it is difficult to gather all data/information needed by one data source. Therefore, integrated use of more than two data/information sources is required. As for the compilation and arrangement of data, the Guideline describes i) Digitization of Information, ii) Format of River Basin PSI, iii) Arrangement of Data for River Basin PSI, and iv) Data Management and River Basin PSI Application.

(7) Capacity Development Condition of Output-2

The comparison results of capacity assessment between initial and final phase of Output-2 based on the questionnaire surveys revealed the following trends.

1) Officers both in VEA and Thai Nguyen DONRE evaluated that their capacity for calculating pollution load has been improved.
2) Officers in Thai Nguyen DONRE evaluated that their capacity has been enhanced for preparing water pollution source control plan based on the estimated pollution load.
3) Officers in both in VEA and Thai Nguyen DONRE considered that their capacity to prepare inventory surrey plan has not been changed.

After the Study, it is recommended to conduct i) Continue trial activity to reflect the PSI Guideline to prepare a plan and implement it, and ii) Expand knowledge for calculating pollution loads, and use them for preparing pollution control plan.

6. Consideration of Pollution Control Approaches for Water Environment Management (Output-3)

(1) Objectives

The specific objectives of Output-3 have been defined as follows:

a) To consider pollution control approaches applicable to water environment management in Vietnam including necessary supporting measures, thereby developing a report presenting the consideration processes and results (Objective 1);

b) To review sections concerned with the compliance inspection of wastewater discharge regulation in existing inspection manual, thereby making recommendations for upgrading it (Objective 2); and

c) To conduct OJT (on-the-job training) for VST staffs in terms of technologies associated with pollution control approaches, so as to strengthen administrative capacity (Objective 3).

(2) Reinforcement Direction of Pollution Control Approaches

In developing the reinforcement direction to response to prime challenges, JST proposes to lay down three (3) basic principles, as follows:

a) Policy mix principle

Implies that Vietnam water pollution control mobilizes diverse pollution control approaches (not single approaches). For the moment, regulatory approach is positioned to play the main tool but it is important increasingly to activate and mix up different approaches to complement each other to realize the approach of "carrot and stick".

b) Participatory principle

Signifies that Vietnam water pollution control incorporates participatory principle involving all related sectors like: pollution generators, general citizens and mass media as well as environment management agencies.

c) Interactive cooperation principle

Implies that Vietnam water pollution control forms and takes advantage of the interactive cooperation among environment management agencies at all levels (VEA, PPCs, DONREs, district divisions of NRE, communes, etc.).

(3) Proposed Actions for Reinforcement

The JICA Study Team proposes the reinforcement direction, studying underlining issues in pollution control approaches/systems as policy enforcement tools. The water pollution control approaches and pertaining systems are reinforced by ensuring the implementation of a series of proposed direction. This direction is commonly applied to the whole of Vietnam, and indicates a guiding direction or a strategy which Vietnam pollution control approaches will go along in the coming future. The proposed reinforcement direction lays down a total of 11 actions to produce four (4) measures, as follows:

Measure 1: Strengthening of enforcement capacity and supporting measures	Action 1.1: Information system of pollution source management
	Action 1.2: Mechanism related with pollution control systems
	Action 1.3: Capacity of local staffs in water environment management
	Action 1.4: Capacity of local agencies in measurement and analysis
Measure 2: Strengthening of wastewater fee and integrated supporting system	Action 2.1: Wastewater fee system
	Action 2.2: Lending capacity of VEPF
	Action 2.3: Integrated supporting system to craft village industries
Measure 3: Promotion of self-supervising management	Action 3.1: Self-monitoring system
	Action 3.2: Environmental supervisor system
Measure 4: Promotion of environmental awareness raising	Action 4.1: Public disclosure of environmental management information
	Action 4.2: Dissemination activities

(4) Review of Inspection Manual

The JST has reviewed the part related with water environmental inspection in the inspection manual prepared by MONRE. The inspection manual prepared by MONRE describes comprehensive contents

which are necessary for the enforcement in actual environmental inspection at site. The contents include: legal framework, tasks of charged units, environmental standards, preparation and procedure of inspection and necessary works after the completion of inspection. This review has found out that the inspection manual is provided with necessary and appropriate contents, in view of necessary environmental inspection in Vietnam and actual practices of DONREs. Hence, JST has judged that the modification of the inspection manual is not necessary. As such, VST and JST have confirmed the completion of the review and recommendation of inspection manual.

(5) Capacity Development Conditions of Output-3

The comparison results of capacity assessment between initial and final phase of Output-3 based on the questionnaire surveys revealed the following trends.

1) Main tasks of members of VEA in pollution control approaches are to establish the legal and institutional mechanism of pollution control systems and to guide their enforcement. Meanwhile, members of DONREs have tasks to enforce pollution control systems as a frontline agency. As identified in the study of Output-3, their main tasks are not properly fulfilled due to weak institutional capacity, except for a limited part of control systems like EIA, environmental inspection, and wastewater fee collection.

2) Various activities for capacity development have been taken through the Study. Up to now, it has been observed that, in the sense of individual abilities of members both at central and local level have been gradually changing upward. As seen from the questionnaire survey of "after the project", the effect caused by the capacity development of this project can be observed in the differences between "before and after".

3) From the viewpoint of individual ability that most members have been strengthening some of necessary knowledge and skills, especially concerning pollution control systems now prevalent in Vietnam like EIA, environmental inspection, and wastewater fee system. However, it is assessed that their abilities are not enough to change current insufficient practices inhabiting in VEA. While their abilities are largely different depending on members, significant room for capacity building is seen to exist, on the whole.

After the Study, it is recommended to conduct the following actions:

a) Further understanding of pollution control approaches and establishing secure mechanism:	To establish secure administrative system of water environment management in Vietnam, i) by examining current issues on various pollution control approaches like regulatory, economic, technical renovation, awareness raising and infrastructure development, including approaches/systems applied to foreign countries, and ii) by considering the necessity in introducing new pollution control approaches.
b) Specific knowledge and skills for respective pollution control systems:	To acquire secure abilities for effectively enforcing pollution control systems in the frontlines of the management, i) by examining the analysis result on existing pollution control systems for finding out inhabiting hindrances and solutions, and ii) by discussing the necessity of additional pollution control systems and successful conditions.
c) Understanding the necessity of good cooperative actions to promote pollution control approaches/systems and establishing secure cooperation mechanism:	To construct effective cooperation mechanism between other relevant agencies in the water environment management sector and also in other sectors , i) by clarifying respective roles of concerned agencies, and ii) by discussing specific methods for realizing good cooperation to address specific problems.

Source: JICA Study Team

7. Development of Water Environment Management Plan in the Model Area of Cau River (Output-4)

(1) Introduction

The Water Environment Management Plan (WEMP) in the model area was prepared aiming at water environment protection, strengthening overall administrative enforcement capacities, and supporting implementation of "the Master Plan on the Protection and Sustainable Development of the Landscape and Ecological Environment of Cau River Basin (CRB M/P).

(2) Stakeholders of WEMP

The WEMP should be planned, designed, implemented, monitored, and managed by the administrative bodies concerned, such as CRC, Vietnam Environment Administration (VEA) under MONRE, the Provincial People's Committee (PPC) of Bac Kan and Thai Nguyen, the Department of Natural Resources and Environment (DONRE) and other related Departments in Bac Kan and Thai Nguyen, the District Divisions in charge. Besides, WEMP should also involve concerned stakeholders to be discussed, shared, participated, collaborated, and contributed, such as state and private enterprises and related groups, local residents and associations, the Environmental Management Board of Industrial Parks and Zones (EMBIPZ) in order to promote and activate the proposed WEMP effectively and efficiently. Their positive involvement and participation is inevitable for the effective implementation of WEMP and for conservation of water environment in the Cau river basin.

(3) Identification of Critical Areas in the Model Area

The nine (9) potential critical areas selected the following viewpoints were identified and these should be scrutinized and prioritized in the course of preparation of WEMP.

a) Areas where pollution sources such as factories, mining areas, craft villages, and hospitals,

b) Areas with close relation between pollution source and water usage, and

c) Areas where heavy pollution have been monitored in current monitoring program.

(4) Current Issues on Water Environment Management in the Model Area

Although both Bac Kan DONRE and Thai Nguyen DONRE are tackling water environment management in the model area, they face several difficulties in promotion of environment management. In Bac Kan DONRE, it has difficulties on water environment management mainly due to lack of human resources and capacity with more critical concerns. In Thai Nguyen province, the industrial sector, especially iron/steel and mining industry, plays an important role in economic development, and it is expected to develop rapidly until 2020. However, Thai Nguyen DONRE can not lead it to comply with environmental regulations very much. Considering current situation on environmental management and pollution control activities, the following several points can be pointed out as common issues in Bac Kan and Thai Nguyen DONRE;

a) DONRE has not developed integrated pollution source inventory database. Each division has their own data but they do not share them. As a result, the data cannot be used for environmental management effectively.

b) Capacity of DONRE in conducting environmental inspection and managing environment protection fee from industry is not sufficient.

c) DONRE does not enforce administrative sanctions appropriately.

d) Current environment protection fee and preferential loan system can not afford enough incentives for enterprises.

e) In the District DONREs, lack of skills and human resources is the biggest obstacles in their water environment management. Improvement of cooperation and support from DONRE is an urgent issue as well.

In addition to above issues, cooperation between Bac Kan DONRE and Thai Nguyen DONRE should be developed in order to promote river basin management stipulated by Decree No.120/2008, their coordination is critical.

(5) Pollution Load Analysis

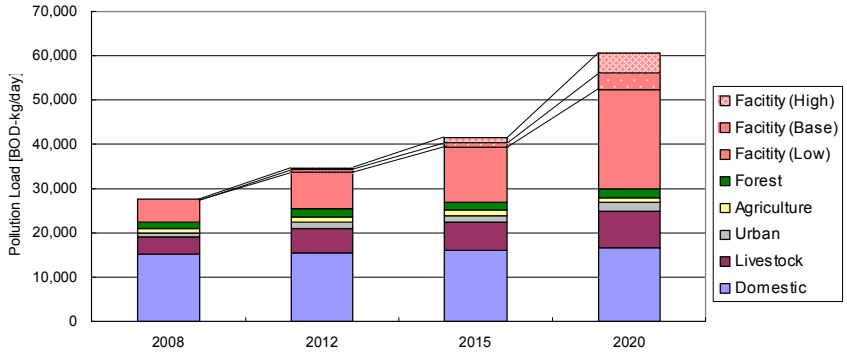
In this WEMP, "Pollution Load" means pollution load reaching to the river multiplying pollution load at sources by run-off ratio. The pollution load is estimated by collecting information on fundamental number and pollution load unit in accordance with classification of pollution load. Based on the currently available data and information such as provincial statistic data, results of pollution source inventory survey, land use map, and pollution load units, the base numbers and units for calculation of pollution load are selected for preparation of WEMP in the model area.

(6) Setting Socio-economic Development Scenario

Both Bac Kan and Thai Nguyen provinces have prepared the socio-economic development M/Ps which specify the prospects of population growth, development targets of turnover and GRDP, land use plans and so on. Therefore, based on the M/Ps of Bac Kan and Thai Nguyen, the socio-economic scenarios are developed. Future population, turnover, GRDP, etc. are estimated by multiplying the latest statistic by the growth rates mentioned in the M/Ps. If the M/Ps do not contain sufficient information, other sector development plans, such as the Revised M/P of Agricultural and Rural Development of Thai Nguyen Province until 2020, are reviewed. In addition, relevant organizations are interviewed to obtain necessary information. Especially, with respect to economic items, i.e. turnover and GRDP, three development scenarios, high, base and low, are prepared. The socio-economic scenarios such as population, turnover, livestock, and land use are set in the target years (2012, 2015, and 2020) based on the above development M/Ps and sector development plans.

(7) Future River Condition without Measures

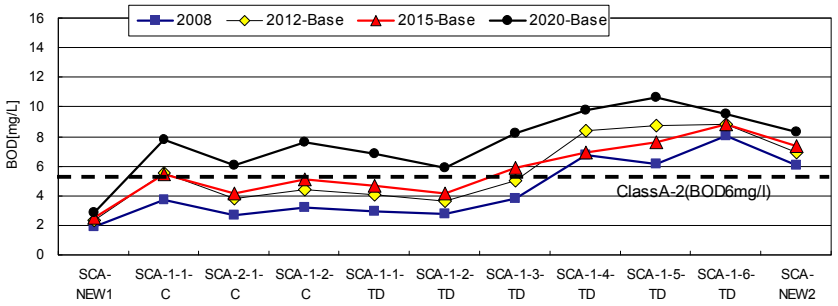
The future pollution load is estimated based on the set socio-economic scenarios. Pollution load increases and decrease in accordance with population growth, increase of the industrial turnover and livestock, and variation of land use pattern. The Figure below shows the yearly trend of pollution load at the model area of the Cau River Basin. Pollution load in 2020 is estimated as twice of that in 2008.



Source: JICA Study Team

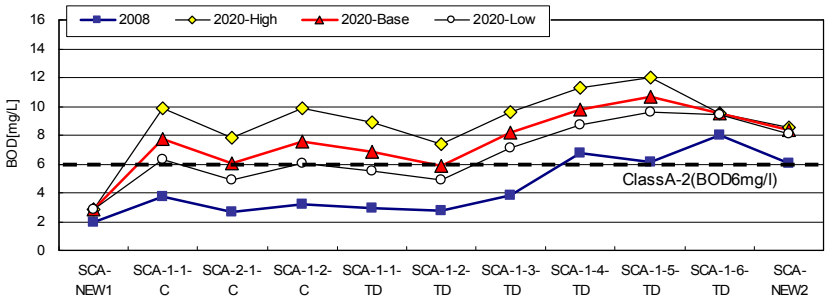
Future Pollution Load (BOD) of the Three Scenarios in 2020

The future water quality is simulated based on the results of pollution load estimation and water balance study of each target year and scenario. The Figure below shows the future water quality (BOD) of the base scenario in 2012, 2015, and 2020 and Figures below shows the future water quality (BOD) of the three scenarios in 2020. Water quality from SCA-1-1-C (downstream area of Bac Kan Town) to the downstream area of the base scenario in 2020 is estimated beyond Class A-2 level (6 mg/L).



Source: JICA Study Team

Future Water Quality (BOD) of the Base Scenario in 2012, 2015, and 2020



Source: JICA study team

Future Water Quality (BOD) of the three Scenarios in 2020

8. Water Environment Management Plan of the Model Area

(1) Vision, Goal, and Target Year

A Vision is a long-term development image of the Cau River basin. It shows 'how we wish to maintain the Cau River in future', and must be shared among all of stakeholders in the basin. The vision of the Cau River for the Water Environment Management Plan (WEMP) is set as follows:

> ***'A healthy river water environment supporting ecosystem, people's livelihoods and socio-economic development in the Cau River Basin'***

A goal is a positive impact created by implementation of WEMP, and it is set as follows:

> ***'Achieve clean river water quality which meets Class A-2 of QCVN 08: 2008/BTNMT in the all model area in 2020'***

(2) Classification of the Cau River and Target Water Quality

The Cau river in the model area is classified into five river sections referring to current and future water quality, pollution sources and water use. Water quality reference points are set up in each section.

Classified River Sections and Their Target Water Quality*

	Section	Water Quality of 2008	Target Water Quality			Water Quality Reference point
			2012	2015	2020	
A	Uppermost area until boundary of Bac Kan town	A-1 level**	A-1	A-1	A-1	SCA-New-1
B	From Bac Kan town to provincial boundary	A-1 level	A-2	A-2	A-2	SCA-1-1-C, SCA-1-3-C
C	From provincial boundary to before confluence point of Du River	A-2 level	A-2	A-2	A-2	SCA-1-1-TD
D	From confluence point of Du River to before Tac Hong Weir	B-1 level	B-1	B-1	A-2	SCA-1-3-TD, SCA-1-5-TD
E	From Tac Hong Weir to before confluence point of the Cong River	B-1 level	B-1	B-1	A-2	SCA-1-6-TD, SCA-New-2

* QCVN 08: 2008/BTNMT; ** Simulation result

Source: JICA Study Team

(3) Target Pollution Sources and Critical Areas

The point sources are main targets of WEMP because their polluters can be identified clearly and effectiveness of water pollution control can be evaluated. On the other hand, though non-point sources are not main targets, WEMP contains some measures contributing to decrease pollution load from them. Target pollutants of WEMP are BOD, COD, SS, As, Cd, Pb, and Zn because they are major pollutants identified by monitoring results in the model area and target pollutants of environmental protection fee (Decree No.67/2003 and Joint Circular No.106/2007).

The 7 priority critical areas are selected from sub-basins where point sources (domestic and facilities) are concentrated, and urban and industrial development are planned. In the critical areas, around 77% of facilities identified by the pollution source inventory survey are located.

(4) Consideration of Pollution Load Reduction Plan

The pollution load from the point sources to be reduced for achievement of the goal of WEMP in the model area in 2020 is shown below. Based on this figure, several alternative pollution load reduction plans are considered.

Domestic and Facility Pollution Load to be Reduced

Province	Section	Critical area	Pollution Load from Point Sources to be Reduced (kg/d)	
			Domestic Pollution Load	Facility Pollution Load
Bac Kan	A	-	0	0
	B	CBK-1	200	3,300
Thai Nguyen	C	-	0	140
	D	CTN-1 CTN-2 CTN-3	900	7,700
	E	CTN-4 CTN-5 CTN-6	1,300	2,900

Source: JICA Study Team

(5) Consideration of Measures and Actions

Considering the pollution control approaches applied in Vietnam and the current issues on water environment management in the model area, the following 5 measures are proposed to achieve the goal of WEMP in the model area in accordance with the pollution load reduction plan. Each measure consists of the Projects aiming at direct pollution load reduction to be implemented by the management bodies of the target pollution sources collaborating with the administrative enforcement bodies on water environment, and of the Operation Program supporting effective and efficient implementation of the Projects.

a) Measure-1: To promote environmental management by enterprises

b) Measure-2: To improve monitoring system and to identify pollution condition

c) Measure-3: To develop public sewerage system in urban areas

d) Measure-4: To promote river basin management

e) Measure-5: To improve environmental awareness and public participation

(6) Policy of Formulating Projects and Operation Programs

For formulation of the projects and operation programs of WEMP, the following basic policies are adopted:

1) To apply Polluter Pays Principle (PPP),

2) To prioritize severe pollution sources as the first target,

3) To evolve from ‘end-of-pipe (control of concentration)’ to ‘win-win (renovation of production process compatible with pollution load reduction)’, and

4) To exclude the currently planned and/or on-going projects, but deal them with the given conditions of WEMP.

(7) Outline of the Proposed Projects

The Project should possess substantial impacts being driven to achieve the vision and goal of WEMP. Thus, its first priority target must be the industrial wastewater especially from severe pollution sources, and the domestic wastewater from dense populated areas. Through detailed analysis related to effectiveness and cost performance by the water quality simulation results, the following 7 Projects are proposed for WEMP in the model area.

- Project 1: Improvement of Water Quality from the Highest Priority Facilities in the Critical Areas, including those of Decision No. 64 and Circular No. 07,
- Project 2: Improvement of Water Quality from Higher Priority Facilities in the Critical Areas,
- Project 3: Improvement of Water Quality from other Facilities in the Critical Areas and Facilities Outside of Critical Areas,
- Project 4: Pollution Load Reduction by Introducing Total Pollution Load Control in the Model Area,
- Project 5: Construction of Small-scale Public Sewerage System in Central Bac Kan Town,
- Project 6: Construction of Public Sewerage System in North and Southeast Central Thai Nguyen City, and
- Project 7: Construction of Public Sewerage System in Southeast of Thai Nguyen City.

The Project 1, 2, and 3 are aiming at control of industrial pollution load from facilities by installation and operation of wastewater treatment plant. The Project 4 aims at introduction of a new concept of total pollution load control which regulates not by concentration, but by total amount of pollution load. The Project 5, 6, and 7 are aiming at control of domestic wastewater pollution load in and around Thai Nguyen city and at Bac Kan town.

(8) Outline of the Proposed Operation Programs

The Operation Program is formulated aiming at effective and efficient implementation of the proposed Projects mentioned above and of the pollution control activities as a whole by focusing on the capacity development of concerned administrative bodies. Therefore, the Operation Program should have closer links with the proposed Projects and the actual pollution control activities taken in the model area. Taking the current administrative enforcement situations into account, the following 9 Operation Programs are proposed for WEMP in the model area.

- Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas,
- Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas,
- Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas,
- Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area,
- Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City,
- Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City,
- Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin,

- Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE, and

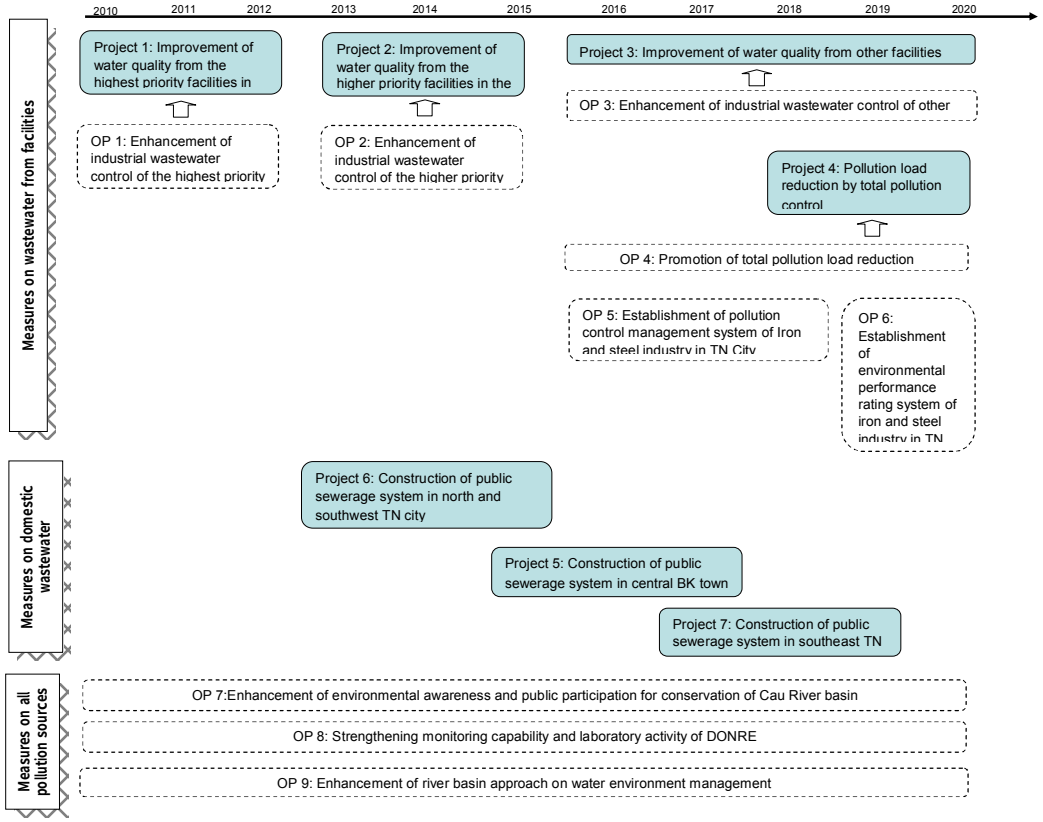
- Operation Program 9: Enhancement of River Basin Approach on Water Environment Management.

The Operation Program 1 to 4 are supporting effective implementation of the corresponding Project 1 to 4. The Operation Program 5 and 6 are aiming at enhancement of environmental management capacity of iron and steel enterprises that are major industrial pollution sources in the model area. The Operation Program 7 to 9 are aiming at enhancement of regional capacity on water environment management.

(9) Relation between Projects and Operation Programs of WEMP in the Model Area

The relation of the proposed Projects and Operation Programs is shown below.

Measure	Proposed Project	Proposed Operation Program (OP)
1. Measure-1	-Project 1 to 4	- OP 1 to 6
2. Measure-2	-	- OP 5 to 8
3. Measure-3	-Project 5 to 7	-
4. Measure-4	-	- OP 2
5. Measure-5	-	- OP 5 to 7



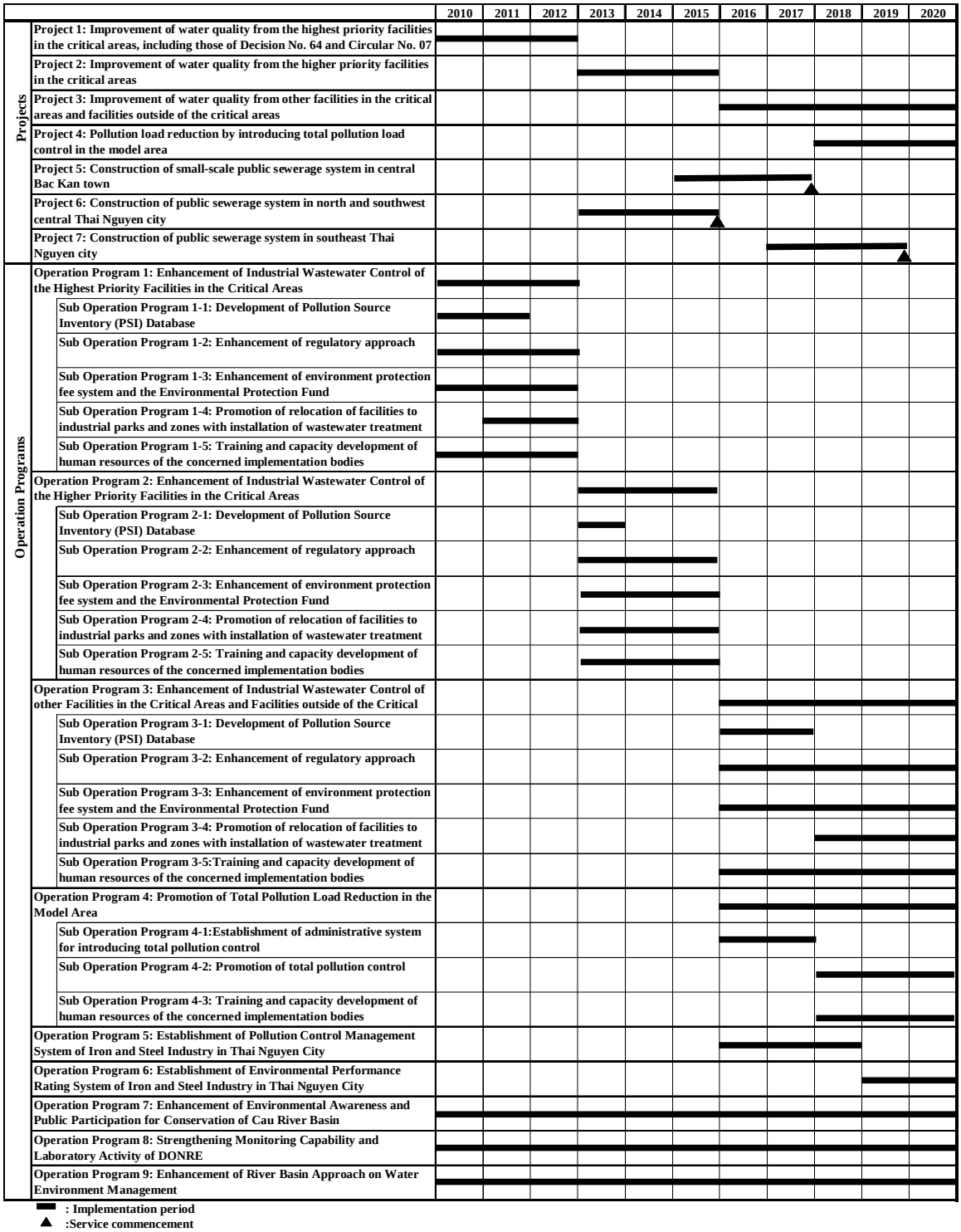
Source: JICA Study Team

Relation between Projects and Operation Programs of WEMP

(10) WEMP Implementation Schedule

An implementation schedule of the Projects and Operation Programs proposed in WEMP is shown in Table below.

Implementation Schedule of WEMP



Source: JICA Study Team

(11) Cost and Financial Source

The WEMP covers 7 Projects and 9 Operation Programs and its indicative cost is summarized in Table below. The total indicative cost was estimated approximately 155 million US$ by fixed price at 2008.

Indicative Cost of the Projects from 2010 to 2020 (1) (fixed price at 2008)

Unit : 1,000 US$

Title of Project in WEMP	a) Initial Cost	b) O&M Cost		Total Cost a) + b)
		Annual Cost	Total Amount by 2020	
Project-1: Improvement of water quality from the highest priority facilities in the critical areas, including those of Decision No. 64 and Circular No. 07	44,235	1,327	10,616	54,851
Project-2: Improvement of water quality from the higher priority facilities in the critical areas	10,103	303	1,515	11,618
Project-3: Improvement of water quality from other facilities in the critical areas and facilities outside of the critical areas	22,763	320	640	23,403
Project-4: Pollution load reduction by introducing total pollution load control in the model area	5,600	200	200	5,800
Project 5: Construction of small-scale public sewerage system in central Bac Kan town	4,431	76	228	4,659
Project 6: Construction of public sewerage system in north and southwest central Thai Nguyen city	17,071	228	1,142	18,213
Project 7: Construction of public sewerage system in southeast Thai Nguyen city	20,924	266	266	21,190
Total Project Cost				139,734

Source: JICA Study Team

Indicative Cost of the Operation Programs from 2010 to 2020 (2) (fixed price at 2008)

Unit : 1,000 US$

Title of Operational Program in WEMP	Total Cost
Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas	3,040
Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas	2,480
Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas	4,480
Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area	1,828
Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City	1,196
Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City	456
Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin	440
Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE	740
Operation Program 9: Enhancement of River Basin Approach on Water Environment Management	468
Total Operation Program Cost	15,128

Source: JICA Study Team

(12) Preliminary Balance Consideration on Indicative Cost and Financing

Based on the indicative cost estimation results and the implementation schedule of the proposed Projects and the Operation Programs in WEMP, an annual balance sheet is prepared preliminary as shown in Table below. As for the cost of the Projects, its initial construction cost is allocated equally by the years of construction period, and its operation and maintenance (O/M) cost is allocated every year after commencement of the services. The cost of the Operation Programs is allocated equally by the years of duration period of each Operation Program. In terms of the financing sources, these are estimated to assume the following conditions:

a) 1% of Provincial Expenditure:

The provincial expenditure is expected to increase based on the annual growth rate of GRDP and the amount of the 1% expenditure budget for environmental protection will increase with same manner. Since this budget should be used not only for WEMP but also other similar purposes, it is assumed only 40% of this budget will be available for WEMP.

b) Environmental Protection Fee:

The amount of environment protection fee is assumed that it will increase accompanying annual increase of turnover of enterprises which is linked to the annual growth rate of GRDP. The base

amount is set a total amount of fee which is actually collected in 2008 in Bac Kan and Thai Nguyen provinces, though its collection coverage percentage is still low especially from enterprises. Therefore, it is expected that the prediction amount could be much more increase by improvement of its coverage ratio of the target enterprises.

c) Subsidy from the State and Provincial Government:

The percentage of subsidy from the state and provincial government differs from case by case in Vietnam. Because of financial vulnerability, rather high percentage of subsidy has been currently given to the target facilities of the Decision No. 64 by the state and provincial government, especially for hospitals, state/provincial owned enterprises, and so on. Therefore, the subsidy from the state and provincial government is assumed that 70% of the cost of the Project 1 to 3, and 20% of the Project 4 considering present situation. However, its balance should be carefully decided by the government to avoid exceedingly relying on the subsidy. Preparation of some soft loan system such as VEPF and preferential tax application should be considered for urging self-reliance of each facility based on the PPP polity. As for the sewerage system construction, its initial cost is usually covered by the government and its O/M cost covered by the tariff from users. Thus, the cost coverage of the Project 5 to 7 is provisionally assumed 30% by subsidy and the rest by financial assistance from donors. Since the most activities of the Operation Programs are regarding to ordinal ones of the administrative bodies on environment management, its cost should be covered by the government. So, it is assumed that 50% of the Operation Program 1 to 9 will be covered by subsidy.

d) Own budget of the Target Enterprises:

Although the target enterprises should cover the cost for wastewater treatment plant installation based on the PPP policy, their affordability might not be enough to cover all cost. Therefore, it is assumed that the target enterprises will cover 10% of the cost of the Project 1 to 3, and 70% of the Project 4. Due to financial vulnerability of the target enterprises, the government should consider to provide them preferential loans.

e) Environmental Fund:

It is assumed that the financial source of environmental fund will cover the expected deficit of balance in the initial 3 years (2010-2012) which is around 2 million US$ in each year.

f) Others:

It is assumed that the financial source from the grant and/or loan of international donor agencies and international development bank such as WB and ADB will cover 60% of the cost of the Project 5 to 7.

(13) Results of Balance Consideration

Based on the assumptions mentioned above, a provisional balance sheet between cost and income related to WEMP is considered and its key findings are as follows. This preliminary balance consideration should be discussed further with the Vietnamese side to seek for the applicable financing figure of WEMP.

1) Under the assumptions mentioned above, the cost of WEMP and the expected financing will balance approximately in total.
2) The budget from the 1% of expenditure and the environmental protection fee will not be enough to cover the cost of WEMP. Therefore, the subsidies from the state and province will be inevitable for balancing.
3) The target enterprises should share 10% of the cost of the Project 1 to 3, and should owe 70% of the Project 4.
4) The financial assistance from the grant and/or loan of international donor agencies and international development bank should be expected for adequate balance.

5) It is recommended that the actual investment for WEMP should be coordinated with the budget planning for the priority projects decided by CRC to achieve CRB M/P.

Provisional Balance Sheet of WEMP in the Model Area

Item		Unit	2008	WEMP Period											
				2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
A) Expenditure of PPC annual budget	A-1) Thai Nguyen province	billion VND	3,255	3,743	4,305	4,950	5,693	6,547	7,529	8,658	9,957	11,451	13,168	15,144	91,145
		1,000 US$	180,833	207,958	239,152	275,025	316,279	363,720	418,278	481,020	553,173	636,149	731,572	841,307	5,063,635
	A-2) Bac Kan province	billion VND	2,125	2,380	2,666	2,985	3,344	3,745	4,194	4,698	5,261	5,893	6,600	7,392	49,158
		1,000 US$	118,056	132,222	148,089	165,860	185,763	208,054	233,021	260,983	292,301	327,377	366,663	410,662	2,730,995
	Total of A)	billion VND	5,380	6,123	6,970	7,936	9,037	10,292	11,723	13,356	15,219	17,343	19,768	22,535	140,303
		1,000 US$	298,889	340,181	387,241	440,884	502,041	571,775	651,299	742,003	845,475	963,527	1,098,234	1,251,970	7,794,630
B) Cost of WEMP	Project-1: Improvement of water quality from the highest priority facilities in the critical areas, including those of Decision No. 64 and Circular No. 07	1,000 US$	-	14,745	14,745	14,745	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	54,851
	Project-2: Improvement of water quality from the higher priority facilities in the critical areas	1,000 US$	-	0	0	0	3,367	3,367	3,367	303	303	303	303	303	11,618
	Project-3: Improvement of water quality from other facilities in the critical areas and facilities outside of the	1,000 US$	-	0	0	0	0	0	0	3,553	3,553	3,553	6,373	6,373	23,403
	Project-4: Pollution load reduction by introducing total pollution load control in the model area	1,000 US$	-	0	0	0	0	0	0	0	0	1,867	1,867	2,067	5,800
	Project 5: Construction of small-scale public sewerage system in central Bac Kan town	1,000 US$	-	0	0	0	0	0	211	2,110	2,110	76	76	76	4,659
	Project 6: Construction of public sewerage system in north and southwest central Thai Nguyen city	1,000 US$	-	0	0	0	813	8,129	8,129	229	229	229	229	229	18,213
	Project 7: Construction of public sewerage system in southeast Thai Nguyen city	1,000 US$	-	0	0	0	0	0	0	0	996	9,964	9,964	267	21,190
	Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas	1,000 US$	-	877	1,081	1,081	0	0	0	0	0	0	0	0	3,040
	Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas	1,000 US$	-	0	0	0	947	767	767	0	0	0	0	0	2,480
	Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas	1,000 US$	-	0	0	0	0	0	0	1,100	1,100	760	760	760	4,480
	Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area	1,000 US$	-	0	0	0	0	0	0	228	228	457	457	457	1,828
	Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City	1,000 US$	-	0	0	0	0	0	0	399	399	399	0	0	1,196
	Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City	1,000 US$	-	0	0	0	0	0	0	0	0	0	228	228	456
	Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin	1,000 US$	-	40	40	40	40	40	40	40	40	40	40	40	440
	Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE	1,000 US$	-	67	67	67	67	67	67	67	67	67	67	67	740
	Operation Program 9: Enhancement of River Basin Approach on Water Environment Management	1,000 US$	-	43	43	43	43	43	43	43	43	43	43	43	468
	Total of B)	1,000 US$	-	15,772	15,976	15,976	6,604	13,740	13,951	9,397	10,394	19,084	21,733	12,236	154,862
C) Financing	C-1) 40% of 1% Expenditure (0.4% of A)	billion VND	35	39	45	52	59	67	77	88	101	115	132	151	926
		1,000 US$	1,919	1,361	1,549	1,764	2,008	2,287	2,605	2,968	3,382	3,854	4,393	5,008	31,179
	C-2) Environmental protection fee from indusries	billion VND	0.36	0.41	0.46	0.52	0.59	0.67	0.76	0.85	0.97	1.09	1.23	1.39	9
		1,000 US$		23	26	29	33	37	42	47	54	61	68	77	497
	C-3) Subsidy from state and provincial government (70% of cost of Project 1to 3, 20% of cost of Project 4, 30% of cost of Project 5 to 7, 50% of cost of OP 1 to 9)	1,000 US$	-	10,835	10,937	10,937	3,742	5,846	5,910	4,882	5,181	7,579	9,186	6,317	81,351
	C-4) Own budget of enterprises (10% of cost of Project 1 to 3, 70% of cost of Project 4)	1,000 US$	-	1,474	1,474	1,474	469	469	469	518	518	1,825	2,107	2,247	13,047
	C-5) Foreign donor assistance (60% of cost of Project 5 to 7 excluding O/M cost)	1,000 US$	-	0	0	0	488	4,877	5,004	1,403	2,001	6,161	6,161	343	26,437
	C-6) Other finincial sources such as VEPF	1,000 US$	-	2,000	2,000	2,000	0	0	0	0	0	0	0	0	6,000
	Total of C)	1,000 US$	-	15,693	15,986	16,204	6,740	13,517	14,030	9,819	11,135	19,480	21,915	13,992	158,512
D) Balance between cost of WEMP and possible financing amount (finaicing C) - cost of WEMP B))		1,000 US$	-	**-79**	**10**	**228**	**136**	**-222**	**79**	**421**	**742**	**396**	**182**	**1,756**	**3,649**

Source: JICA Study Team

(14) Institutional Structure

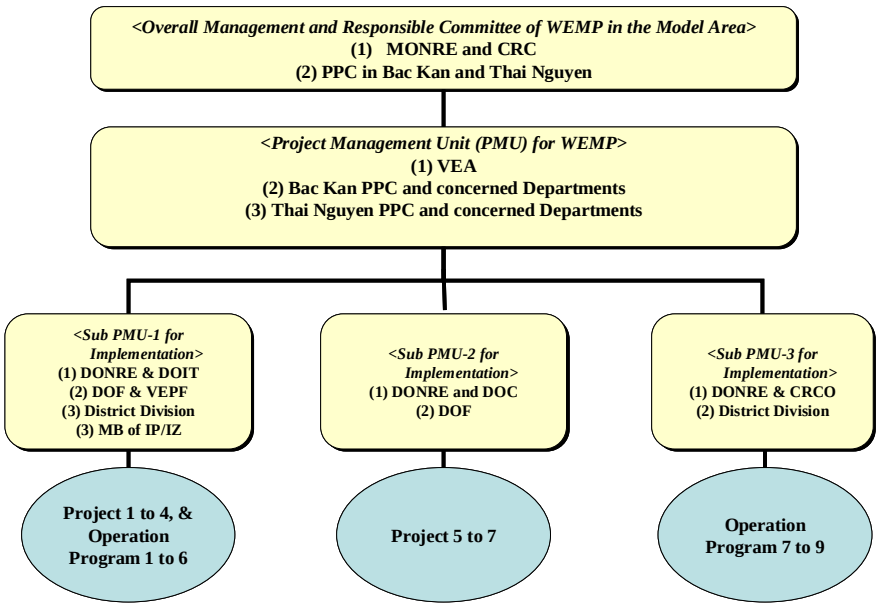
Since WEMP includes broad wide components for water environment management in the model area, its responsible, management, and implementation organization should be the following 3-stories structure.

a) Overall Management and Responsible Committee: the highest decision making committee consists of MONRE, CRC, Bac Kan PPC, and Thai Nguyen PPC.

b) Project Management Unit (PMU) for WEMP: the actual implementation and management body mostly consists of VEA, PPC and concerned Departments in Bac Kan and Thai Nguyen provinces.

c) Sub Project Management Unit (Sub PMU): the field implementation body mostly consists of organizations concerning to the actual implementation of the Projects and the Operation Programs in WEMP. Considering the components of the Projects and the Operation Programs, at least 3 Sub-PMU should be established, namely the Sub PMU-1 for conducting the Projects 1 to 4 and the Operation Program 1 to 6 concerning to industrial pollution control, the Sub PMU-2 for conducting the Projects 5 to 7 concerning to domestic pollution control, and the Sub PMU-3 for conducting the Operation Program 7 to 9 concerning to capacity development of pollution control. The actual members of each Sub PMU should be subject to the components to be covered.

The Figure below summarizes the institutional structure for management and implementation of WEMP.



Source: JICA Study Team

Institutional Structure for Management and Implementation of WEMP

(15) Capacity Development Conditions of Output-4

The comparison results of capacity assessment between initial and final phase of Output-4 based on the questionnaire surveys revealed the following trends.

1) Almost all officers in each organization recognized the Cau River Basin M/P. The interviewees answered that they understand objective of the Cau River Basin M/P and task of Cau River Committee well.
2) It is considered that knowledge on pollution load estimation should be enhanced.
3) Among various pollution control approaches, officers considered that they have knowledge on technical renovation approach and awareness raising approach more than regulatory approach and economic approach.

9. Development of Handbook for Formulation of Water Environment Management Plan (WEMP) (Output-5)

(1) Purpose

The purpose of this handbook is to provide a common framework of WEMP and baseline procedures for developing WEMP on river basin approach by using experiences and data/information obtained through the Study as examples. Because planning conditions (natural conditions, administrative situations, aimed targets and others) are different from regions to regions, the results of the Study may not be used always, as it is. However, the baseline way of thinking and procedures may be common. Hence, it is expected that basic methodologies are commonly applicable to the development of WEMP in other regions, as useful tools and/or milestones. To assist specifying the procedure introduced in the handbook to apply each river basin, several tools prepared under the Study, such as guidelines and reports related to Output-1, 2 and 3, can be used.

(2) Scope of Handbook

The handbook introduces general contents to be included in WEMP and general procedures for formulating WEMP. Besides, WEMP could deal with various topics related to water environment management on several types of water resources. It is considered that this handbook is especially useful for i) Inner and Inter-provincial River Basins Management, and ii) River Water Quality Management.

(3) Expected User

Expected users of this handbook can be classified three categories, such as planners, supervisors, and advisors for formulating a WEMP at river basin level. Organizations concerning each category in Vietnam are shown below:

1) Provincial departments and River Basin Committee Office (RBCO) as implementation bodies of WEMP formulation
2) PPCs and River Basin Committee (RBC) as supervisors for formulating WEMP, and
3) MONRE and research institutes related to water environment management as advisors for formulating WEMP.

(4) Framework of WEMP

Framework of WEMP must express clear objectives to be achieved and activities necessary for achieving these objectives, so that the developed WEMP can be implemented and evaluated, appropriately. A planning process of WEMP is divided into four (4) steps: preparation of framework, assessment of issues to be addressed by WEMP, planning of WEMP and Evaluation of Developed WEMP. The overall planning process is as follows.

(5) General Procedure for WEMP Formulation

A planning process of WEMP are divided into four (4) steps: preparation of framework, assessment of issues to be addressed by WEMP, planning of WEMP and Evaluation of Developed WEMP. The overall planning process is as follows.

1) Overview

The basic aim of WEMP is to establish specific methodologies and objectives for solving problems identified water environment management in a region. Therefore, the development of WEMP starts with the clarification of present situation of water environment, and ends by examining the appropriateness of formed WEMP. While there are different ways being applied for the development of WEMP, depending on countries, regions, planners and so on, a common procedure shown in Figure 3.1-1.

The procedure introduced here is basically comprised of four (4) steps: preparation of framework, analysis of issues to be addressed, planning and evaluation. Even if characters of subject areas are diverse, these basic procedural steps (including component steps) may be applicable, commonly.

It is very common that the development work of WEMP is not by "one way trip" but by the way of "trial and error" with several times. Hence, it should be remarked that the repeated examinations of "go" and "back" are always requested at all steps, until rational solutions arise.

2) Setting Framework

Before the detail analysis, this step roughly clarifies the present situation of water environment in the planning area, including natural and socio-economic characteristics, water quality conditions, current management practices, etc. In this step, the collected data/information are gone through to know main agenda of the WEMP to be developed, and, based on this, the "goal" of WEMP is raised in view of a long-term perspective on the water environment in the planning area.

3) Identification of Current Issues

WEMP is an intervention to respond to certain problems, by initiating a number of activities. Therefore, all problems concerned must be clarified, including their causes. The issues are identified by three (3) steps: i) analyzing current issues, ii) predicting pollution load and water quality in target years, and iii) analyzing problems to be solved.

In the process of analyzing current issues, locations, and characteristics of pollution sources in the region are clarified with the calculation of pollution load generation, and the river water qualities are evaluated comparing to surface water quality standards considering regional water usage condition. In the aspect of environment management, current management practices are clarified in terms of administrative management practices, pollution mitigation measures at generation sources, activities of organizations concerned, resources of management sectors, etc.

In the next step, pollution load generation are calculated along a socio-economic growth scenarios and river water qualities in the target years of WEMP are calculated by means of the simulation with a water quality model.

Following the clarification of present situations and prospected pollution load generation and river water qualities, the problem analysis takes place to analyze the mechanism of problem structure in the region.

4) Planning of WEMP

Planning of WEMP is a core step of WEMP development, comprising: setting up a "objective" and "targets", considering pollution load reduction planning, setting up "measures" and actions, developing "projects for countermeasure", preparing other necessary management accounts.

The "objective" and "target" of WEMP are defined as a specific desirable status to be achieved within a target year and an indicator for measuring the achievement status of the "objective", respectively. Pollution load reduction plan is examined on how to achieve the "objective" from the viewpoint of water quality. In preparation of pollution load reduction plan, pollution load generation is calculated along a socio-economic growth scenarios and river water qualities in the target years of WEMP are calculated by means of the simulation with a water quality model.

"Measures" with attached by "indicators" are conditions necessary for producing the "objective", and are produced by successful implementation of "projects for countermeasure". The "measures" are raised as required states to solve problems coming from environment management and to attain pollution reduction plan to lead the "goal".

"Projects for countermeasure" are activity components which participants of the WEMP implement according to a time schedule. The achievement of "projects for countermeasure" produces successful attainment of the "measures".

Hence, a ”objective”, “measures” and “projects for countermeasure” are mutually connected with the relationship of “measure” and “end”, logically. It is common that this planning step of WEMP is repeated several times by way of “trial and error” to obtain rational results.

5) Evaluation of Developed WEMP

As a final stage, WEMP formed by the steps before are evaluated with certain criteria from a comprehensive aspect, to verify its appropriateness.

10. Recommendations on Legal Framework and Coordination Mechanism for Water Environment Management Plan at River Basins (Output-6)

(1) Overall Issues of Legal Regulation System

Since the beginning of 2000s, Vietnam has promulgated large numbers of national policies and strategies on environment management in line with the river basin water resource management. Along such policies and strategies, the Law on Environment Protection (LEP) has been amended in 2005 (Law No. 52), and the Vietnam Government have been taking aggressive specific actions especially for the alleviation against serious pollution facilities, wastewater fee collection, water environment management with river basin approach.

In the course of the Study, the following weak constraints in legal regulation system have been identified.

1) Construction of Effective Legal Mechanism for Environment Management

Many policies and strategies for the water environment management have been little activated in the sense of the actual enforcement without the construction of effective legal mechanisms for the implementation. It is resulting from insufficient allocated resources (human resources, finances, etc.), underdeveloped institutional capacities, lacking cooperation mechanisms among all levels, etc. in the environment management sector in Vietnam.

2) Policy-Mix Approach for Pollution Control

The LEP is defining almost all pollution control approaches and pertaining systems for water pollution control. However, guidance necessary for actually enforcing pollution control approaches are deviated to only the regulatory approach (like EIA, environmental inspection, administrative sanction, etc.) and a part of economic approach (wastewater fee system). This is why diverse pollution control approaches have not been realized in Vietnam, at present. In this sense, VEA as the central government agency, is requested to lead the development of supplemental regulations and guidelines in order to guide and activate now sleeping approaches.

3) Activation of Pollution Control at All Levels

Decentralization in the administration of environment management is in progress along the prioritized policy of Vietnam. Along this trend, each District DONRE is placed at the authorization agency for many pollution sources which are registered by EPC. However, its institutional capacities are underdeveloped at present. Unlike pollution sources authorized by EIA, the sizes of pollution sources registered by EPC are relatively small, but they are discharging large pollution load due to the existence of large numbers of small-scale enterprises. To activate pollution control approaches/systems, special endeavors for effective guiding should be made, so that District DONRE can fulfill their mandates in environmental management such as authorization of EPC, environmental inspection, and administrative sanction.

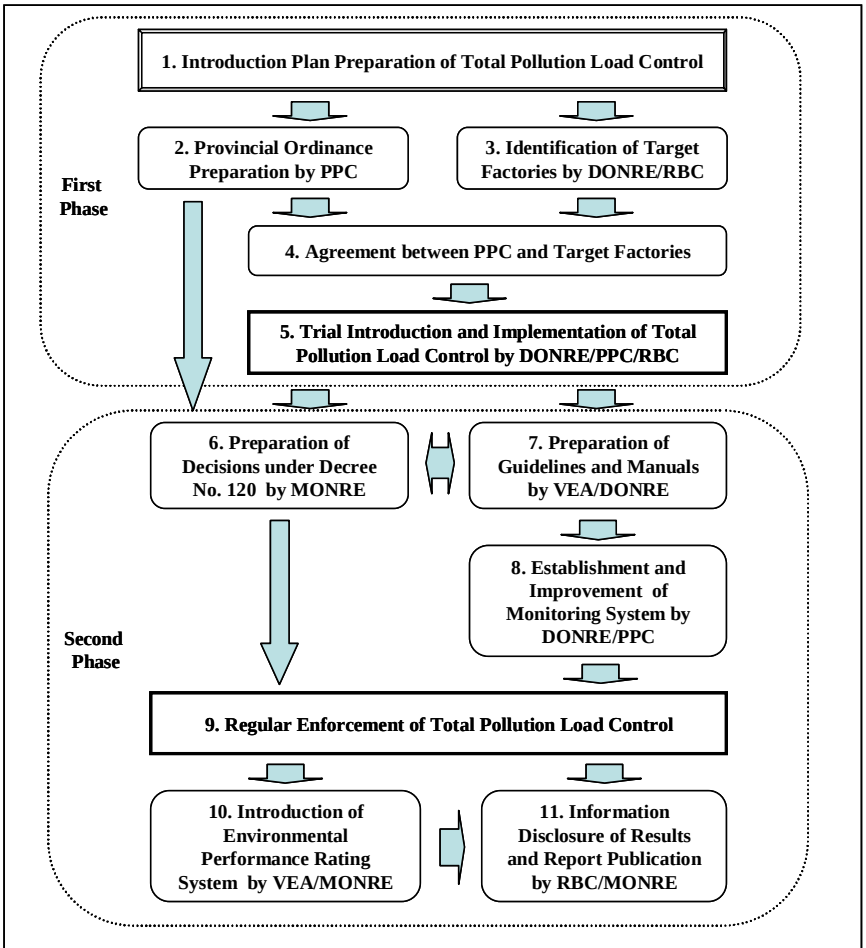
The mentioned above are regarded to represent underlying persistent issues inhabiting in the water environment management sector at all levels, rather than just issues in legal regulation system. Hence, it is advised that these issues be tackled from a long-term view in a strategic initiative for reinforcing comprehensive abilities of the whole water environment management sector in addressing increasing and diversifying environmental pressures.

(2) Regional Specific Issues of Legal Regulation System

Considering current situation on environmental management and pollution control activities in the model area, several issues on i) the command and control activities such as inspection and sanction, ii) the economic incentive activities such as preferential tax and funding system are found to be tackled and developed in order to promote water environment management in river basin stipulated by Decree No.120/2008.

(3) Introduction of Total Pollution Load Control Method

A total pollution load control is one of new tools for pollution control in river basins in Vietnam. At first, it will require a legal framework for introduction such as Decisions under the Decree No. 120. Moreover, it will also require more right system related to planning, design, monitoring, and implementation for actual enforcement by the local administrative authorities. Considering the current local situations on water environment management, a step by step procedure is recommended for actual introduction of the total pollution load control method as shown in Figure below.



Proposed Introduction Procedure of Total Pollution Load Control

Source: JICA Study Team

(4) Recommendations on Legal Framework

Through the Study, a number of impediments and insufficiencies in current pollution control have been clarified as mentioned above. Some items will require specific legal system solutions as shown in Table below to ensure the enforcement of WEMP. It is recommended that some needs of them may be timely responded by setting up "Ordinances" at the provincial level by PPCs, as an expeditious way and/or issues peculiar to a region.

Specific Needs for Strengthening of Legal Regulation System

No.	Pollution Control Approaches/Systems	Needs for Strengthening	Relevant Regulations
1	Environmental inspection and fines	- Enabling the environmental inspection on site without pre-notification on, to promote the environmental compliance. - Increasing the amount of fines against violations to promote the environmental compliance.	- Law on Inspection (June 24, 2004) - Decree No.41/2005/ND-CP and others -Circular No.07/2007/TT-BTNMT
2	Wastewater fee system	- Increasing the fee rate to render clear economic incentive to payers. - Setting up the payment of compensation for environmental damages against the violations beyond the effluent standard. - Setting up the penalties against no fee payers. - Setting up the minimum effluent discharge to be adopted for wastewater fee, to save the management resources of the environment management sector.	- Decree No.67/2003/ND-CP - Joint Circular No.125/2003/TTLT- BTC-BTHMT and others
3	Total load pollution load control	- Introducing the regulation of the total pollution load (calculated by multiplying wastewater flow and concentration) discharged from enterprises located in a special designated area. - Promotion of specific agreement between the local authorities and enterprises.	- To issue newly established regulation, due to no corresponding regulation at present.
4	Environmental supervisor system	- Introducing the regulation of environmental supervisor system to be applied to enterprises for promoting specialized environment management by a certified supervisor. - Promotion of specific agreement between the local authorities and enterprises. - Introduction of regional specific regulations such as more stringent standards, increasing control substances, and cut-down criterion.	- To issue newly established regulation, due to no corresponding regulation at present.
5	Integrated supporting system to small-scale industries	- Launching integrated supporting (planning, constructing, soft-loan rendering, etc.) with establishment of a special agency under the auspices of MONRE, to promote the environment protection measures in small-scale industries.	- To issue newly established regulation, due to no corresponding regulation at present.

Source: JICA Study Team

(5) River Basin Management Approach and General Structure

Currently, the following Decrees and Decisions can be enumerated related to the Cau river basin in general and these explicitly state the range of concerned organizations, coordination functions, and responsibilities. Under this legal frame, the concerned 6 PPCs have agreed a shared commitment to the protection and sustainable exploitation of water in the Cau River basin.

-"A General Project on Protection and Sustainable Development for Ecological Environment and Landscape in sub River Basin" (Decision No. 174/2006/QD-TTg)

-"Establishing Cau River Basin Environmental Protection Committee" (Decision No.171/2007QD-TTg)

-"Promulgation of organization and operation regulation of Cau River Committee Office" (Decision No.1770/2008/QD-BTNMT)

-"Decree on River Basin Management" (Decree No.120/2008/ND-CP)

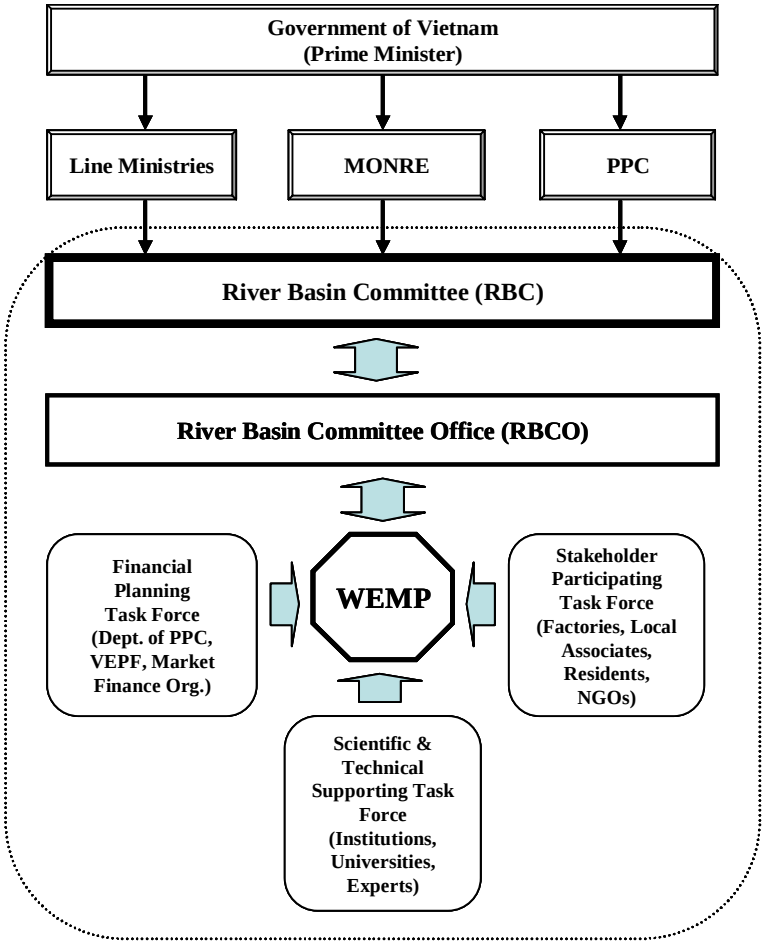
(6) Specific Requirements on Coordination Mechanism on WEMP

At present, the established CRC has dedicated great efforts to achieve CRB M/P holding the CRC meetings at 4 times so far. Therefore, it is expected that the proposed WEMP in the model area should be built in the overall plans and activities of CRC for its successful implementation. The current crucial issues in the CRC meetings to be coordinated could be a) prioritization of the projects and programs formulated in WEMP, b) financial aspect for implementation of WEMP, and c) participation of concerned stakeholders. It is recommended to establish special task forces to cope with these issues under RBC and RBCO as shown in Table and Figure below.

Recommendation on Establishment of Special Task Force

No.	Task Force	Focal Activities	Organizations
1	Financial Planning Task Force	- To propose draft plans and materials for coordination to be discussed in RBC meeting concerning to financial matters of WEMP - To assist and support RBCO's coordination activities related to financing and budgeting - To propose mechanism, system, and legal frame of WEMP	1)Leading: Representative of RBCO 2)Others: -Dept. of Finance in MONRE -Dept. of Finance in PPC and District -Environmental Fund such as VEPF & provincial fund -Market financial organizations such as commercial bank and development bank
2	Scientific and Technical Supporting Task Force	- To propose draft plans and projects to RBCO - To evaluate proposed plans and projects from technical viewpoint - To advise and support RBC and RBCO from scientific and technical viewpoint -To support technical appraisal of environmental fund application	1)Leading: Representative of RBCO 2)Others: -Concerned Dept. in PPC -Technical institutions -Universities -Scientific and technical experts
3	Stakeholder Participating Task Force	- To propose draft plans and activities - To promote and coordinate participatory approach of WEMP - To advise and support RBC and RBCO related to stakeholder participation -To support and propose related to data publication and information disclosure to RBC and RBCO -To plan and propose holding symposium, seminar, and workshop	1)Leading: Representative of RBCO 2)Others: -Concerned Dept. in PPC and District -Representative of local associations -Representative of enterprises -Universities -Local experts -NGOs

Source: JICA Study Team



Source: JICA Study Team

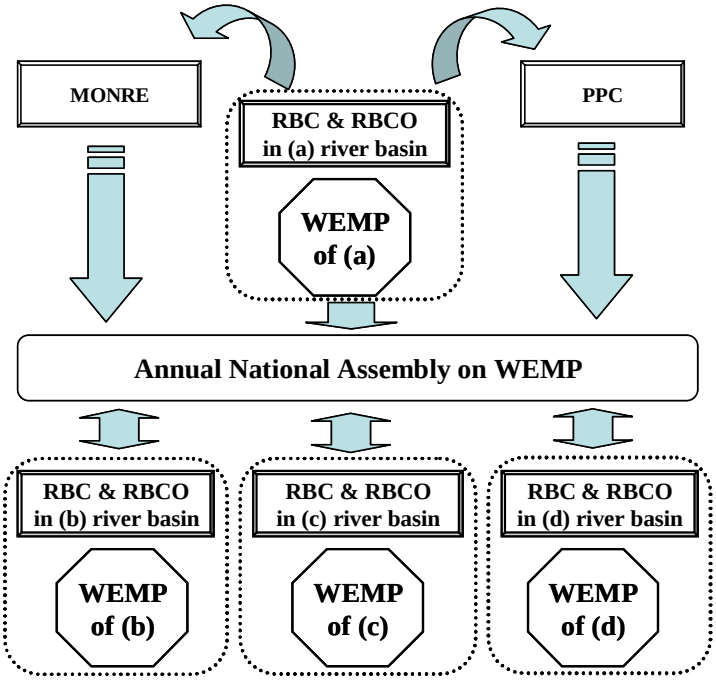
Recommended Structure of WEMP

(7) Active Use and Dissemination of WEMP

The WEMP in the model area and a series of Guidelines are developed mainly for the administrative organizations such as VEA in MONRE, DONRE in PPC, District DONRE, and the River Basin Committee (RBC). In particular, it is expected to be fully used by the River Basin Committee Office (RBCO) because of its functional duties to RBC. In other words, these organizations should take an initiative not only for effective and efficient use but also for improvement and revision to meet its river basin specific conditions. Then, it is recommended that these experiences are to be accumulated and shared with the concerned organizations of other river basins holding a periodic national assembly in Vietnam. This schematic dissemination concept is depicted in Figure below.

In the PCU meeting held on 13th November 2009 suggested that a trial apply of the Outputs of the Study should be conducted in the Nhue-Day river basin in order to obtain practical lessons and points to be improved in other river basin, and also recommended to apply them for the next project opportunities such as the National Water Environment Management Capacity Strengthening Project.

It should be noted that this WEMP consists of some parts of the overall River Basin Management concept in Vietnam. In fact, the "Decree on River Basin Management" (Decree No.120/2008/ND-CP) is promulgated pursuant to both Law of Environmental Protection on 29/11/2005 (LEP) and Law of Water Resource on 20/05/1998 (LWR), and contain broad wide aspects on the river basin management. Thus, it is expected that WEMP should be formulated being subjected to this Decree No.120, and it could be a part of the Overall River Basin Management Plan in future.



Source: JICA Study Team

Concept of Transfer and Dissemination of WEMP

11. Training in Japan

In the course of the Study, the following three (3) training courses in Japan were implemented for better understanding of the river basin water environment management.

1) Water Environment Management Policy Course,

2) Water Environment Management Administration Course, and

3) Water Environment Management Course for the Cau River Committee.

1. General

1.1 Objectives of the Study

The long-term objective of the Study for Water Environment Management on River Basins in Vietnam (the Study) is to strengthen the overall capacities of the governmental institutions to ensure effective water environment management of river basins, such as Cau, Nhue-Day, and Dong Nai river basins, focusing on the successful implementation of the "Master Plan (M/P) on the Protection and Sustainable Development of the Landscape and Ecological Environment of Cau River Basin" (Cau River Basin M/P) and M/Ps for other river basins in the future.

The main study area is the Cau River basin. The Cau River model represents the upstream basin area of Cau River (upstream area from the Con River confluence point). The Nhue-Day River basin is a sub-study area, with available information to be used for the development of some of the outputs.

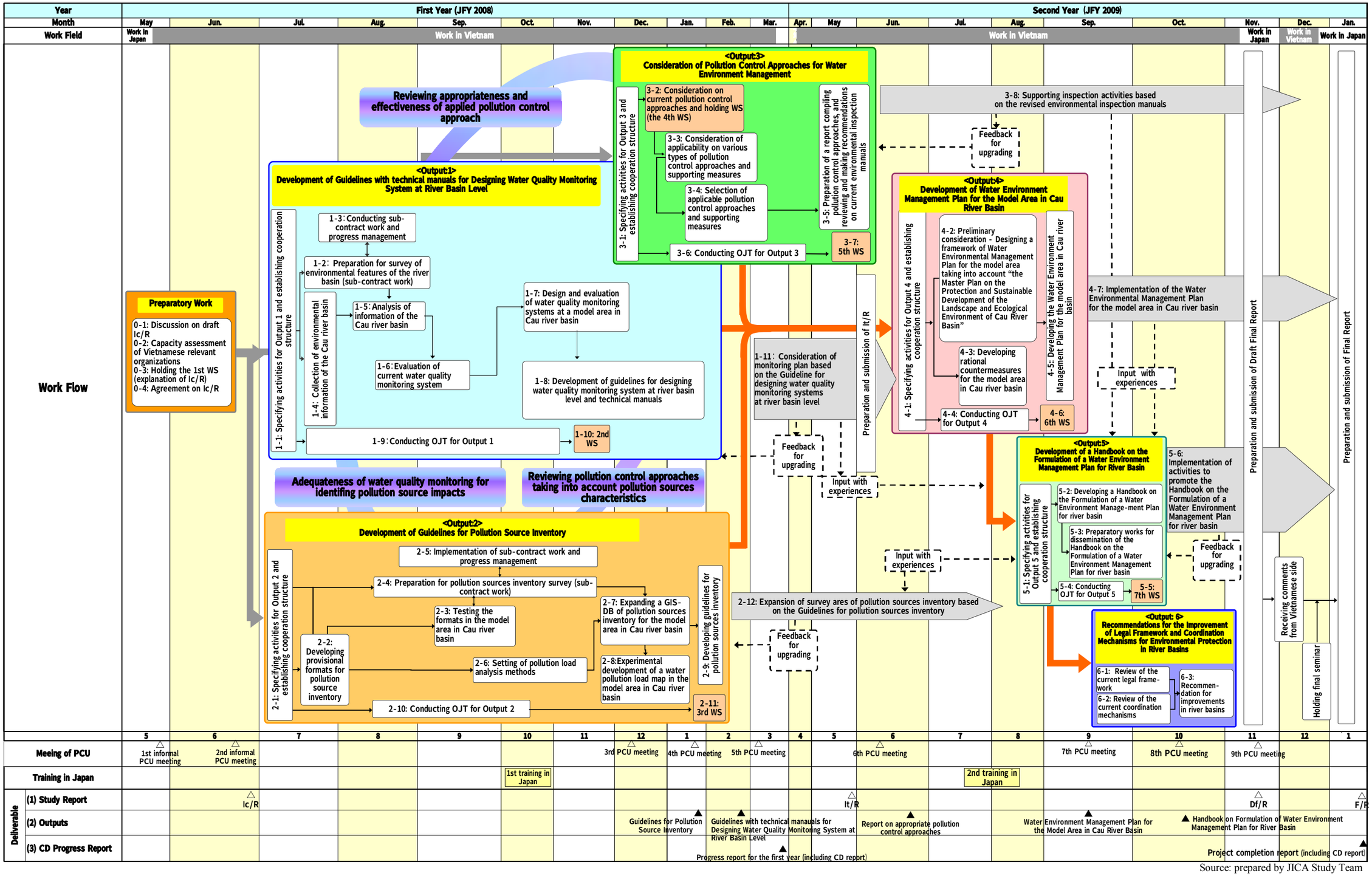
1.2 Scope of Work

In order to achieve the objectives mentioned above, the S/W for the Study covers six items described in Table 1.2-1, and its overall work flow is shown in Figure 1.2-1. The S/W was confirmed and shared with the Vietnamese side in the first workshop held on 9th July 2008.

Table 1.2-1 Scope of Work of the Study

Item	Contents	Activities
Output-1	Development of guidelines with a technical manual for designing water quality monitoring systems at the river basin level	1) Grasp the environmental features of the river basin 2) Evaluate the current water quality monitoring systems in Cau and Nhue-Day Rivers 3) Develop guidelines for designing water quality monitoring systems at the river basin level, and a technical manual for database development
Output -2	Development of guidelines for pollution sources inventory	1) Develop provisional formats for pollution source inventory 2) Test the formats in a "model area" in the Cau River basin 3) Expand the GIS database of pollution source inventory for a "model area" in Cau River basin 4) Develop a water pollution map which includes at least the pollution source and ambient water quality data in a "model area" in the Cau River basin 5) Develop guidelines for pollution source inventory
Output -3	Consideration of regulatory approaches for water environment management in river basins	1) Identify the features of wastewater generation and pollution control measures employed in Vietnam 2) Study various types of pollution control approaches, including technical, economic, and market-oriented ones as well as various types of supporting measures 3) Examine the applicability of the approaches and technologies studied above 4) Prepare a report compiling appropriate regulatory approaches and technologies for Vietnam 5) Review and make recommendations on environmental inspection and supervision procedures in Vietnam
Output -4	Development of a water environment management plan (WEMP) for the model area in Cau River basin	1) Design the framework of a WEMP for the model area, taking into account the "M/P on the Protection and Sustainable Development of the Landscape and Ecological Environment of Cau River Basin" (the Cau River M/P) 2) Develop rational countermeasures for the model area in Cau River basin 3) Develop the WEMP for the model area in Cau River basin
Output -5	Development of a handbook on the formulation of the water environment management plan for river basins	1) Develop a handbook on the formulation of the WEMP for river basins 2) Disseminate the handbook in order to be applicable to other river basins
Output -6	Recommendations for the improvement of the legal framework and coordination mechanisms for environmental protection in river basins	1)Review the existing legal framework and coordination mechanisms for environmental protection in river basins based on related information provided by the Vietnamese side 2) Recommend improvements on the legal framework and coordination mechanisms for environmental protection in river basins

Source: JICA Study Team

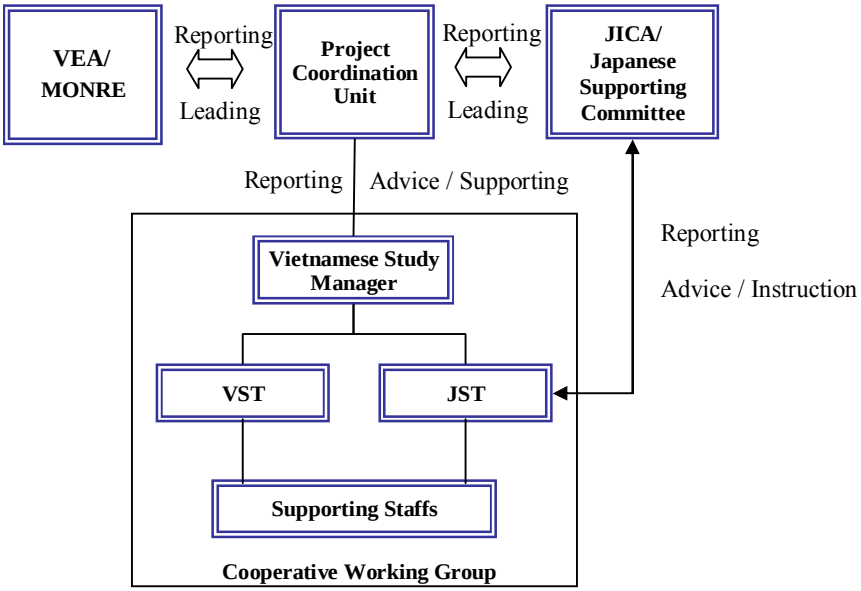


Source: prepared by JICA Study Team

Figure 1.2-1 Overall Work Flow

1.3 Organization of the Study

The proposed organization chart for the Study is shown in Figure 1.3-1.



Source: JICA Study Team

Figure 1.3-1 Organization of the Study

(1) Project Coordination Unit (PCU)

The PCU is the highest decision-making organization for smooth implementation of the Study. Its major roles are to support smooth implementation of the Study and to promote active use and dissemination of the corresponding outcomes. Based on discussions with the Vietnamese side, the members of PCU are listed in Table 1.3-1.

Table 1.3-1 Member List of PCU

In charge	Name	Organization	Major Items to be Discussed
Chairman	1. Dr. Bui Cach Tuyen	Director General of Vietnam Environment Administration (VEA/MONRE)	1) Items of direction, organization, methodology, contents, and condition of the Study 2) Items for implementation, evaluation, approval, and dissemination of the Study outputs 3) Coordination and support of inter-ministerial matters 4) Information to be disclosed and public relation matters
Member	2. Mr. Nguyen Xuan Bao Tam	Deputy Director of ICD/MONRE	
	3. Dr. Nguyen Thai Lai	Director General of DWRM	
	4. Dr. Nguyen Minh Son	Vice Director of VAST/IET	
	5. Mr. Nguyen Xuan Tien	Deputy Director of the Department of Foreign Economic, MPI	
	6. Mr. Duong Van Khanh	Director of DONRE in Thai Nguyen Province	
	7. Mr. Tran Nguyen	Vice Director of DONRE in Bac Kan Province	
	8. to be named	Cau River Committee Office	
	9. Mr. Phung Van Vui and Dr. Do Nam Thang	Team Leader of the Vietnamese Study Team (VST), VEA	
	10. Mr. Yoichi Iwai	Team Leader of the JICA Study Team (JST)	
	11. Mr. Motonori Tuno	Chief Representative of the JICA Vietnam Office	
	12. Ms. Nguyen Thi Kim Quy	Officer of ICD/MONRE	
Observer	13. Mr. Yosuke Tomizawa	Embassy of Japan	
	14. Mr. Yutaka Matsuzawa	JICA Expert (MONRE)	

Source: JICA Study Team

In total, nine (9) PCU meetings have been held so far. Major discussion results of the PCU meeting are summarized in Table 1.3-2, and the Minutes of Meeting (M/M) is attached in the Report.

Table 1.3-2 Discussion Results of PCU Meeting

No. /Date	Theme	Comments and Proposals	Actions of VST/ JST
Informal PCU Meeting (2008/May/30: Con Duan Hotel)	-Discussion of the draft Inception Report (Ic/R)	1) The informal PCU did not agree on the establishment of the Cau River water environment committee task force. 2) Roles of VAST/IET should be clarified. 3) Bac Kan province is not keen on the water environment management plan due to its environmental background.	1) The comments on PCU meeting should be recorded in M/M. 2) VST and JST should discuss the comments how to cope with jointly. 2) VST and JST will not propose the establishment of the task force. 3) Roles of VAST/IET were reported in the next PCU meeting.
Informal PCU Meeting (2008/Jun/18: VEA)	-Discussion and approval of the Ic/R	1) The informal PCU raised the comment on differences of members between the M/M signed on 4 March 2008 and the current proposal described in the Ic/R. 2) The JICA advisory mission expressed the importance of co-working between VST and JST. 3) The informal PCU agreed on the contents of the Ic/R, and approved to hold a WS on the Ic/R.	1) JST explained its difference to PCU members, and VST also carried out additional explanation. 2) VST and JST recognized the importance of co-working with each other. 3) The 1st WS for the Ic/R was held on 9 July, 2008.
PCU Meeting (2008/Dec/10: VEA)	-Discussion and approval of water quality guideline and technical manual	1) PCU approved the monitoring guideline and its WS to be held in December 2008. PCU also recommended to proceed with the official procedure for dissemination of the monitoring guideline, such as through a decree and/or circular, and to conduct technical training. 2) PCU recommended the establishment of a Vietnamese expert group to check and support the outputs from scientific viewpoints. 3) PCU committed to support and coordinate for the Study. 4) PCU recommended further discussion related to local expert and additional inventory survey to VST and JST.	1) The 2nd WS for the monitoring guideline was held on 22 December 2008. 2) JST will discuss the matters related to the local expert and additional inventory survey with JICA HQ.
PCU Meeting (2009/Jan/20: VEA)	- Discussion and approval of the inventory guideline	1) PCU approved the inventory guideline and its WS to be held in February 2009. 2) The Vietnamese version of the inventory guideline should be elaborated considering usage of technical terms. 3) PCU recommended training of DONRE staff for actual use of the inventory guideline.	1) The 3rd WS for the inventory guideline was held on 24 February 2009. 2) The Vietnamese version will be checked by the local expert and VST. 3) JST will plan to conduct a practical training in 2009 JFY.
PCU Meeting (2009/Mar/3: VEA)	- Discussion of the Study activities in 2008 JFY and planned activities in 2009 JFY	1) PCU appreciated the activities for Output-1 and 2, and requested JST to conduct Output-3 and 4 activities considering political, socio-economic, and cultural characteristics of Vietnam. 2) VST and JST should propose concrete and detailed countermeasures considering lessons learned in Japan. 3) WEMP should be prepared considering specific river conditions, water quality standard, pollution source, future economic development plan, and collaboration among concerned agencies. 5) Thai Nguyen Province appreciated the effect of Decision No.64.	1) VST and JST will hold a mini-WS for Output-3 and prepare a detailed report as much as possible. 2) VST and JST will prepare applicable WEMP considering specific and concrete descriptions.
PCU Meeting (2009/Jun/11: VEA)	- Discussion and approval of pollution control approach and the Interim Report	1) PCU requested to clarify more detailed actions and their priorities on pollution control approaches applicable in Vietnam. 2) Future socio-economic development conditions and incentives to enterprises should be considered in the pollution control approach. 3) PCU expected that WEMP in the model area could support CRC to achieve the Cau River Basin M/P. 4) There are no specific comments on the Interim Report.	1) VST and JST will figure out more detailed actions through the WEMP preparation works in the model area. 2) Several socio-economic development scenarios, including incentives, will be considered through discussion with concerned departments in PPC.
PCU Meeting (2009/Oct/21: Con Duan Hotel)	- Discussion and approval of the WEMP in the model area of Cau River	1) PCU approved the proposed WEMP in the model area prepared by VST and JST, and a WS to be held in Thai Nguyen. 2) PCU requested to clarify the linkage between current issues and the proposed activities. 3) A risk analysis should be included in WEMP.	1) VST and JST will hold WS for Output-4 in Thai Nguyen. 2) VST and JST will include the linkage and risk analysis in WEMP.
PCU Meeting (2009/Nov/13: VEA)	- Discussion and approval of the Handbook for formulation of WEMP	1) PCU approved the proposed draft Handbook for formulation of WEMP and its WS to be held in November. 2) PCU requested to modify several contents for general use in Vietnam especially for describing “how to do”. 3) Quotations from WEMP in the model area should be minimized.	1) VST and JST will hold WS for Output-5 in Hanoi. 2) VST and JST will continue to revise the draft as much as possible.
PCU Meeting (2009/Dec/21: VEA)	- Discussion and approval of the draft Final Report (dF/R)	1) PCU approved the contents of dF/R. 2) PCU agreed holding the Final Seminar. 3) There are no specific comments of the dF/R.	1) VST and JST will hold the Final Seminar on 22nd December 2009. 2) VST and JST will prepare the Final Report considering the discussion results.

Source: JICA Study Team

(2) Vietnamese Study Team (VST)

The Vietnam Study Team (VST) consists of the following nine members as shown in Table 1.3-3, and conducts the Study with the JICA Study Team (JST).

Table 1.3-3 Member List of VST

Position	Major Roles	VEA/MONRE	DONRE
1. Director of the Study	-Overall management and operation of the Study as a Director -Report to PCU	Mr. Phung Van Vui (Director of Department of Biodiversity Protection, VEA) up to Sept. 2009 and Dr. Do Nam Thang from Oct. 2009 (Institute of Environmental Science and Management, VEA)	-
2. Study Manager (Team Leader of VST)	-Management and operation of VST -Implementation and cooperation of the Study with JST -Chairman of the weekly regular meeting	Dr. Do Nam Thang (Institute of Environmental Science and Management, VEA)	-
3. Member	-In charge for output-1 and co-working	Mr. Nguyen Huu Thang (Center for Environmental Monitoring, VEA)	Mr. Nguyen The Giang and Ms. Tran Thi Huong (Thai Nguyen DONRE/ CRCO member) Mr. Luong Phuong Nam (Bac Kan DONRE/CRCO member)
	-In charge for output-2 and co-working	Mr. Ho Kiem Trung (Waste Management and Environmental Protection Agency, VEA)	
	-In charge for output-3, 4, 5 and co-working	Ms. Nguyen Lan Huoung (Waste Management and Environmental Protection Agency, VEA)	
		Ms. Nguyen Minh Phuong (Waste Management and Environmental Protection Agency, VEA/CRCO member)	
	-In charge for planning and financing matters of the Water Environment Management Plan (WEMP)	Mr. Cao Minh Tuan (Department of Planning and Finance, VEA)	
4. Coordinator	- Coordination of relevant stakeholders	Ms. Nguyen My Hoang (Department of Pollution Control, VEA)	-

Source: JICA Study Team

For smooth and better communication between the Vietnamese side and the JICA side, VST agreed to hold a regular meeting with JST in every week. Up to December 2009, the regular meetings have held 63 times in total as shown in Table 1.3-4.

Table 1.3-4 List of Regular Meeting with VST

No.	Date	Discussion Item
1	2008/June/21	Comments on draft Ic/R, and operation plan of Output-1
2	2008/July/1	Finalization of Ic/R , and WS for Ic/R and CD of Output-1 and 2
3	2008/July/7	WS for Ic/R and training in Japan
4	2008/July/14	Informal PCU meeting and WS for Ic/R
5	2008/July/22	Progress of Output-1 and sub-contract work of Output-2
6	2008/July/28	Sub-contract work of Output-2 and its bidding
7	2008/Aug/4	Sub-contract work of Output-2 and its bidding, preparatory work for training in Japan
8	2008/Aug/8	Sub-contract work of Output-2 and its bidding, preparatory work for training in Japan, discussion on monitoring guideline
9	2008/Aug/18	Discussion on development of monitoring guideline and inventory guideline, and pollution source inventory survey
10	2008/Aug/25	Discussion on development of monitoring guideline and inventory guideline, and sub-contract work of Output-1 and pollution source inventory survey
11	2008/Sep/8	Draft monitoring guideline, sub-contract work of pollution source inventory survey, and establishment of PCU
12	2008/Sep/15	Establishment of PCU , activities of CRC, mini-WS for Output-3PCU
13	2008/Sep/22	Mini-WS for monitoring guideline, sub-contract work of pollution source inventory survey, and progress of Output-3
14	2008/Sep/30	Activities of monitoring guideline preparation, progress of pollution source inventory survey, and progress of Output-3
15	2008/Oct/13	Mini-WS for monitoring guideline, progress of pollution source inventory survey, and progress of Output-3 and 4
16	2008/Oct/20	Progress of pollution source inventory survey, and progress of Output-3 and 4
17	2008/Oct/28	Progress of pollution source inventory survey, and progress of Output-3 and 4
18	2008/Nov/3	Revision of monitoring guideline, progress of pollution source inventory survey, Output-3, and Output-4
19	2008/Nov/10	Discussion on PCU meeting, revision of monitoring guideline, progress of pollution source inventory survey, Output-3, and Output-4
20	2008/Nov/17	Discussion on PCU meeting, revision of monitoring guideline, progress of pollution source inventory survey, Output-3, and Output-4
21	2008/Nov/25	Discussion on PCU meeting, revision of monitoring guideline, result of pollution source inventory survey, and progress of Output-3
22	2008/Dec/1	Discussion on PCU meeting, WS for monitoring guideline, result of pollution source inventory survey, and progress of Output-3
23	2008/Dec/8	PCU meeting, WS for monitoring guideline, result of pollution source inventory survey
24	2008/Dec/15	WS for monitoring guideline, result of pollution source inventory survey, and progress of Output-3
25	2008/Dec/23	Preparation of PCU meeting, and WS for monitoring guideline
26	2008/Dec/29	Further revision of monitoring guideline, progress of pollution source inventory survey
27	2009/Jan/5	Revision of monitoring guideline, progress of pollution source inventory survey, Output-3

No.	Date	Discussion Item
28	2009/Jan/13	Discussion on PCU meeting, revision of monitoring guideline, result of pollution source inventory survey , progress of Output-3
29	2009/Jan/14	Additional employment of local experts, additional inventory survey, and discussion on PCU meeting
30	2009/Jan/23	Draft inventory guideline, WS for Output-3
31	2009/Feb/3	PCU meeting, revision of monitoring guideline, discussion on Output-3 and draft framework of WEMP
32	2009/Feb/9	PCU meeting, revision of monitoring guideline, GIS-DB, WS for Output-3, and mini-WS for draft framework of WEMP
33	2009/Feb/16	PCU meeting, WS for Output-2 and 3, mini-WS for Output-3 and 4, revision of monitoring guideline, GIS-DB, revision of draft framework of WEMP
34	2009/Feb/24	PCU meeting, WS for Output-2, mini-WS for Output-3
35	2009/Mar/6	Comments on report of Output-3, and draft framework of WEMP
36	2009/May20	Discussion on the planned activities in JFY of 2009, candidates and activities of the local experts, and reception of JICA advisory committee mission
37	2009/May/27	TOR for the local experts, contents and schedule of the training in Japan for C/P, progress of Output-1, 2, 3, and 4
38	2009/Jun/1	Candidates of the training in Japan for C/P, progress of Output-1, 2, 3, and 4
39	2009/Jun/8	Mini-WS for Output-3, preparation of PCU meeting for discussion on It/R with JICA advisory mission, and progress of the Study
40	2009/Jun/15	Submission of It/R, discussion on practical training , progress of Output-1, 2, 3, and 4
41	2009/Jun/22	TOR for PSI survey, finalization of the pollution control approach report, and discussion on water quality simulation
42	2009/Jun/29	Discussion on PSI survey, simulation results, and meeting with CRCO related to the framework of Output-4
43	2009/July/7	Mini-WS for Output-4 at Thai Nguyen, progress of practical training
44	2009/July/13	Selection of the local experts, progress of practical training, and progress of Output-4
45	2009/July/20	Progress of practical training, progress of Output-4, and preparatory works of training in Japan for CRC
46	2009/July/28	Progress of practical training, discussion on future pollution load prediction, and progress of Output-4
47	2009/Aug/4	Progress of practical training, discussion on progress, and capacity assessment sheet of Output-4
48	2009/Aug/10	Monitoring plan of Bac Kan DONRE, training on PSI database, progress of practical training, and discussion on critical areas and socioeconomic conditions with Thai Nguyen DONRE
49	2009/Aug/19	Progress of practical training, and discussion on progress of Output-4
50	2009/Aug/26	Progress of practical training and Output-4
51	2009/Aug/31	Progress of practical training and Output-4, and training in Japan for CRC
52	2009/Sep/7	Progress of practical training and Output-4, and confirmation of comments of mini-WS in Thai Nguyen
53	2009/Sep/14	Plan of external QC activities, progress of practical training, and Output-4
54	2009/Sep/21	Progress of practical training, long term monitoring program of CEM, demonstration meeting of PSI in Bac Kan and Thai Nguyen, discussion on mini-WS and PCU meeting of Output-4
55	2009/Oct/5	Progress of practical training, results of mini-WS in Thai Nguyen on draft WEMP
56	2009/Oct/13	Progress of practical training, preparation of draft WEMP, and framework of Handbook (HB)
57	2009/Oct/19	Progress of practical training, preparatory works of PCU and WS of WEMP, and framework of Handbook (HB)
58	2009/Oct/26	Progress of practical training, and preparatory works of WS of WEMP in Thai Nguyen
59	2009/Nov/2	Progress of practical training, discussion on draft HK, and preparatory works of PCU on HB
60	2009/Nov/9	Discussion on draft HB, and preparatory works of PCU and WS
61	2009/Nov/16	Discussion on draft HB, and preparatory works of WS, and confirmation of the schedule of the JICA advisory mission in December
62	2009/Dec/14	Schedule confirmation of the JICA Advisory Mission. Discussion on the draft Final Report (dF/R) and Final Seminar.
63	2009/Dec/23	Discussion on finalizing the Study reports and preparation of the Final Report.

Source: JICA Study Team

(3) JICA Study Team (JST)

The JST consists of the following eight members as shown in Table 1.3-5, and conducts the Study with VST. The assignment schedule for the JST is shown in Table 1.3-6.

Table 1.3-5 Member List of JST

Position	Name
1. Team Leader/ Water Environment Management Policy/ Assistance Coordination	Yoichi Iwai
2. River Basin Water Environment Management Plan	Kengo Naganuma
3. Administrative Enforcement of Water Environment Management	Tadashi Shoji
4. Environmental Monitoring/ System Analysis	Shunsuke Hieda
5. Integrated River Basin Environmental Management	Takashi Kaji
6. Pollution Control Measure and Technology	Shinsuke Sato
7. Hydro-meteorological Analysis	Masahito Miyagawa
8. Coordination/ Simulation and GIS	Yoshiki Yamamoto

Source: JICA Study Team

Table 1.3-6 Assignment Schedule of JICA Study Team

	No.	Position	Name	JFY 2008 4	5	6	7	8	9	10	11	12	1	2	3	JFY 2009 4	5	6	7	8	9	10	11	12	1	2	3	JFY 2008 M/M Vietnam	Japan	JFY 2009 M/M Vietnam	Japan	Total M/M Vietnam	Japan
		Work Schedule		Commencement of project/Collection and analysis of existing information; Development of Guideline for Pollution Sources Inventory; Development of Guideline with a technical manual for Designing Water Quality Monitoring System; Consideration on Regulatory Approaches; Development of Water Environment Management Plan; Development of Handbook on Formulation of Water Environment Management Plan; Recommendation for Legal Framework and Coordination Mechanisms; Phase 1; Phase 2																															
Work in Vietnam	1	Leader/Water Environment Management Policy/Assistance Coordination	Yoichi Iwai	25 May to 16 Jul (1.77)					10 Sep to 23 Dec (3.50)		12 to 7 Jan (0.20)		1 to 26 Feb (0.86)		3 to 10 Mar (0.27)	18 May to 10 Jul (1.80)					30 Aug to 21 Nov (2.80)			(0.40)				6.60	-	5.00	-	11.60	-
	2	River Basin Water Environment Management Policy Plan	Kengo Naganuma	25 May to 2 Jul (1.30)				12 Aug to 25 Sep (1.50)			24 Nov to 10 Mar (3.57)					18 May to 27 Jul (2.37)					23 Aug to 21 Nov (2.70)			(0.40)				6.37	-	5.80	-	12.17	-
	3	Administrative Enforcement of Water Environment Management	Tadashi Shoji					2 Sep to 6 Oct (1.50)		24 Nov to 23 Dec (1.00)		12 Jan to 6 Mar (1.80)				21 May to 19 Jul (2.00)					23 Sep to 21 Nov (2.00)							4.30	-	4.00	-	8.30	-
	4	Environmental Monitoring/ System Analysis	Shunsuke Hieda			18 Jun to 10 Sep (2.83)				19 Nov to 27 Dec (1.30)								18 Jun to 10 Sep (2.83)											4.13	-	2.83	-	6.96	-
	5	Integrated River Basin Environmental Management	Takashi Kaji						29 Sep to 30 Oct (1.07)			12 Jan to 10 Mar (1.93)				18 Jun to 30 Jul (1.43)			4 Aug to 14 Sep (1.43)										3.00	-	2.20	-	5.20	-
	6	Pollution Control Measure and Technology	Shinsuke Sato					3 Sep to 2 Oct (1.00)		5 Nov to 23 Dec(1.63)		5 Jan to 26 Feb (1.77)				18 to 26 May (0.30)	4 Jun to 10 Jul (0.30)			18 Aug to 20 Oct (2.00)									4.40	-	3.67	-	8.07	-
	7	Hydro-meteorological Analysis	Masahito Miyakawa		2 Jul to 1 Aug (1.03)			5 Aug to 2 Sep(0.97)			24 Nov to 23 Dec (1.00)																		3.00	-	0.00	-	3.00	-
		Coordination/Simulation･GIS	Yoshiki Yamamoto			2 Jul to 30 Aug (2.00)			30 Sep to 13 Nov (1.50)							18 May to 10 Jun (0.80)					7 Sep to 11 Nov (2.20)								-		-	0.00	-
				4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	31.80	-	23.50	-	55.30	-
Work in Japan	1	Leader/Water Environment Management Policy/Assistance Coordination	Yoichi Iwai																									-	0.40	-	0.60	-	1.00
	2	River Basin Water Environment Management Policy Plan	***																									-	0.60	-	0.90	-	1.50
	3	Administrative Enforcement of Water Environment Management	***																									-	0.00	-	0.00	-	0.00
	4	Environmental Monitoring/ System Analysis	***																									-	0.00	-	0.00	-	0.00
	5	Integrated River Basin Environmental Management	***																									-	0.00	-	0.00	-	0.00
	6	Pollution Control Measure and Technology	***																									-	0.00	-	0.00	-	0.00
	7	Hydro-meteorological Analysis	***																									-	0.00	-	0.00	-	0.00
		Coordination/Simulation･GIS	***																									-		-		-	-
				4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	-	1.00	-	1.50	-	2.50
Legend ■ : Work in Vietnam; □ : Work in Japan			Report				△ IC/R								△ P/R			△ IT/R					△ DF/R	△ F/R				32.80		25.00		57.80	
			Work shop /Seminar				△ WS					△ WS		△ WS △ WS				△ WS				△ WS	△ WS	△ seminar									
			Training in Japan							▨									▨	▨														

Source: JICA Study Team

2. Current Situation of the Model Area of Cau River

2.1 Socio-economic Conditions of Bac Kan and Thai Nguyen Provinces

(1) Administrative Units

Bac Kan province is located in the inland center of the northeast region of Vietnam, with a total area of 486,841 ha. The capital of the province is Bac Kan. The province is composed of eight administrative units. There are several ethnic groups residing in the province, such as the Kinh, Tay, H'Mong, and Dao. Table 2.1-1 summarizes the administrative conditions of Bac Kan province.

Table 2.1-1 Administrative Information of Bac Kan Province

Administrative units		Land area (ha)
Capital	Bac Kan Town	13,708
District	Pac Nam	47,744
	Ba Be	68,535
	Ngan Son	64,696
	Bach Thong	54,718
	Cho Don	91,317
	Cho Moi	60,716
	Na Ri	85,407
Total land area		486,841

Source: Bac Kan Statistical Yearbook 2008

Thai Nguyen City is 80 km far from Hanoi and 50 km from the Noi Bai International Airport. The province has a total area of 353,435 ha, consisting of nine administrative units. Thai Nguyen is the cultural center of the northern mountainous provinces of Vietnam. Based on the Satisfying Vietnamese standards, Thai Nguyen City is classified as level 2. Ethnic groups, such as the Kinh, Tay, Nung, San Diu, Mong, San Chay, Hoa, and Dao, reside in the province. Table 2.1-2 summarizes the administrative conditions of Thai Nguyen Province.

Table 2.1-2 Administrative Information of Thai Nguyen Province

Administrative units		Land area (ha)
Capital	Thai Nguyen City	18,970
Town	Song Cong	8,364
District	Dinh Hoa	51,109
	Vo Nhai	84,010
	Phu Luong	36,897
	Dong Hy	45,775
	Dai Tu	57,706
	Phu Binh	24,936
	Pho Yen	25,668
Total land area		353,435

Source: Thai Nguyen Statistical Yearbook 2008

(2) Population

The total population in Bac Kan Province was 308,798 persons in 2008. The average annual growth rate of its population from 2005 to 2008 was 1.03%. Table 2.1-3 shows the population at the district level in Bac Kan Province. The population in Thai Nguyen Province was 1,150,018 persons in 2008. Average annual growth rate of population from 2003 to 2008 was 1.17%. Table 2.1-4 shows the number of population at the district level.

Table 2.1-3 Population at District Level in Bac Kan Province

		Year											
		2005			2006			2007			2008		
		Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
Total	**Population**	**300,218**	**45,224**	**254,994**	**302,786**	**45,606**	**257,180**	**305,759**	**46,026**	**259,733**	**308,798**	**46,680**	**262,118**
	Growth Rate (%)	1.30	2.04	1.17	0.86	0.84	0.86	0.98	0.92	0.99	0.99	1.42	0.92
Bac Kan Town	**Population**	**33,543**	**20,602**	**12,941**	**33,852**	**20,766**	**13,086**	**34,204**	**20,952**	**13,252**	**34,585**	**21,250**	**13,335**
	Growth Rate (%)	-	-	-	0.92	0.80	1.12	1.04	0.90	1.27	1.11	1.42	0.63
Pac Nam District	**Population**	**27,950**	-	**27,950**	**28,189**	-	**28,189**	**28,466**	-	**28,466**	**28,780**	-	**28,780**
	Growth Rate (%)	-	-	-	0.86	-	0.86	0.98	-	0.98	1.10	-	1.10
Ba Be District	**Population**	**48,399**	**2,975**	**45,424**	**48,809**	**2,993**	**45,816**	**49,288**	**3,021**	**46,267**	**49,748**	**3,064**	**46,684**
	Growth Rate (%)	-	-	-	0.85	0.61	0.86	0.98	0.94	0.98	0.93	1.42	0.90
Ngan Son District	**Population**	**29,909**	**7,200**	**22,709**	**30,157**	**7,400**	**22,757**	**30,455**	**7,473**	**22,982**	**30,725**	**7,579**	**23,146**
	Growth Rate (%)	-	-	-	0.83	2.78	0.21	0.99	0.99	0.99	0.89	1.42	0.71
Bach Thong District	**Population**	**32,168**	**1,785**	**30,383**	**32,428**	**1,785**	**30,643**	**32,746**	**1,801**	**30,945**	**33,072**	**1,827**	**31,245**
	Growth Rate (%)	-	-	-	0.81	-	0.86	0.98	0.90	0.99	1.00	1.44	0.97
Cho Don District	**Population**	**50,168**	**6,021**	**44,147**	**50,596**	**6,021**	**44,575**	**51,072**	**6,077**	**44,995**	**51,539**	**6,163**	**45,376**
	Growth Rate (%)	-	-	-	0.85	-	0.97	0.94	0.93	0.94	0.91	1.42	0.85
Cho Moi District	**Population**	**38,433**	**3,027**	**35,406**	**38,757**	**3,027**	**35,730**	**39,138**	**3,055**	**36,083**	**39,526**	**3,098**	**36,428**
	Growth Rate (%)	-	-	-	0.84	-	0.92	0.98	0.93	0.99	0.99	1.41	0.96
Na Ri District	**Population**	**39,648**	**3,614**	**36,034**	**39,998**	**3,614**	**36,384**	**40,390**	**3,647**	**36,743**	**40,823**	**3,699**	**37,124**
	Growth Rate (%)	-	-	-	0.88	-	0.97	0.98	0.91	0.99	1.07	1.43	1.04

Source: Bac Kan Statistical Yearbook 2007 and 2008

Table 2.1-4 Population at District Level in Thai Nguyen Province

		Year																	
		2003			2004			2005			2006			2007			2008 *		
		Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
Total	**Population**	**1,085,872**	**247,680**	**838,192**	**1,095,991**	**248,058**	**847,933**	**1,109,955**	**259,880**	**850,226**	**1,125,577**	**269,341**	**856,236**	**1,137,671**	**272,112**	**865,559**	**1,150,018**	**281,766**	**868,252**
	Growth Rate (%)	1.22	2.60	0.82	0.93	0.15	1.16	1.27	4.77	0.27	1.41	3.64	0.71	1.07	1.03	1.09	1.09	3.55	0.31
Thai Nguyen City	**Population**	**229,855**	**162,505**	**67,350**	**232,440**	**164,894**	**67,546**	**235,832**	**172,561**	**64,200**	**241,565**	**180,000**	**61,565**	**244,160**	**181,974**	**62,186**	**259,124**	**190,627**	**68,497**
	Growth Rate (%)	-	-	-	1.12	1.47	0.29	1.46	4.65	-4.95	2.43	4.31	-4.10	1.07	1.10	1.01	6.13	4.76	10.15
Song Cong Town	**Population**	**44,169**	**22,536**	**21,633**	**44,509**	**22,761**	**21,748**	**47,228**	**23,725**	**23,453**	**48,921**	**24,647**	**24,274**	**49,447**	**24,868**	**24,579**	**49,983**	**25,777**	**24,206**
	Growth Rate (%)	-	-	-	0.77	1.00	0.53	6.11	4.24	7.84	3.58	3.89	3.50	1.08	0.90	1.26	1.08	3.66	-1.52
Dinh Hoa District	**Population**	**88,779**	**5,925**	**82,854**	**89,444**	**6,011**	**83,433**	**89,605**	**6,060**	**83,450**	**89,967**	**6,068**	**83,899**	**90,934**	**6,122**	**84,812**	**91,919**	**6,186**	**85,733**
	Growth Rate (%)	-	-	-	0.75	1.45	0.70	0.18	0.82	0.02	0.40	0.13	0.54	1.07	0.89	1.09	1.08	1.05	1.09
Vo Nhai District	**Population**	**62,004**	**3,397**	**58,607**	**62,623**	**3,426**	**59,197**	**63,223**	**3,431**	**59,725**	**63,809**	**3,473**	**60,336**	**64,495**	**3,504**	**60,991**	**65,194**	**3,600**	**61,594**
	Growth Rate (%)	-	-	-	1.00	0.85	1.01	0.96	0.15	0.89	0.93	1.22	1.02	1.08	0.89	1.09	1.08	2.74	0.99
Phu Luong District	**Population**	**103,428**	**7,696**	**95,732**	**104,483**	**7,769**	**96,714**	**105,077**	**7,601**	**97,364**	**106,061**	**7,694**	**98,367**	**107,200**	**7,763**	**99,437**	**108,362**	**8,065**	**100,297**
	Growth Rate (%)	-	-	-	1.02	0.95	1.03	0.57	-2.16	0.67	0.94	1.22	1.03	1.07	0.90	1.09	1.08	3.89	0.86
Dong Hy District	**Population**	**122,757**	**16,812**	**105,945**	**123,899**	**13,978**	**109,921**	**123,327**	**16,883**	**106,313**	**124,491**	**17,092**	**107,399**	**125,829**	**17,244**	**108,585**	**114,893**	**17,320**	**97,573**
	Growth Rate (%)	-	-	-	0.93	-16.86	3.75	-0.46	20.78	-3.28	0.94	1.24	1.02	1.07	0.89	1.10	-8.69	0.44	-10.14
Dai Tu District	**Population**	**162,573**	**8,125**	**154,448**	**164,199**	**8,197**	**156,002**	**166,097**	**8,292**	**157,628**	**167,013**	**8,362**	**158,651**	**168,807**	**8,436**	**160,371**	**170,636**	**8,330**	**162,306**
	Growth Rate (%)	-	-	-	1.00	0.89	1.01	1.16	1.16	1.04	0.55	0.84	0.65	1.07	0.88	1.08	1.08	-1.26	1.21
Phu Binh District	**Population**	**137,482**	**7,751**	**129,731**	**138,760**	**7,987**	**130,773**	**142,087**	**8,075**	**134,012**	**144,048**	**8,500**	**135,548**	**145,596**	**8,576**	**137,020**	**147,174**	**8,114**	**139,060**
	Growth Rate (%)	-	-	-	0.93	3.04	0.80	2.40	1.10	2.48	1.38	5.26	1.15	1.07	0.89	1.09	1.08	-5.39	1.49
Pho Yen District	**Population**	**134,825**	**12,933**	**121,892**	**135,634**	**13,035**	**122,599**	**137,479**	**13,252**	**124,081**	**139,702**	**13,505**	**126,197**	**141,203**	**13,625**	**127,578**	**142,733**	**13,747**	**128,986**
	Growth Rate (%)	-	-	-	0.60	0.79	0.58	1.36	1.66	1.21	1.62	1.91	1.71	1.07	0.89	1.09	1.08	0.90	1.10

* Preliminary figure

Source: Thai Nguyen Statistical Yearbook 2008

(3) Gross Regional Domestic Product (GRDP)

The GRDP of Bac Kan Province was 997,146 million VND (approximately US$55 million) in 2008. The average annual growth rate of the GRDP from 2001 to 2005 was relatively high at 11.85%. On the other hand, the average growth rate from 2006 to 2008 was 10.81%. In 2008, agriculture, forestry and fishery accounted for 44% of the GRDP, while industry and construction accounted for 16%. The industrial turnover in Bac Kan Province was VND 361,213 million (approximately US$20 million) in 2008. Manufacturing accounted for 30.83% of the total industrial turnover, while the mining sector accounted for 13.04%. Mining and processing industries have the largest share in the industrial structure. The total industrial turnover has increased to 29% during 2001 to 2005.

Table 2.1-5 shows the GRDP of Bac Kan Province while Table 2.1-6 and Table 2.1-7 present the industrial turnover and its breakdown at district level, respectively.

Table 2.1-5 GRDP of Bac Kan Province

Year	Total		Agriculture, forestry and fishery		Industry and construction		Service	
	GRDP	Growth rate (%)	GRDP	Growth rate (%)	GRDP	Growth rate (%)	GRDP	Growth rate (%)
1999	-	-	-	-	-	-	-	-
2000	418,772	-	262,393	-	41,077	-	115,302	-
2001	469,497	12.11	277,063	5.59	59,835	45.67	132,599	15.00
2002	525,528	11.93	293,960	6.10	81,092	35.53	150,476	13.48
2003	593,111	12.86	312,482	6.30	98,084	20.95	182,545	21.31
2004	658,627	11.05	332,335	6.35	119,960	22.30	206,332	13.03
2005	733,206	11.32	349,289	5.10	140,412	17.05	243,505	18.02
2006	804,066	9.66	363,955	4.20	154,320	9.91	285,791	17.37
2007	910,575	13.25	411,592	13.09	166,653	7.99	332,330	16.28
2008*	997,146	9.51	435,614	5.84	156,705	-5.97	404,827	21.81

* Preliminary figure; Unit: Million VND
Source: Bac Kan Statistical Yearbook 2003, 2006, 2007 and 2008

Table 2.1-6 Industrial Turnover of Bac Kan Province

Year	Total		Mining		Manufacturing		Electricity, gas and water supply		Construction	
	Turnover	Growth rate (%)	Turnover	Growth rate (%)	Turnover	Growth rate (%)	Turnover	Growth rate (%)	Turnover	Growth rate (%)
2004	-	-	-	-	-	-	-	-	-	-
2005	330,297	-	71,735	-	83,315	-	9,933	-	165,314	-
2006	360,314	9.09	82,988	15.69	89,008	6.83	13,897	39.91	176,478	6.75
2007	397,295	10.26	63,905	-22.99	143,141	60.82	14,278	2.74	197,813	12.09
2008	361,213	-9.08	47,099	-26.3	111,345	-22.21	14,734	3.19	188,035	-4.94

Unit: Million VND
Source: Bac Kan Statistical Yearbook 2007 and 2008

Table 2.1-7 Industrial Turnover of Bac Kan Province at District Level

Year	Total	Bac Kan Town	Pac Nam District	Ba Be District	Ngan Son District	Bach Thong District	Cho Don District	Cho Moi District	Na Ri District
2005	164,983	122,512	1,035	6,425	5,967	6,636	20,328	6,595	5,485
2006	185,893	120,307	1,310	8,630	8,690	8,610	22,460	8,435	7,451
2007	221,324	139,381	1,803	10,034	10,251	10,201	30,677	10,127	8,850
2008	173,178	114,099	1,036	7,268	7,425	7,387	22,218	7,335	6,410

Unit: Million VND; Note: Excluding turnover of construction sector
Source: Bac Kan Statistical Yearbook 2007 and 2008

The GRDP of Thai Nguyen Province was VND 5,257,300 million (approximately US$292 million) in 2008. The average annual growth rate of GRDP from 2000 to 2008 was 9.78%, and from 2006 to 2008 was 11.69%. Agriculture, forestry and fishery accounted for 24% of the GRDP in 2008, while industry and construction accounted for 43%. The industrial turnover in Thai Nguyen Province was VND 9,752,820 million (approximately US$541 million). In Thai Nguyen Province, the iron and steel industry has rapidly recovered since year 2000. The state-owned industry plays an important role and its contribution is over 70% of the industrial turnover. The average annual turnover rate from 2001 to 2005 was 17%.

Table 2.1-8 shows the GRDP of Thai Nguyen Province while Table 2.1-9 and Table 2.1-10 show the industrial turnover and its breakdown at the district level, respectively.

Table 2.1-8 GRDP of Thai Nguyen Province

Year	Total		Agriculture, forestry and fishery		Industry and construction		Service	
	GRDP	Growth rate (%)	GRDP	Growth rate (%)	GRDP	Growth rate (%)	GRDP	Growth rate (%)
1999	2,272,553	-	837,116	-	729,287	-	706,150	-
2000	2,436,606	7.22	880,857	5.23	793,110	8.75	762,639	8.00
2001	2,653,577	8.90	916,857	4.09	922,615	16.33	814,105	6.75
2002	2,895,343	9.11	956,480	4.32	1,060,556	14.95	869,307	6.78
2003	3,164,598	9.30	996,795	4.21	1,162,736	9.63	1,005,067	15.62
2004	3,449,954	9.02	1,049,346	5.27	1,289,941	10.94	1,110,667	10.51
2005	3,773,031	9.36	1,101,782	5.00	1,428,496	10.74	1,242,753	11.89
2006	4,193,460	11.14	1,146,192	4.03	1,632,166	14.26	1,415,102	13.87
2007	4,716,200	12.47	1,198,800	4.59	1,932,400	18.39	1,585,000	12.01
2008*	5,257,300	11.47	1,252,800	4.50	2,237,800	15.80	1,766,700	11.46

* Preliminary figure; Unit: Million VND

Source: Thai Nguyen Statistical Yearbook 2004, 2007 and 2008

Table 2.1-9 Industrial Turnover of Thai Nguyen Province

Year	Total		Mining		Manufacturing		Electricity, gas and water supply		Construction	
	Turnover	Growth rate (%)	Turnover	Growth rate (%)	Turnover	Growth rate (%)	Turnover	Growth rate (%)	Turnover	Growth rate (%)
2004	5,194,780	-	193,816	-	3,924,145	-	365,698	-	695,148	-
2005	5,878,110	13.15	228,439	17.86	4,532,383	15.50	395,382	8.12	701,557	0.92
2006	6,660,280	13.31	265,710	16.32	5,122,868	13.03	439,034	11.04	810,323	15.50
2007	8,207,460	23.23	278,060	4.65	6,424,890	25.42	609,050	38.73	867,800	7.09
2008 *	9,752,820	18.83	298,660	7.41	7,476,600	16.37	872,170	43.20	1,067,430	23.00

* Preliminary figure; Unit: Million VND

Source: Thai Nguyen Statistical Yearbook 2007 and 2008

Table 2.1-10 Industrial Turnover of Thai Nguyen Province at District Level

Year	Total	Thai Nguyen City	Song Cong Town	Dinh Hoa District	Vo Nhai District	Phu Luong District	Dong Hy District	Dai Tu District	Phu Binh District	Pho Yen District
2004	4,499,635	3,364,315	378,421	8,104	161,479	83,126	132,612	139,892	14,670	217,016
2005	5,175,597	3,801,759	460,326	9,246	185,709	97,624	149,161	163,094	15,991	292,687
2006	5,849,958	4,132,359	607,567	12,660	257,671	135,227	172,117	177,244	16,982	338,131
2007	7,339,670	5,204,430	795,420	20,230	314,100	176,260	197,010	174,890	20,270	437,060
2008*	8,685,380	5,922,700	991,850	21,970	351,750	192,560	100,970	167,310	21,830	914,440

Unit: Million VND; Note: Excluding turnover of construction sector; *Preliminary figure

Source: Thai Nguyen Statistical Yearbook 2007 and 2008

(4) Land Use

In Bac Kan Province, agricultural land, including paddy fields and forests, are predominant, with 76% of the total area in 2008. About 68% of the total land is covered by forest. Non-agricultural land, which accounts for only 12% of the total land area, is limited in the province. Only 3% of the total land is used as residential area. Table 2.2-11 shows the land use in Bac Kan Province.

Table 2.1-11 Land Use in Bac Kan Province in 2008

Category		2008
Total land		486,841
Agricultural land		371,767
	Paddy	19,180
	Weed land for animal raising	871
	Othre annual crop land	12,485
	Perennial crop land	5,262
	Forest	333,059
	Othres	910
Non-agricultural land		18,582
	Residential area	2,345
	Others	16,237
Unused land		96,492

Unit: ha
Source: Bac Kan Statistical Yearbook 2008

In 2008, 78% of the total land area of Thai Nguyen Province was agricultural land, including forest land. Non-agricultural land, on the other hand, accounted for 12% of the total land area, with only 3% of the total area used as residential land. Table 2.2-12 shows the land use distribution in Thai Nguyen Province.

Table 2.1-12 Land Use in Thai Nguyen Province in 2008

Category		2008
Total land		353,435
Agricultural land		276,197
	Paddy	43,274
	Weed land for animal raising	310
	Othre annual crop land	16,246
	Perennial crop land	39,555
	Forest	172,632
	Othres	4,180
Non-agricultural land		41,463
	Residential area	10,082
	Others	31,381
Unused land		35,777

Unit: ha
Source: Thai Nguyen Statistical Yearbook 2008

(5) Socio-economic Development Plan until 2020

1) General Direction of Socio-economic Development until 2020

The Master Plan (M/P) for Socio-economic Development of Bac Kan Province until 2020 was prepared in 2008. It contains the socio-economic development goals and targets as well as the five-year multi sector development plans of Bac Kan Province . However, the contents of the master plan are not as detailed as that of Thai Nguyen Province because Bac Kan Province was newly established in 1997.

The general objective of the master plan is to progressively increase the GRDP per capita and to improve the people's living standard. Bac Kan Province emphasizes development of the services and tourism sector. It aims to increase the share of services and tourism sector in the economic activities. On the other hand, the province plans to decrease the share of the agricultural sector. The province focuses on development of livestock in the agricultural sector, and of processing in the industrial sector. The ratio of non-agriculture labor to the total labor will be significant. The industrialization and modernization of the province will lead to a shift in labor from low capacity sectors such as agriculture, to high capacity sectors such as industry and services. Table 2.1-13 summarizes the general direction of socio-economic development of Bac Kan Province until 2020.

Table 2.1-13 Socio-economic Development of Bac Kan Province until 2020

Category	Development Plan
Growth of GRDP*	2006 to 2010: 11.0% (Agriculture, forestry and fishery: 8.2%, Industry and construction: 11.0%, Service: 14.6%) 2011 to 2015: 13.0% per year (Agriculture, forestry and fishery: 7.0%, Industry and construction: 15.0%, Service: 17.4%) 2016 to 2020: 13.5% per year (Agriculture, forestry and fishery: 6.5%, Industry and construction: 15.0%, Service: 16.8%)
Share of GRDP	2010: Agriculture, forestry and fishery: 33.6%; Industry and construction: 22.2%; Service: 44.2% 2015: Agriculture, forestry and fishery: 23.6%; Industry and construction: 24.4%; Service: 51.9% 2020: Agriculture, forestry and fishery: 15.5%; Industry and construction: 25.2%; Service: 59.3%
GRDP per capita	2010: 600 USD 2015: 995 USD 2020: 1,841 USD
Population*	2006 to 2010: 1.12% 2011 to 2015: 1.10% 2016 to 2020: 1.08%
Percentage of urban population	2010: 19.94% of total population 2015: 27.11% of total population 2020: 37.74% of total population

* Per year
Source: Master Plan of Socio-Economic Development of Bac Kan Province until 2020

The Socio-economic Development Master Plan in Thai Nguyen Province toward 2020 was prepared in May 2007. It stipulates general direction of socio-economic development of the province. It also clarifies five-year development plans of several socio-economic sectors.

Thai Nguyen Province aims to become the economic, cultural, educational and medical center of the northern midland. The most emphasized direction is to increase the shares of industry and construction, and service sectors. The province has a plan to decrease the share of the agriculture, forestry and fishery sector. In parallel with industrial development, it plans to promote infrastructure development and to narrow down the gap of the average income per capita with the national level. Table 2.1-14 summarizes the general direction of the socio-economic development plan until 2020.

Table 2.1-14 Socio-economic Development of Thai Nguyen Province until 2020

Category	Development Plan
Growth of GRDP*	2006 to 2020: 11-12% (Agriculture, forestry and fishery: 5-5.5%, Industry and construction: 13.5-14.5%, Service: 12-13%)
Share of GRDP	2010: Agriculture, forestry and fishery: 16-17%; Industry and construction: 44-45%; Service: 38-39% 2015: Agriculture, forestry and fishery: 13-14%; Industry and construction: 46-47%; Service: 39-40% 2020: Agriculture, forestry and fishery: 9-10%; Industry and construction: 47-48%; Service: 42-43%
GRDP per capita	2010: US$800 2015: US$1,300-1,400 2020: US$2,200-2,300
Population*	2006 to 2020: 0.9% (natural population growth: 0.8 -0.82%; immigration growth: 0.08-0.1%)
Percentage of urban population	2010: 35% of total population 2020: 45% of total population

* Per year
Source: Social-Economic Development Master Plan in Thai Nguyen Province toward 2020

2) Industrial Sector

The Bac Kan Province intends to hasten the development of industry by expanding the mining and processing industries first. In the later stage, it aims to develop the production of high-quality consumable goods and high technology industries. During the period of 2006-2010, the province has started to receive investments for infrastructure development, but these are not sufficient for the development plan implementation. The industries still depend on mineral exploitation and processing. The industrial and construction sector will achieve lower growth rate in comparison with the previous period. Its turnover grew by 29.03% per year from 1997 to

2000 and 28.86% from 2001 to 2005. However, it is anticipated that this will decrease to 14.05% per year from 2006 to 2010 to which mineral exploitations and processing industries will contribute. Table 2.1-15 shows the development target of the industrial sector in Bac Kan Province.

Table 2.1-15 Target of Turnover of Industry in Bac Kan Province

Category	Growth of Turnover (per year)
Overall industrial sector	2006 to 2010: 14.05% 2011 to 2015: 18.40% 2016 to 2020: 18.90%
Mining	2006 to 2010: 9.63% 2011 to 2015: 19.00% 2016 to 2020: 17.00%
Mineral processing	2006 to 2010: 18.30% 2011 to 2015: 18.00% 2016 to 2020: 20.00%
Electricity and water	2006 to 2010: 9.22% 2011 to 2015: 10.77% 2016 to 2020: 10.57%

Source: Master Plan of Socio-economic Development of Bac Kan Province until 2020

Thai Nguyen Province aims to hasten industrial development by enhancing the major industries, developing new industries, increasing exports, improving market share of the private sector and attracting new investments. The industrial sector will be developed at a turnover rate of 16.5-17.0% per year from 2006 to 2010, and at 12.5-13.5% per year from 2011 to 2020. In terms of industrial parks (IPs), Thai Nguyen plans to expand the existing Song Cong IP, and develop several other potential IPs. Table 2.1-16 summarizes the development targets of the major industries.

Table 2.1-16 Development Target of Major Industries in Thai Nguyen Province

Category	Development Targets
Growth of GRDP of industry and construction sector	2006 to 2020: 13.5 -14.5% per year
Overall industrial sector	2006 to 2010: 16.5-17% per year 2011 to 2020: 12.5-13.5% per year
Iron and steel	2006 to 2010: 16-17% per year 2011 to 2020: 14 -15% per year
Machinery	To meet the basic demand for agricultural machinery and equipment as well as domestic market, to produce machinery for mining, mineral processing, iron and steel industries
Mining and mineral processing	2006 to 2010: 13.5-14.5% per year 2011 to 2020: 13-14% per year
Construction material	2006 to 2010: 17-18% per year 2011 to 2020: 16-17% per year
Textile and tanning	2006 to 2010: over 15% per year 2011 to 2020: 16% per year
Food processing	2006 to 2010: over 16.5% per year 2011 to 2020: 22% per year

Source: Social-economic Development Master Plan in Thai Nguyen Province toward 2020

2.2 Natural Condition of Cau River

(1) Topographical Characteristics

The Cau River basin is one of the largest river basins in northern Vietnam. The river originates from Van On Mountain in Bac Kan Province and flows to Thai Binh River at Pha Lai. The river basin is located partly or entirely across six provinces, namely, Bac Kan, Thai Nguyen, Vinh Phuc, Hai Doung, Bac Ninh, and Bac Giang. The main stream of Cau River has a length of about 288 km and a catchment area of 6,030 km^2 (10,530 km^2 if the tributaries are included). The main tributaries

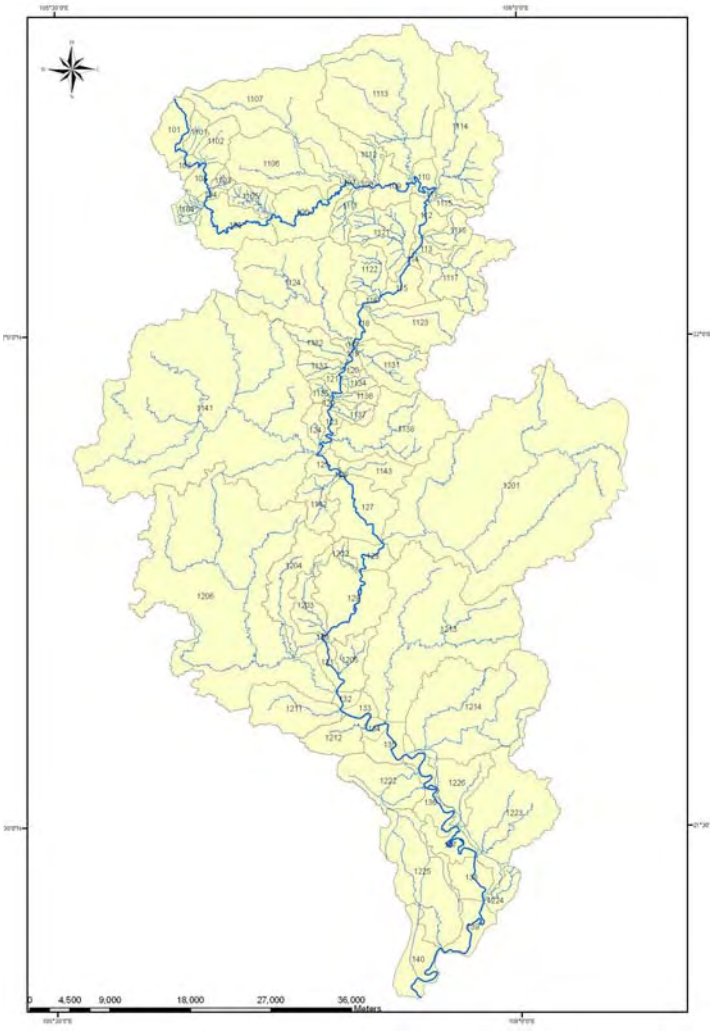
are Cho Chu River with 437 km^2, Nghinh Tuong River with 465 km^2,, Du River with 361 km^2,, Cong River with 957 km^2, and Ca Lo River with 88 km^2 [1].

(2) Meteorological and Hydrological Characteristics

Climate in the river basin area is tropical with an average annual temperature of approximately 18℃. The average annual rainfall in the basin varies from 1,500 mm to 2,700 mm. The highest value of 3,000 mm is observed at the Tam Dao area. Dry season is from November to April while the rainy season is from May to October where 80-85% of rainfall is recorded. The total annual discharge is approximately 4.2 x10^9 m^3 (133 m^3/s in average), of which discharges from the Cong River and Ca Lo River account for 19.8% and 19.5%, respectively.

(3) Cau River System in the Model Area

The model area covers the upstream of Cau River basin from its origin at Van On Mountain in Bac Kan Province to the confluence point of Con River, with main stream length of approximately 230 km and catchment area of 3,500 km^2. The river system in the target area is shown in Figure 2.2-1. The main tributaries are Cho Chu River, Nghinh Tuong River, and Du River. For the pollution load analysis, the river basin codes were put on each sub-basin as shown below.



Source: JICA Study Team

Figure 2.2-1 Cau River System in the Model Area

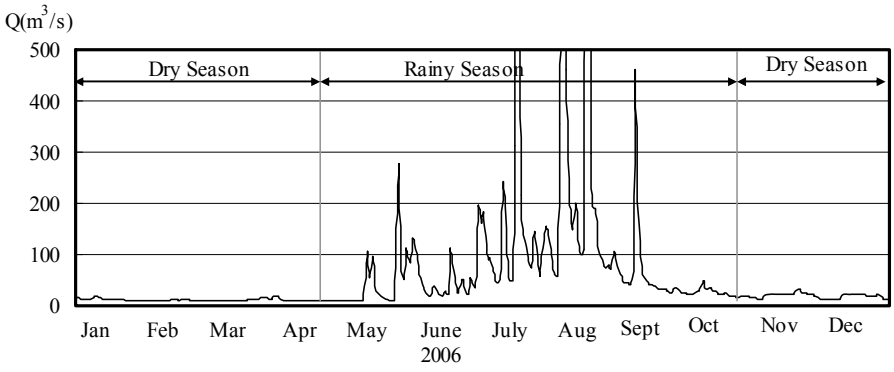
River Basin Code	River Name
1101	Suối Nà Càng
1102	Suối Nà Kê
1103	Khuổi Phầy
1104	Khuổi Vác
1105	Khuổi Vái
1106	Suối Bản Chừng
1107	Nậm Cát
1111	Na Nang
1112	Khuoi Thuon
1113	Suối Nà Cú
1114	Suối Nà Cát
1115	Khuổi Lung
1116	Nậm Đất
1117	Khuổi Đeng
1121	Suối Bản Rạo
1122	Suối Tát mèn
1123	Khuổi Thếu
1124	Khuổi Pen
1131	Suối Khuổi Thuổng
1132	Khuổi Thi
1133	Khuổi Lắc
1134	Suối Pe Pây
1135	Khuổi Táo
1136	Khuổi Tai
1137	Khuổi Tràng
1138	Suối Nhĩ Cà
1141	Sông Cho Chu
1142	Suoi Cua Khe
1143	Suối Nà Làng
1201	Suối Cái
1202	Suối Khe Gia
1203	Suối Đồng Tâm
1204	Suối Cầu Dạt
1205	Suối Cầu Mơn
1206	Sông Đu
1211	Suối Lang Ngo
1212	Sông Mó Bạch
1213	Suối Đèo Khế
1214	Sông Ngòi Rừng
1221	Sông Xam Lan
1222	Sông Vó Ngựa
1223	Kênh Giữa
1231	Sông Công
1232	Song Mang

Note: River basin codes were set by JICA Study Team for pollution load analysis.

[1] The Master Plan on the Protection of Ecological Environment and Landscape of Cau River Basin

(4) River Water Flow

In the Cau River, there are three river discharge measurement stations, namely, 1) Thac Rieng (measured until 1981), 2) Thac Buoi (measured until 1996) and 3) Gia Bay (measured from 1997). The recorded discharge data in Gia Bay station shows that the river discharge is relatively stable from November to April during the dry season; on the other hand, significant fluctuations in discharge is observed during the rainy season from May to October, as illustrated below. The average annual rainfall in the basin varies from 1,500 mm to 2,700 mm, with about 80-85% of the rainfall recorded during the rainy season.



Source: DWRM/VEA

Figure 2.2-2 Recorded River Discharge at Gia Bay Station in 2006

2.3 River Water Use Condition

(1) Water Intake License

The information on water use condition was collected by PPC, DONRE, Department of Statistics, and other offices in the Cau River basin. The following table shows the list of water intake licenses for surface water use in the Cau River model area. There are three licenses in Bac Kan Province and 14 licenses in Thai Nguyen Province.

Table 2.3-1 List of Water Intake Licenses for Surface Water

No	Production/Processing Establishments	Location (Province/ City)	Quantities of Intake water
1	Bac Kan Water Supply and Drainage Company	Bac Kan	73,000 m^3/year
2	Bac Kan Water Supply and Drainage Company	Bac Kan	109,500 m^3/year
3	Bac Kan Water Supply and Drainage Company	Bac Kan	182,500 m^3/year
4	Ban Tich Joint-Stock Enterprise, Thai Nguyen Branch	Thai Nguyen Province	346,750 m^3/year
5	Phan Me Coal Mine	Phu Thuong District, Thai Nguyen Province	47,450 m^3/year
6	Gia Sang Metal Co. Ltd Company	Thai Nguyen Province	22,000 m^3/year
7	Trai Cau Iron Mine	Dong Hy District, Thai Nguyen Province	292,000m^3/year
8	La Hien Cement Plant	Vo Nhai District, Thai Nguyen Province	164,250 m^3/year
9	Cao Ngan Thermo-Electric Plant	Thai Nguyen Province	3,766,800m^3/year
10	Hoang Van Thu Paper Plant	Dinh Hoa District, Thai Nguyen Province	116,800 m^3/year
11	Truong Xuan Paper Co. Ltd Company	Yen Pho District, Thai Nguyen Province	not confirmed
12	Khanh Hoa-One Member Coal Co. Ltd Company	Thai Nguyen Province	25,550m^3/year
13	Thai Nguyen Nonferrous Metal-One Member Co., Ltd. Company	Phu Xa, Thai Nguyen Province	14,800m^3/year
14	Thai Nguyen Cast Iron Company	Thai Nguyen Province	22,995,000m^3/year
15	Gia Sang Metal Co. Ltd Company	Thai Nguyen Province	12,045 m^3/year
16	Thai Nguyen Mineral Processing Joint-Venture Company	Thai Nguyen Province	1,752,000 m^3/year
17	Thai Nguyen Paper Joint-Stock Company	Tan Long District, Thai Nguyen Province	18,250 m^3/year

Source: Thai Nguyen DARD

(2) Water Use and Demand

1) Domestic Water Demand (Surface Water)

At present, the Thai Nguyen City and the town of Song Cong have water treatment plants with a combined capacity of 30,000 m^3/day[2]. One of the water treatment plants in Thai Nguyen City is located in Tích Luóng District with a capacity of 20,000 m^3/day. According to the interview with the Department of Agriculture and Rural Development (DARD), the domestic water demand in Thai Nguyen City and Song Cong Town is about 20,000 m^3/day.

The domestic water demand from surface water was estimated with the following equation:

(Domestic water demand)

= (Population in area) x (Service coverage ratio) x (Per Capita Consumption)
/ (1 - Unaccounted water ratio)

Considering the approximately 291,600 people* living in Thai Nguyen City and the town of Song Cong with 58.5 % coverage ratio, 80 liter/person/day**, 30% unaccounted water ratio, the domestic water demand was estimated at 20,000 m^3/day which is equal to 0.23 m^3/s.

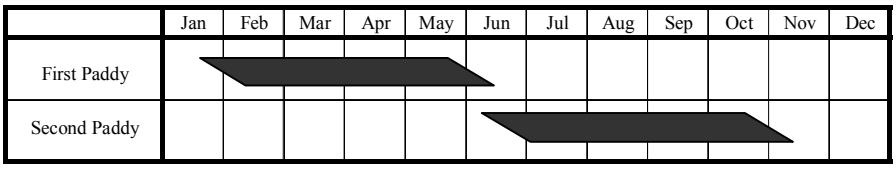
*: estimated from the Yearbook of Statistical data in Thai Nguyen Province
**: ref. 167 liter/person/day, 67% NRW in Ho Chi Minh in 2001 (Source: ADB Website, City Water Supply Indicators)
125 liter/person/day, 30% NRW as national average in 2004 (Source: South East Asian Water Utilities Network Website)

2) Industrial Water Demand

According to information obtained from relevant studies and subcontract works, there are 16 firms with water intake licenses and the total water demand for industry is 5.3 m^3/s.

3) Irrigation Water Demand

The main water usage in the Cau River is for irrigation. Two large irrigation schemes exist in the model area such as the Cau River Irrigation System and the Lower Nui Coc Irrigation System. Figure 2.3-1 below shows the typical cropping pattern in the Cau River model area. In terms of water usage, the land preparation period, rooting period, and heading period require abundant water.



source: Thai Nguyen DARD

Figure 2.3-1 Cropping Pattern in the Cau River Model Area

The Cau River Irrigation System was designed and built by the French in 1922, and was completed in 1936. The initial task was irrigating the 28,000 ha of cultivated land in Phu Binh District in Thai Nguyen City and the districts of Tan Yen, Viet Yen, and Hiep Hoa of Bac Giang Province. The Cau River Irrigation System is serving 23,640 ha of cultivated land for the spring crop and 27,900 ha of cultivated land for the summer crop.

The extracted water volume is regulated through the Da Gan weir, an intake of irrigation water supply canal. According to the local farmers, the Thac Huong weir does not overflow since water from Cau River is regularly diverted to the irrigation canal from January to March. This information was also confirmed through the interview with Thai Nguyen DARD officers in

[2] Website of Thai Nguyen Province http://www.thainguyen.gov.vn/eg/Index.asp?c=73&KT=2&id_gioithieu=490

December 2008 and the field investigation in February 2009. Table 2.3-2 shows the irrigation water requirement and deficit of the Cau River Irrigation System.

Table 2.3-2 Irrigation Water Demand and Deficit of the Cau River Irrigation System

	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Discharge in Gia Bay	12.3	12.6	12.4	12.5	49.3	90.7	162	154	105	38.7	20.9	14.5
Irrigation Water Demand (m^3/s)	21.96	21.96	21.96	18.26	20.16	28.5	20.16	20.16	20.16	24.23	32.6	28
Deficit (m^3/s)	9.66	9.36	9.56	5.76	-	-	-	-	-	-	11.7	13.5
No. of days for supplying irrigation water	31	28	16	15	-	-	-	-	-	-	14	25

Source: Thai Nguyen DARD

From the above table, the irrigation water demand of the Cau River Irrigation System from January to March was evaluated and calculated to be 22 m^3/s.

In addition to the Cau River Irrigation System, there is another irrigation system located downstream of the Nui Coc reservoir between the Cau River and the Cong River. This is known as the Lower Nui Coc Irrigation System. This system is designed to irrigate about 12,000 ha but at present the system serves only about 6,360 ha in spring and 9,800 ha in summer. The total water demand of the Lower Nui Coc Irrigation System in five dry months from December to April was estimated and confirmed at 62 million m^3.

During the field investigation, it was confirmed that the maximum flow capacity of the main canal known as the Kenh Chinh Canal is approximately 20 m^3/s. It means that the maximum water supply volume from the Nui Coc reservoir to the Lower Nui Coc Irrigation system is 20 m^3/s.

(3) Water Discharge

1) Domestic and Industrial Water Discharge

The volume of domestic and industrial water discharge was estimated at 70% of the total water supplied from the river or the reservoir. It was assumed that about 30% of domestic and industrial water was consumed .and the rest are wastewater

2) Irrigation Water Discharge

About 90% of irrigation water supply was estimated as return flow.

3) Domestic Water Discharge from Underground Water Source

Ground water is the main water source for domestic use in the provinces of Bac Kan and Thai Nguyen, Thai Nguyen City, and the town of Song Cong, About 70% of the water supply is considered as wastewater to be treated and to be discharged to the river as expressed in the following equation:

Water Discharge from Ground Water Source

= (Population in area) x (Service coverage ratio) x (Per Capita Consumption) x 70%

The water discharge from ground water sources in Bac Kan City and the relative towns in Thai Nguyen Province are summarized in Table 2.3-3:

Table 2.3-3 Domestic Water Discharge Volume from Underground Water Source

		Population	Service coverage	Per Capita Consumption	Domestic Water Use Volume	Domestic Water Discharge Volume
		(people)	(%)	(Lpcd)	(m^3/s)	(m^3/s)
Bac Kan	Bac Kan	21,866	100.0%	80	0.02	0.01
Thai Nguyen	Thai Nguyen city	242,523	41.5%	80	0.09	0.07
	Song Cong	49,181	41.5%	80	0.02	0.01
	Dinh Hoa	89,637	100.0%	80	0.08	0.06
	Vo Nhai	63,992	100.0%	80	0.06	0.04
	Phu Luong	106,360	100.0%	80	0.10	0.07
	Dong Hy	124,842	100.0%	80	0.12	0.08
	Phu Binh	144,505	100.0%	80	0.13	0.09
Total	-	842,906	-	-	0.62	0.44

Source: Bac Kan and Thai Nguyen DONRE

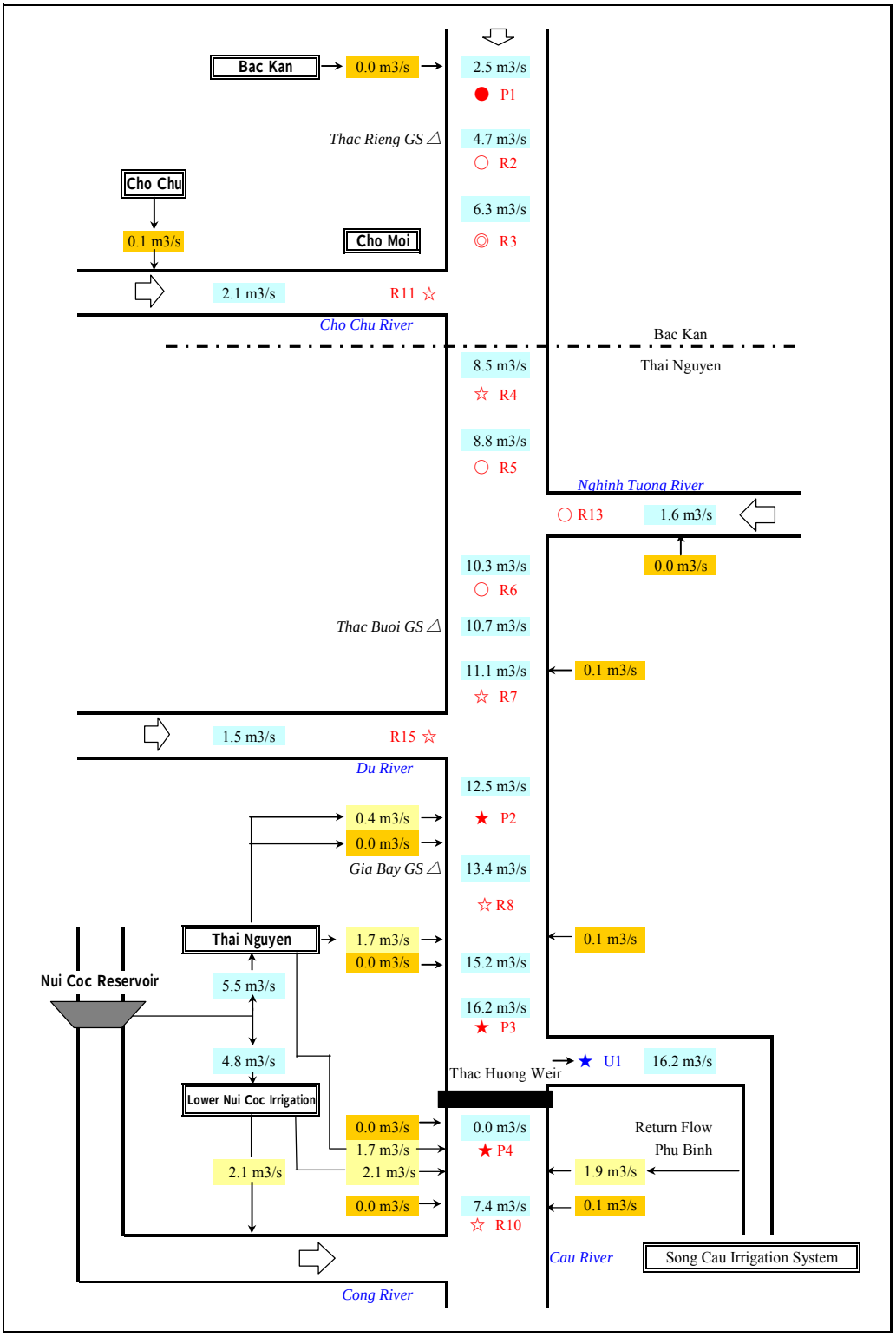
(4) Water Balance Study

Considering the domestic, industrial and irrigation water demand requirements and the inter-basin water supply systems namely the Nui Coc reservoir and the Thac Huong weir, the river discharge of the selected stations was examined through the water balance study. As described in Figure 2.2-2, the river discharge during dry and rainy seasons varies. Considering the river water demand and supply, the water balance study was carried out in two cases, i.e., in February and in June.

In Case 1, the monthly average from 1998 to 2007, which is approximately equal to the discharge for 73% duration, was applied since discharge in February is supposed to be the lowest during the year.

In Case 2, the monthly average in June equivalent to 13% duration, which represents the river discharge in the rainy season, was applied.

The result of the water balance study for Case 1 is shown in Figure 2.3-2.



Note: Station No. such as "P1" and "R2" in the future show recommended water quality monitoring points shown in Figure 3.2-1.

Source: JICA Study Team

Figure 2.3-2 Schematic River Discharge Diagram in the Cau River Model Area (February, Average of 1998-2007)

2.4 River Water Quality

(1) Monitoring Results in 2007

The status of water quality in the Cau River model area in July 2007 is shown in Table 2.4-1. Although the biological oxygen demand (BOD) of 4.0 mg/L in the upper reaches of Bac Kan City exceeded Class A-1 for surface water quality standard (QCVN 08: 2008/BTNMT), the water quality conditions were relatively good compared with the conditions around Thai Nguyen City with BOD of 19.2 mg/L and chemical oxygen demand (COD) of 42.7 mg/L at the Gia Bay Bridge.

Table 2.4-1 Water Quality at the Model Area in Cau River

Parameter	Monitoring Point												
	Bac Kan *1							Thai Nguyen *2					
	NM1	NM11	NM12	NM14	NM16	NM17	NM18	SCA 1-1	SCA 1-2	SCA 1-3	SCA 1-4	SCA 1-5	SCA 1-6
BOD5	4.3	5.2	4.9	4.8	5.4	6.0	6.5	10.4	5.4	12.6	19.2	11.0	16.2
COD	8.6	9.0	8.2	8.0	9.0	10.5	12.0	21.1	10.0	29.0	42.7	21.6	26.4
SS	34.6	47.7	44.0	60.3	50.1	52.0	63.7	16.0	28.1	49.2	14.2	29.4	13.2

Unit: mg/l

*1: Monitoring period is 27th to 29th July 2007; Souece: Monitoring results of Bac Kan DONRE

*2: 75% value; Source: Monitoring conducted by Bac Kan and Thai Nguyen DONRE

Note: NM1: Pha Brige in Bac Kan Town; NM11: End of Bac Kan Town; NM12: Phuong vien Commune, Cho Don District; NM14: Cho Don District; NM16: Nong Ha commune, Cho Moi District; NM17: Thanh Binh Commune, Cho Moi District; NM18: Cho Moi Town, Cho Moi District; SCA 1-1: Van Lang; SCA 1-2: Hoa Binh; SCA 1-3: Son Cam; SCA 1-4: Gia Bay Bridge; SCA 1-5: Huong Waterfall Damp; SCA 1-6: May Bridge

(2) Monitoring Results in 2008

The CEM/VEA and Thai Nguyen DONRE conducted surface water quality monitoring at the designated monitoring points in the Cau River main stream, as shown in Figure 2.4-1. The monitoring results in 2008 are described below.

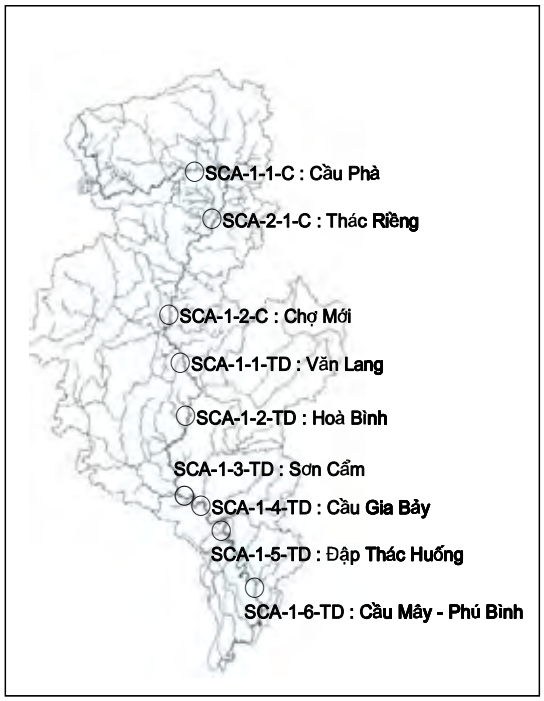
1) BOD, COD, and SS

The average concentration of 75 % value[3] of BOD, COD and suspended solids (SS) are shown in Figure 2.4-2. The BOD and COD monitoring results showed the same trend from the upper to lower reaches of the target area. From upstream of Bac Kan Town (SCA-1-1-C) to Cho Moi (SCA-1-2-C), the water quality level was maintained at Class A-1 standard of QCVN 08:2008/BTNMT. From Cho Moi to Hoa Binh (SCA-1-2-TD), the water quality level has shifted to Class A-2 standard of QCVN 08:2008/BTNMT. The downstream area of the model area is significantly affected by the domestic and industrial wastewater comparing with the upstream area. The water quality level in the area did not meet the Class A-2 standard at some monitoring points. The SS showed a different tendency from BOD and COD, and its concentrations in the downstream area were not always higher than those in the upstream area.

2) Heavy Metals

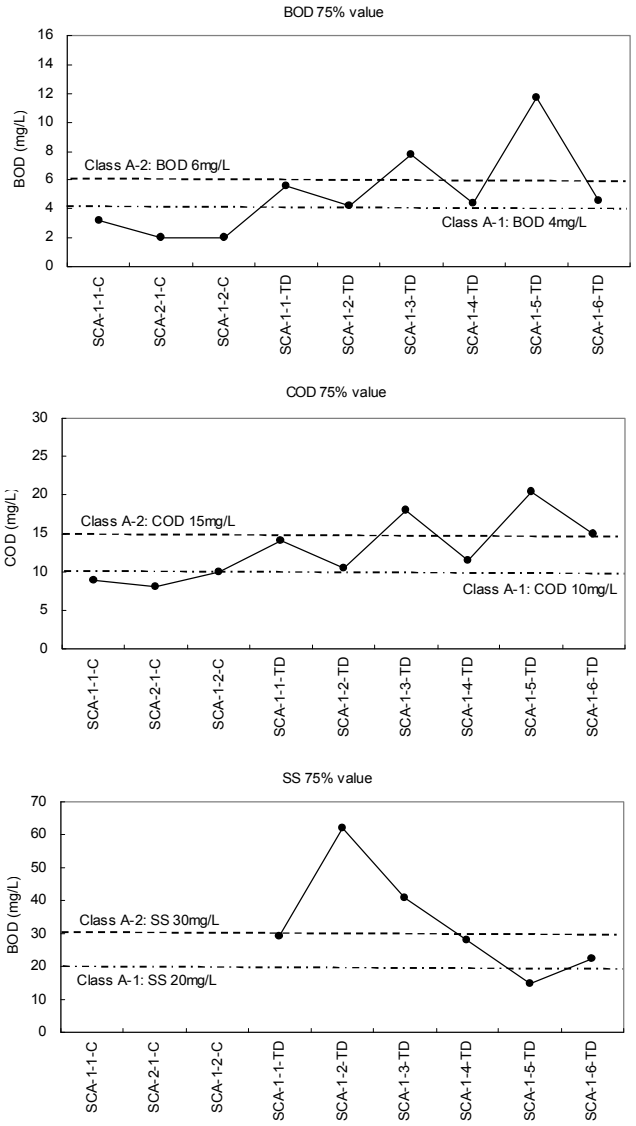
The average concentrations of heavy metals at the designated monitoring point in 2008 are shown in Table 2.4-2. Comparing the monitoring results with Class A-2 standards of QCVN 08:2008/BTNMT, there is a significant presence of toxic heavy metals, such as lead and cadmium at the downstream of the target area, which exceeded the water quality standards.

[3] The 75% value is the water quality data which is equaled or exceeded by 75% of the data in the year. The Guideline for Designing Water Quality Monitoring System at River Basin Level, prepared by the Study, proposes to use 75% value for BOD, COD and SS.



Note: "C" means CEM/VEA's points. "TD" means "Thai Nguyen D
Source: JICA Study Team

Figure 2.4-1 Monitoring Point



Note: At the SCA-1-1-C, 2-1-C, and 1-2-C, SS did not measures in 2008.
Source: CEM/VEA, Thai Nguyen DONRE

Figure 2.4-2 BOD, COD and SS Monitoring Results in 2008

Table 2.4-2 Heavy Metals Monitoring Results in 2008

Sampling Point	Fe	Pb	Cr^{6+}	Zn	As	Hg	Cd	Cu
Class A-2 standards y QCVN 08:2008/BT/TMT	1	0.02	0.02	1.0	0.02	0.001	0.005	0.2
Cầu Phà	1.4	n.d.			0.000	n.d.	0.0002	
Thác Riềng	0.9	n.d.			0.000	n.d.	0.0002	
Chợ Mới	1.0	n.d.			0.000	n.d.	0.0002	
Chợ Chu-Định Hoá	1.3	0.01		0.02	0.006		0.0007	
Văn Lang	1.4	0.01	0.003	0.02	0.005	0.0010	0.0010	0.008
Suối Nghinh Tường	0.3	0.01	0.005	0.02	0.009	0.0010	0.0013	0.006
Hoà Bình	0.9	0.02	0.001	0.02	0.006	0.0010	0.0008	0.009
Phục Linh	1.9	0.01	0.004	0.03	0.025	0.0010	0.0007	0.031
Giang tiên (sông Đu)	1.4	0.01	0.011	0.02	0.013	0.0010	0.0010	0.091
Sơn Cẩm	1.1	0.01	0.002	0.02	0.006	0.0010	0.0007	0.011
Suối Phượng Hoàng	0.4	0.01		0.02	0.006		0.0011	
Sông Cầu - Sau điểm xả suối Phương Hoàng	0.4	0.02		0.02	0.005		0.0010	
Suối tiếp nhận nước thải khu dân cư phường Hoàng Văn Thụ	0.4	0.01		0.02	0.008		0.0014	
Cầu Gia Bảy	0.8	0.01	0.012	0.03	0.010		0.0048	0.005
Linh Nham	0.5	0.01		0.03	0.005		0.0014	
Sông Cầu - Sau cửa xả suối Linh Nham	0.3	0.01		0.02	0.006		0.0010	
Suối Xương Rồng (Trước khi đổ ra sông Cầu)	0.8	0.02		0.05	0.007		0.0010	

Sampling Point	Fe	Pb	Cr^{6+}	Zn	As	Hg	Cd	Cu
Class A-2 standards y QCVN 08:2008/BT/TMT	1	0.02	0.02	1.0	0.02	0.001	0.005	0.2
Sông Cầu - Sau điểm xả suối Xương Rồng	0.5	0.03		0.35	0.007		0.0009	
Suối Loàng (Trước khi đổ ra sông Cầu)	1.1	0.03		0.28	0.018		0.0068	
Sông Cầu - Sau cửa xả Suối Loàng	0.5	0.02		0.02	0.006		0.0023	
Đập Thác Huống	0.5	0.02	0.006	0.03	0.007	0.0010	0.0035	0.017
Suối Thác Lạc-Trại Cau	1.2	0.01	0.005	0.02	0.007	0.0010	0.0020	
Suối Cam Giá (Trước khi đổ ra sông Cầu)	0.7	0.35	0.033	2.74	0.006	0.0010	0.0098	0.036
Sông Cầu - Sau cửa xả suối Cam Giá	0.9	0.19	0.019	0.69	0.007	0.0010	0.0033	0.029
Suối Phố Hương	0.9	0.02		0.02	0.006			
Sau điểm xả suối Phố Hương	0.7	0.03		0.22	0.007		0.0014	
Cầu Mây - Phú Bình	0.9	0.01	0.002	0.02	0.006	0.0010	0.0012	0.014
Suối Văn Dương - Cửa xả trước khi đổ ra Sông Công	1.4	0.01	0.012	0.13	0.007	0.0010	0.0037	0.015
Sông Công - Sau điểm xả của suối Văn Dương	0.8	0.02	0.003	0.04	0.008	0.0010	0.0016	0.025

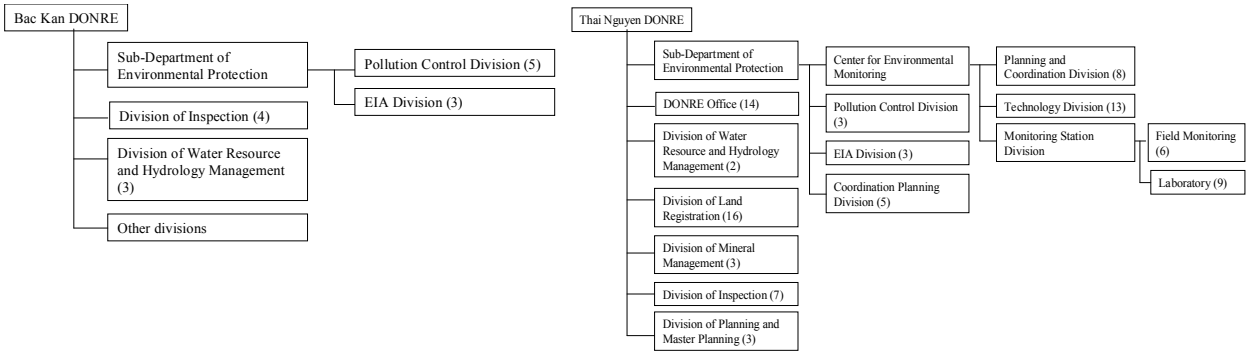
Note: "n.d. "means that the heavy metal was not detected. "---" means that there is no data at the sampling point.
Highlighted values are not satisfied with surface water quality standard Class A-2 of QCVN 08:2008/BTNMT.
Source: JICA Study Team

2.5 Water Environmental Management Activities

2.5.1 Administrative Conditions

(1) Provincial Level

The administrative body for environmental management in the provincial level is DONRE under PPC. The organizational structure of the Bac Kan and Thai Nguyen DONRE is shown in Figure 2.5-1. The Sub-Department of Environmental Protection and the Division of Inspection are mainly in charge of pollution control. Only the Thai Nguyen DONRE runs its own laboratory.



Source: JICA Study Team

Figure 2.5-1 Organization Structure of Bac Kan and Thai Nguyen DONRE

(2) District Level

At the district level, there are eight administrative units in Bac Kan Province and nine units, including the city and town, in Thai Nguyen Province. These are shown in Table 2.5-1. The Division of Natural Resources and Environment (District DONRE) of each administrative unit has the responsibility towards the environmental management of their respective areas. Generally, only a few staffs are assigned to carry out environmental management in the District DONRE.

Table 2.5-1 Districts in Bac Kan and Thai Nguyen Provinces

Bac Kan		Thai Nguyen	
Capital	Bac Kan Town	Capital	Thai Nguyen City
District	Pac Nam	Town	Song Cong Town
	Ba Be	District	Dinh Hoa
	Ngan Son		Vo Nhai
	Back Thong		Phu Luong
	Cho Don		Dong Hy
	Cho Moi		Dai Tu
	Na Ri		Phu Binh
			Pho Yen

Source: Bac Kan Statistical Year Book 2008,T hai Nguyen Statistical Year Book 2008

2.5.2 Water Environment Management Activities in the Model Area

(1) Environmental Impact Assessment (EIA)

At provincial level, DONRE is in charge of appraising EIA and EPP from enterprises under their authority. There are several enterprises operating without appropriate environmental certificates. According to the survey conducted by VEA in 2008, 3 out of 10 in Bac Kan province, and 7 out of 37 enterprises in Thai Nguyen province did not obtain EIA or EPP approval. In terms of EPP approval, 2 are waiting for issuance of EPP approvals as of September 2009 in Bac Kan province, and only one enterprise has obtained in Thai Nguyen province as of September 2009. In terms of EPC register from relatively small-scale enterprises, the District DONRE is responsible for appraising. In addition, they also have responsibility in appraising EPP under their management. Due to lack of information, it is difficult to identify current condition. However, it seems that a number of enterprises have not obtained EPC register or EPP approval. For instance, there are 153 projects in 2009 in Bac Kan town, but Bac Kan town DONRE has registered only 8 of them as of June 2009.

(2) Self-Monitoring Report

A self-monitoring report must be submitted by the enterprises obtaining EIA and EPP approval. However, many of the enterprises do not comply with this requirement. The Bac Kan DONRE has received self-monitoring reports from only two enterprises out of five facilities obtaining EIA approval in 2009, while the Thai Nguyen DONRE has received from 23 enterprises out of 59 obtaining EIA approval as of August 2009.

(3) Environmental Inspection and Check

In Bac Kan DONRE, the Division of Inspection has four staff members whose main responsibility is inspection of enterprises. They prepare two detailed inspection plans every year, one for the first period from January to June, and the other for the second period from July to December. The average number of inspected facilities is around 30 to 40 per year. In 2009, Bac Kan DONRE had inspected 16 enterprises in the first period, and will carry out inspection of another 16 to 17 targets in the second period. Table 2.5-2 shows the inspection plan of Bac Kan DONRE in 2009.

Table 2.5-2 Inspection Plan of Bac Kan DONRE in 2009

Responsible Body	Period	Number of Target Enterprises	Category of Enterprises	Sampling of Wastewater
Division of Inspection	First period (from January to June) *	16	Mining:6; Paper/Wood:3; Metal:2; Hospital: 2; Food: 1; Industrial zone: 1; Other: 1	No
	Second period (from July to December)	To be prepared	To be prepared	No
Total		Around 30-40	-	-

* Inspection was finished in July 2009; Source: Bac Kan DONRE (Complied by JICA Study Team)

The Bac Kan DONRE usually does not take any samples in their regular inspection. They only take samples in some additional inspections in response to severe violations and complaints from the residents, in which case Bac Kan DONRE hires a consultant to take samples. Cooperation of the environmental police is very helpful in reporting the violations. The Bac Kan DONRE can conduct inspection to violators without any notice of inspection and without the accompaniment of the environmental police . In 2008, Bac Kan DONRE inspected four to five times together with the environmental police.

In Thai Nguyen DONRE, the Division of Inspection and Pollution Control Division cooperate in their inspection activities. On the average, the Thai Nguyen DONRE inspects 60-70 facilities, including enterprises in an industrial park (IP), every year. The Division of Inspection inspects the more severe pollution sources, usually around 10 facilities out of the 60-70 facilities per year. The two divisions prepare their respective annual inspection plan through a coordination meeting and based on the gathered information. As shown in Table 2.5-3, the Division of Inspection inspected 69 enterprises while the Pollution Control Division inspected four in 2009.

Table 2.5-3 Inspection Plan of Thai Nguyen DONRE in 2009

Responsible Body	Nos. of Target Enterprises	Category of Enterprises	Sampling of Wastewater
Division of Inspection	4	Construction: 2; Food: 1; Electricity: 1	No information
Pollution Control Division	69	Metal:12; Hospital:10: Construction:8; Mining:7; Food: 6; Livestock: 4; Cement:3; Paper:3; Automobile:2; Brick:2; Trade:1; Precious stone:1; Transportation:1; Handicraft:1; Machinery:1; Battery:1; Others: 6	Wastewater is taken at all of facilities
Total	73	-	-

Source: Thai Nguyen DONRE (Complied by JICA Study Team)

During the inspection of the Pollution Control Division, samples of discharged wastewater were collected at all the inspected facilities by the Center for Environmental Monitoring of Thai Nguyen DONRE. Water quality parameters such as SS, BOD, and COD, heavy metals, oil and grease, and others were assessed and analyzed. Based on characteristic of wastewater, Thai Nguyen DONRE selects analyzed parameters, such as SS, BOD, COD,. In some instances, Thai Nguyen DONRE requested the environmental police of Thai Nguyen Province to participate during the inspection, In case that inspection is undertaken together with the environmental police, a non-notice inspection is possible. Since 2008, there have been 100 inspection cases in which Thai Nguyen DONRE have inspected together with the environmental police.

Although it has the obligation to inspect facilities under its management before issuing EPC registration and EPP approval, the District DONRE does not conduct inspection regularly. For example, in Song Cong Town, DONRE inspects only in cases that the local residents complain about their environment, or they only participate in inspections led by the Thai Nguyen DONRE. The Song Cong Town DONRE did not inspect any enterprises in 2008, but they inspected two as of August 2009.

(4) Administrative Sanction

In 2008, Bac Kan DONRE levied fines to about ten enterprises and issued warnings to three or four. The total amount of levied fines was VND 70 million (US$3,900). There was no case of operation suspension in 2008, but the operation of a gold mining company has been suspended in 2009. Its EIA report has not been completed and the discharged wastewater quality did not conform to the effluent standard. The Bac Kan DONRE monitors countermeasures taken by the enterprise, and reports the progress to PPC, which decides the next necessary actions.

The Thai Nguyen DONRE issued warnings in 2008 to 70 inspected enterprises, 24 of which were fined. As shown in Table 2.5-4, the total amount of levied fines was VND 262 million (about US$14,600). For repeated violation cases, Thai Nguyen DONRE can take a hard stance such as

operation suspension or facility closure. However, there were only two cases of facility closure as of to-date.

Table 2.5-4 Levied Fine by Thai Nguyen DONRE in 2008

Date	Sector of Enterprise	Fine
Mar.	Individual	5,000,000
Apr.	Individual	5,000,000
	Metal	2,000,000
	Mining	12,000,000
May	Individual	5,000,000
	Metal	10,000,000
	Construction	31,000,000
	Trade	10,000,000
Jun.	Individual	5,000,000
	Not clear	17,500,000
	Trade	11,500,000
	Steel and iron	3,000,000
Aug.	Concrete	2,000,000
Sep.	Construction	30,000,000
Oct.	Metal	10,000,000
	Mining	10,000,000
	Machinery	18,000,000
	Medical equipment	19,000,000
	Not clear	14,000,000
	Mining	12,000,000
	Construction	8,300,000
	Beer	600,000
Nov.	Not clear	8,000,000
	Paper	13,000,000
Total 24 enterprises		**Total of 261,900,000VND**

Source: Thai Nguyne DONRE (complied by JICA Study Team)

On the other hand, it is difficult for the District DONRE to regularly conduct inspection activities. As a result, they seldom issue warnings and charge fines to violators. For instance, the Song Cong Town DONRE has not issued any warning letters nor levied fines ever. Since the enterprises under the management of District DONRE are relatively small in sizes, the District DONRE tends to instruct the enterprises verbally rather than issuing warnings and fines.

(5) Environment Protection Fee from Industry

The EIA Division is in charge of managing the environment protection fee from the industries in Bac Kan DONRE, and has been collecting fees since 2004. As shown in Table 2.5-5, only four enterprises paid the fees in 2008, with a total amount of VND 26 million (about US$1,400), while four enterprises have paid so far in 2009.

Table 2.5-5 Amount of Collected Environment Protection Fee from Industry in Bac Kan Province

Year	Yearly paid fee (VND)	Total enterprises paying fee (number)
2008	26,412,700	4
2009*	4,102,480	4

* As of September 2009
Source: Bac Kan DONRE

In Thai Nguyen DONRE, the EIA Division is also in-charge for managing the environment protection fee. Based on the EIA and self-monitoring reports, there are 99 listed enterprises which have to pay the corresponding fees in 2009. Table 2.5-6 shows the collected fees from 2006 to 2009. In 2008, the total paid fees was VND 882 million (US$49,000). In the first quarter of 2009, it reached to VND 215 million (about US$12,000), but only VND 62 million (about US$3,400) have been paid in the second quarter as of August 2009.

Table 2.5-6 Amount of Collected Environment Protection Fee from Industry in Thai Nguyen Province

Year	Yearly paid fee (VND)	Paid fee of quarter period (VND)		Total enterprises listed by DONRE (number)	Enterprises paying fee (number)	
2006	274,224,140	First:	207,747,899	64	First quar.:	56
		Second:	46,276,053		Second quar:	20
		Third:	16,915,520		Third quar.:	14
		Forth:	3,284,668		Forth quar.:	3
2007	340,426,273	First:	208,899,476	71	First quar.:	59
		Second:	59,867,368		Second quar:	35
		Third:	20,978,692		Third quar.:	19
		Forth:	50,680,737		Forth quar.:	4
2008	882,130,223	First:	85,865,423	99	First quar.:	35
		Second:	183,422,078		Second quar:	36
		Third:	540,082,645		Third quar.:	45
		Forth:	72,760,077		Forth quar.:	35
2009	277,084,242	First:	215,111,547	99	First quar.:	39
		Second:	61,972,695		Second quar:	28

Source: Thai Nguyen DONRE (complied by JICA Study Team)

(6) Awareness Raising and Public Participation

Bac Kan DONRE plans to promote cooperation programs for the environmental protection with social organizations such as the Vietnam Farmer Association, Ho Chi Minh Communist Youth Union, and Vietnam Women's Union. Thai Nguyen DONRE has prepared a plan for awareness campaign in 2009. The plan includes organizing activities for the occasions of environmental events such as World Environment Day and Biodiversity Day, in cooperation with the socio-political organizations for communication activities on environmental protection in the Cau River basin.

(7) Water Quality Monitoring

Currently, the Center for Environmental Monitoring (CEM) of VEA, Bac Kan DONRE, and Thai Nguyen DONRE conduct monitoring in the model area. The CEM and Thai Nguyen carried out water quality sampling for six times, and the Bac Kan DONRE implemented water sampling twice a year. Several monitoring points of CEM and Thai Nguyen DONRE are very close and sometimes overlapped. The monitored parameters are not unified in the model area. CEM and Thai Nguyen DONRE monitor various parameters, including heavy metals and organo-chloric pesticides, while Bac Kan DONRE monitors basic parameters such as BOD and COD, and inorganic nutrients.

Both Bac Kan and Thai Nguyen Provinces have not stipulated which class, from A 1 to B 2, of QCVN 08:2008/BTNMT is applied to the model area. In terms of the discharged industrial wastewater standard QCVN 24: 2009/BTNMT, they have not yet decided which class, from A to C, is used in the model area.

2.5.3 Pollution Control at Sources

(1) Installation of Wastewater Treatment Facility

Table 2.5-7 shows current situation in the installation of wastewater treatment plants at pollution sources under the management of Bac Kan and Thai Nguyen DONREs. Around 50% of the enterprises in Bac Kan Province and 80% in Thai Nguyen Province have wastewater treatment plants. However, it is not clear whether the enterprises operate their plants properly because of insufficient monitoring and inspection data. According to Bac Kan DONRE, some of the enterprises usually stop operating their treatment plant, and resume the operation only when DONRE will inspect the facility.

Table 2.5-7 Installation of Wastewater Treatment Plant under Control of Bac Kan and Thai Nguyen DONREs

Category	Under Management of Bac Kan DONRE (number of enterprises) [1)]	Under Management of Thai Nguyen DONRE (number of enterprises) [2)]
Total surveyed enterprises	16	37
Installation of wastewater treatment plant	8	29

Source: 1) Bac Kan DONRE (complied by JICA Study Team), 2)Inspection result by VEA in 2008

(2) Cleaner Production and Environmental Management System

In Bac Kan and Thai Nguyen province, cleaner production and environmental management system in the enterprises have not yet prevailed.

(3) Usage of Environmental Protection Fund

A paper company in Bac Kan Province has utilized the fund of the Vietnam Environmental Protection Fund (VEPF) to install a wastewater treatment facility. The paper company is among the serious pollution sources identified by Decision No.63.2003. Table 2.5-8 shows the summary of the environmental protection fund.

Table 2.5-8 Environmental Protection Fund Applied to Paper Company in Bac Kan

Items	Contents
Capacity of wastewater treatment facility	120m3/day
Total cost of facility	700 million VND
Loan from VEPF	400 million VND
Interest rate of loan	0.45%/month
Repayment period	5 years
Repayment method	Every three months

Source: Bac Kan DONRE

In Thai Nguyen Province, Hoang Van Thu Paper Mill Factory has submitted its environmental protection fund application to VEPF with the support from the Department of Pollution Control (PCD) in Thai Nguyen DONRE. At present, VEPF is evaluating the said application.

(4) Measures on Serious Pollution Sources Identified by Decision No.63.2003 and Circular No.07/2007

In the model area, there are four and eight facilities in Bac Kan and Thai Nguyen Provinces, respectively, that were targeted by Decision No.63.2003. The current progress of measures is summarized in Table 2.5-9.

Table 2.5-9 Measures on Serious Pollution Sources in Bac Kan and Thai Nguyen Province

Province	Facilities	Current Conditions
Bac Kan Province	Brick factory	The factory has been closed already.
	Solid waste dumping site	The dumping site has stopped operation. Dumped waste is covered by top soil, but no wastewater treatment facility is installed.
	Hospital	The hospital owns a wastewater treatment facility. But it is not operated properly.
	Paper factory	The factory has installed a wastewater treatment facility using the environmental protection fund from VEPF. It is removed from the list of pollution sources based on Decree No.64. However, the factory is not operated regularly because of shortage of raw materials.
Thai Nguyen Province	C Hospital	It has installed a wastewater treatment plant. The application for confirmation is presently under process. Government provided the funds for installation of the plant.
	Tuberculosis and Lung Disease Hospital	It has installed wastewater treatment plant. Presently processing the application for confirmation. Government provided the funds for installation of the plant.
	Solid Waste Dumping Site	It has installed wastewater treatment plant. It is processing the procedure of application for confirmation. Government provided the fund for installation of treatment plan.
	Thai Nguyen Paper Export JSC	It has installed wastewater treatment plant funded by DANIDA project. It is processing the procedure of application for confirmation of installation.
	A Hospital	The hospital is constructing a treatment work and will complete in 2009. Government provided the fund for installation of treatment plan.
	Thai Nguyen Iron and Steel Company	The company completed continues to invest in and construction of wastewater treatment plant.
	Hoang Van Thu Paper JSC	The company has not finished measures. However, it has closed a powder boiling chain (main source causing pollution).
	Thai Nguyen General Hospital	The hospital does not improve current wastewater treatment system. It has established a project of construction of new wastewater treatment system implemented in 2009 and 2010.

Source: Interviews by JICA Study Team

In the model area, 19 facilities discharging wastewater are identified in Circular No.07/2007 in Thai Nguyen Province. The measures taken by these facilities are summarized in Table 2.5-10. On the other hand, Bac Kan Province has not specified any facilities.

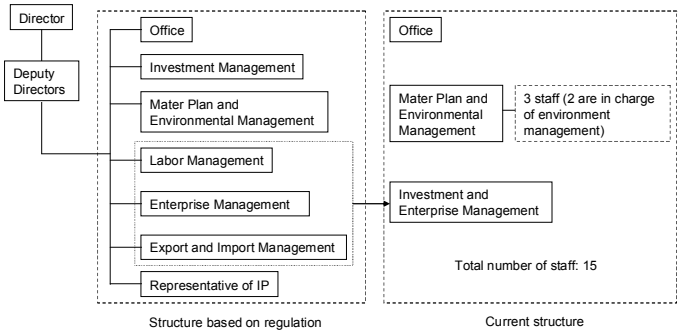
Table 2.5-10 Pollution Sources Targeted by Circular No.07/2007 in Thai Nguyen

Facilities	Current Conditions
1) Thai Nguyen Electrolytic Zinc Company	Installed a wastewater treatment plant
2) Branch of Truong Xuan paper factory	
3) Dai Tu tin enterprise	Plans to install a wastewater treatment plan
4) Non-ferrous making enterprise No.1	No measures yet
5) Non-ferrous making enterprise No.2	
6) Mining and metallurgical one member limited company	
7) Song Cong Diesel One member State limited company	
8) Spare parts one member limited company	
9) Natsteel Vina Joint-Venture company	
10) Thai Nguyen cement deck factory	
11) Thai Nguyen Van dam company	
12) Luu Xa construction concrete factory	
13) Ba Son coal mine	
14) Trai Cau Steel Mine	
15) Branch of Ban Tich JSC	
16) Song Cong Beer enterprise	
17) Ha Thanh Beer Facility	
18) Farm of Ms.Tran Thi Mai	
19) Farm of Ms.Nguyen Thi Suu	

Source: JICA Study Team

(5) Environmental Management of Industrial Parks and Zones

Currently, only one industrial park, Song Cong, is located in the model area in Thai Nguyen Province. There are 23 operating facilities at present, and ten are under construction. The Management Board of the IP was established under the PPC of Thai Nguyen in November 2000. Within the Management Board, there is a section in-charge for environmental management and pollution control. Figure 2.5-2 shows its current organizational structure.



Source: JICA Study Team

Figure 2.5-2 Organization Structure of Management Board of IP of Thai Nguyen Province

The Song Cong IP will complete the construction of the wastewater treatment facility with 2000m^3/day capacity in 2009. Wastewater will be treated to Class B effluent of QCVN 24: 2009/BTNMT. At present, wastewater is treated to Class C of QCVN 24: 2009/BTNMT, with a simple treatment system at each facility, and then discharged to a stream running near the IP., The Management Board has the main responsibility on environmental management. However, due to lack of human resources, most of its duties, such as EIA and EPC appraisal, inspection and monitoring, are not being carried out.

Currently, two enterprises have obtained EIA approvals, three have EPC registration, and three have EPP approvals. The rest of the 25 enterprises still do not have the EIA, EPC, nor EPP. The Management Board is in charge of checking the self-monitoring activities of the enterprises in the IP. However, it does not fulfill this task. Currently, Thai Nguyen DONRE checks the self-monitoring reports instead of the Management Board. Inspection of facilities in the IP is now the task of Thai Nguyen DONRE. Thai Nguyen DONRE also conducts regular monitoring at Song Cong IP because the Management Board does not possess the necessary skills and equipment.

In terms of the environment protection fee, no fees are being collected in the enterprises in Song Cong IP. After the start of the operation of the wastewater treatment facility in the IP, the collection of fees will be done. The company that operates the wastewater treatment facility will have the responsibility to calculate and collect the corresponding fees from the enterprises.

(6) Sewerage Development

In Bac Kan Town, a sewerage development project has been started with the support of the Finnish Government. The service area will be the central part of Bac Kan City. The project will be operational by 2013. Table 2.5-11 summarizes the project features.

Table 2.5-11 Summary of Sewerage Project of Bac Kan Town

Item	Contents
Service site	Central area of Bac Kan town
Service area	200 ha
Service population	10,000 people
Sewerage system	Separate drainage system
Quality of wastewater after treatment	Class B of TCVN 7222: 2002
Total cost	206.3 bil VND (11.6 mil US$)
Service commencement	2013

Source: Bac Kan DOC

In Thai Nguyen City, a sewerage development project has been started with the support of the French Government. The service area will be the central area of Thai Nguyen City. The project will be operational by 2013. Table 2.5-12 summarizes the project features.

Table 2.5-12 Summary of Sewerage Project of Thai Nguyen City

Item	Contents
Service site	Northern centre of Thai Nguyen city
Service area	1,200 ha
Service population	100,000 people
Sewerage system	Semi-separate drainage system
Quality of wastewater after treatment	Class B of TCVN 7222: 2002
Total cost	579.9 bil VND (32.2 mil US$)
Service commencement	2013

Source: Management Board of the Project on drainage and wastewater treatment

3. Development of Guidelines with Technical Manuals for Designing of Water Quality Monitoring System at River Basin Level (Output-1)

The Output 1 includes the implementation of the following works. Its main outcome is the "Guidelines for Designing Water Quality Monitoring System at River Basin Level".

1) Surveys on Environmental Features of River Basin,
2) Evaluation of Current Water Quality Monitoring System,
3) Design and Evaluation of Water Quality Monitoring System at Cau River Model Area, and
4) Development of Guidelines for Designing Water Quality Monitoring System at River Basin Level.

3.1 Evaluation of Current Water Quality Monitoring System

The current water quality monitoring systems operated by CEM, Thai Nguyen DONRE and Bac Kan DONRE were evaluated and its results are described hereunder.

(1) Target Water Quality

In the beginning of 2009, the surface water quality standard was replaced from TCVN 5942 to QCVN 08:2008/BTNMT. In the latter, surface water quality standards are classified under four categories depending on the objectives of water usage. Currently, Thai Nguyen Province applies Class A surface water quality standards of QCVN 08:2008/BTNMT, while Bac Kan DONRE applies Class B. Through the formulation of water environment management plan, the surface water quality standards applied at the model area should be reviewed and modified.

(2) Monitoring Points

Several monitoring points of CEM and Thai Nguyen DONRE are at present either very close or overlapping. Hence, the overlapping monitoring points are to be unified, and one organization, either CEM or Thai Nguyen DONRE, should implement the water quality monitoring. The objectives of the water quality monitoring could differ between CEM and Thai Nguyen. Thus, unifying monitoring points will not always be effective considering the usage of water quality monitoring results. In case CEM and Thai Nguyen DONRE will implement water quality monitoring at the same sampling points in the future, sharing of the monitoring information will be recommended to grasp the water quality condition at river basin level.

(3) Monitoring Parameters and Frequency

Water quality monitoring parameters are not unified at the river basin level among CEM and relevant DONREs in the Cau River basin. For all actors, CEM and Thai Nguyen DONRE carry out water quality monitoring of various parameters including heavy metals and organo-chloric pesticides. Other DONREs conduct the monitoring of basic parameters such as BOD, COD, and inorganic nutrients. To grasp the water quality condition at river basin level from the upper to the lower reaches, water quality parameters should be unified at referential sampling points.

In the model area, CEM and Thai Nguyen carried out water quality sampling six times, while Bac Kan DONRE implemented two times of sampling in a year. To evaluate the water quality trend in a year, at least four times of seasonal sampling should be implemented. To grasp the water quality condition at the river basin level from the upper to lower reaches, each concerned agency is recommended to unify the period of water sampling during every sampling that is carried out.

(4) Sampling and Analytical Methods

In Vietnam, a standard operation procedure (SOP) on water sampling and analysis has been developed, and it has adequacy with international standards such as ISO. The CEM and Thai Nguyen DONRE apply the Vietnamese Technical Standards, TCVNs, and relevant international standards such as ISO, USEPA and APHA, for sampling and analysis of surface water based on the Decision No. 10/2007/QD-BTNMT.

(5) Data Evaluating and Sharing

Monitoring results are evaluated by comparing with surface water quality standard (QCVN 08:2008/BTNMT). Regarding data sharing, Thai Nguyen DONRE reports their monitoring results once a year to CEM. Since there have been no data sharing activities between Bac Kan DONRE and Thai Nguyen DONRE, the enhancement of data sharing activities is required among the concerned organizations for water quality monitoring at river basin level.

3.2 Design of Water Quality Monitoring System at Cau River Model Area

3.2.1 Monitoring Point

In the discussions with above three agencies concerned on water quality monitoring at the model area, the following issues were found:

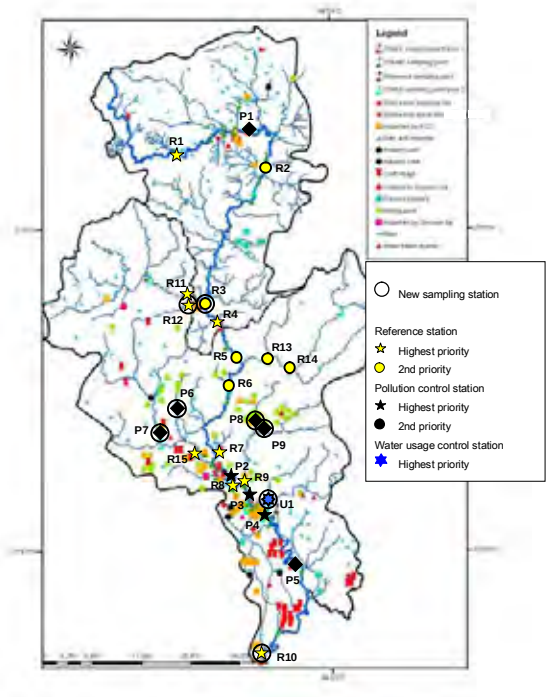
(1) To grasp the baseline and trend of water quality at river basin level, sampling points should be added at the provincial border of Cau River and congestion points of large tributaries with said river,

(2) To monitor the impacts caused by main pollution sources identified through Output-1, several points should be added at the downstream of such pollution sources, and

(3) To evaluate the adequacy of water quality for water usage, a sampling point should be set at Tac Hon weir, which is the main water intake facility for agricultural water usage in the model area.

Considering the above issues, new sampling points were recommended as shown in Figure 3.2-1.

Station No.	Priority	reason
R1	Highest	A-1
R2	2nd	B-1
R3	2nd	B-1
R4	Highest	A-3,A-4
R5	2nd	B-1
R6	2nd	B-1
R7	Highest	A-3
R8	Highest	A-2
R9	Highest	A-3
R10	Highest	A-3
R11	Highest	A-4
R12	Highest	A-4
R13	2nd	B-1
R14	2nd	B-1
R15	Highest	A-3
P1	2nd	D-1
P2	Highest	C-1
P3	Highest	C-1
P4	Highest	C-1
P5	2nd	D-1
P6	2nd	D-1
P7	2nd	D-1
P8	2nd	D-1
P9	2nd	D-1
U1	Highest	E-2



Priority	Reference Points	Pollution Control Points	Water Usage Control Points
Highest Priority	A-1) Upper reach of mainstream A-2) Point measuring water flow or water level A-3) Upstream and downstream areas at confluence point of tributary having critical areas A-4) Province Border	C-1) Serious pollution sources discharging the pollutants showing higher concentration than water quality standard. C-2) Pollution sources to be controlled by relevant regulations such as Decision 64.	E-1) Drinking and domestic water intake points E-2) Irrigation water intake points
Second Priority	B-1) Upstream and downstream areas at confluence point of tributary without critical areas.	D-1) Other critical areas and serious pollution sources than ones mentioned above.	F-1) Industrial water intake points

Source: JICA Study Team

Figure 3.2-1 Application of Monitoring Points in the Model Area of Cau River Basin

3.2.2 Monitoring Parameters

Considering the objectives of each monitoring point, a package of parameters to be monitored was proposed to understand the baseline and trend of water quality, to monitor the main pollution sources, and to evaluate adequately the water quality for water usage. For monitoring impacts of pollution sources, proposed parameters were selected depending on characteristics of wastewater considering the type of activities of pollution sources.

Table 3.2-1 Parameters in the Model area

Objective / Station			Baseline	Mining+Metallurgy +Food processing +Pulp and paper +Hospital +Urban run-off	Mining +Baseline	Food processing +Pulp and paper +Baseline	Mining +Pulp and paper +Baseline	Solid waste disposal site +Food processing	Mining+Metallurgy +Food processing +Pulp and paper +Hospital +Urban run-off	Food processing +Pulp and paper	Mining	Irrigation water use
No.			R1,2,3,4,5,6,11,12,13,14	R7,8	R9	R10	R15	P1	P2,3,4	P5	P6,7,8,9	U1
1	Physical -chemical parameters	Water Temperature	■	■	■	■	■		■	■	■	
3		Odor		■		■	■		■	■		
4		Suspended solid	■	■	■	■	■	■	■	■	■	
5		Conductivity	■	■	■	■	■	■	■	■	■	■
7		Dissolved solid										■
8		pH	■	■	■	■	■	■	■	■	■	■
9		DO	■	■	■	■	■					
11	Nutrients	Ammonia	■	■	■	■	■	■	■	■	■	
12		Nitrate	■	■	■	■	■	■	■	■	■	
13		Nitrite	■	■	■	■	■	■	■	■	■	
14		Total nitrogen	■	■	■	■	■	■	■	■	■	
15		Phosphate		■					■			
17		Total phosphorus	■	■	■	■	■	■	■	■	■	
18	Organic pollutants	COD	■	■	■	■	■	■	■	■	■	
19		BOD	■	■	■	■	■	■	■	■	■	
29	Inorganic substance	Iron		■	■		■	■	■		■	
30		Manganese		■	■		■	■	■		■	
32	Toxic parameters	Cyanide						■				
33		Cadmium		■	■		■	■	■		■	■
34		Lead		■	■		■	■	■		■	■
35		Chromium (VI)		■	■		■	■	■		■	■
36		Chromium (III)		■	■		■	■	■		■	■
38		Mercury		■	■		■	■	■		■	■
39		Copper		■	■		■	■	■		■	
40		Zinc		■	■		■	■	■		■	
44		Arsenic		■	■		■	■	■		■	
45	Others	Oil and Hydrocarbons		■		■		■	■	■		
46		Phenol		■		■	■	■	■	■		
50		Fecal coliform		■					■			■
51		Total Coliform		■		■		■	■	■		
	Total Number of Substances		12	28	22	16	24	24	27	15	21	9

Source: JICA Study Team

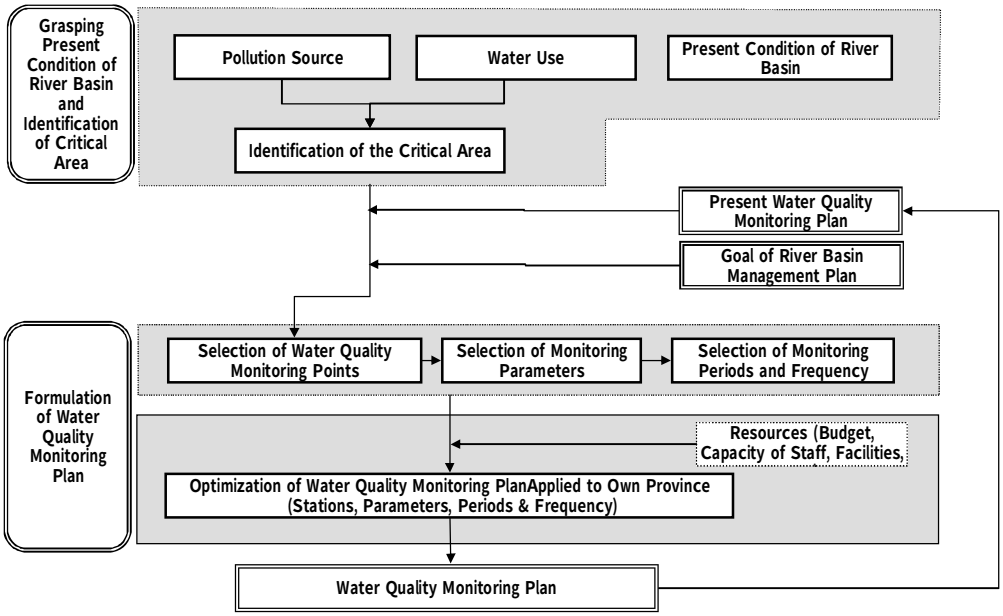
3.2.3 Monitoring Frequency

In accordance with the Cau River water quality monitoring master plan prepared in 2006, it was recommended that water sampling shall be carried out six times for CEM, Bac Kan and Thai Nguyen DONRE. Currently, CEM and Thai Nguyen DONRE already carry out sampling six times a year, while Bac Kan DONRE implements sampling twice a year. Hence, four-time sampling frequency was recommended as the initial proposal for Bac Kan DONRE tentatively.

3.3 Development of Guideline for Designing Water Quality Monitoring System at River Basin Level

3.3.1 General

The procedure for formulating the water quality monitoring plan is shown in Figure 3.2-2.



Source: JICA Study Team

Figure 3.2-2 Procedure for Preparation of Water Quality Monitoring Plan

3.3.2 Selection of Water Quality Monitoring Points

Water quality monitoring points can be classified into three categories, as follows:

(1) Reference Points to Obtain Baseline and Trend of Water Quality

A reference point should be set to obtain baseline and trend of water quality, and to estimate pollution loads. Reference points are required to measure the same parameters at fixed locations from the upper to lower reaches of the river. Therefore, the reference point is intended for grasping long-term chronic and spatial trends of water quality from the upper to lower reaches of the river basin level.

To meet these objectives, the reference points should be set at the following locations.

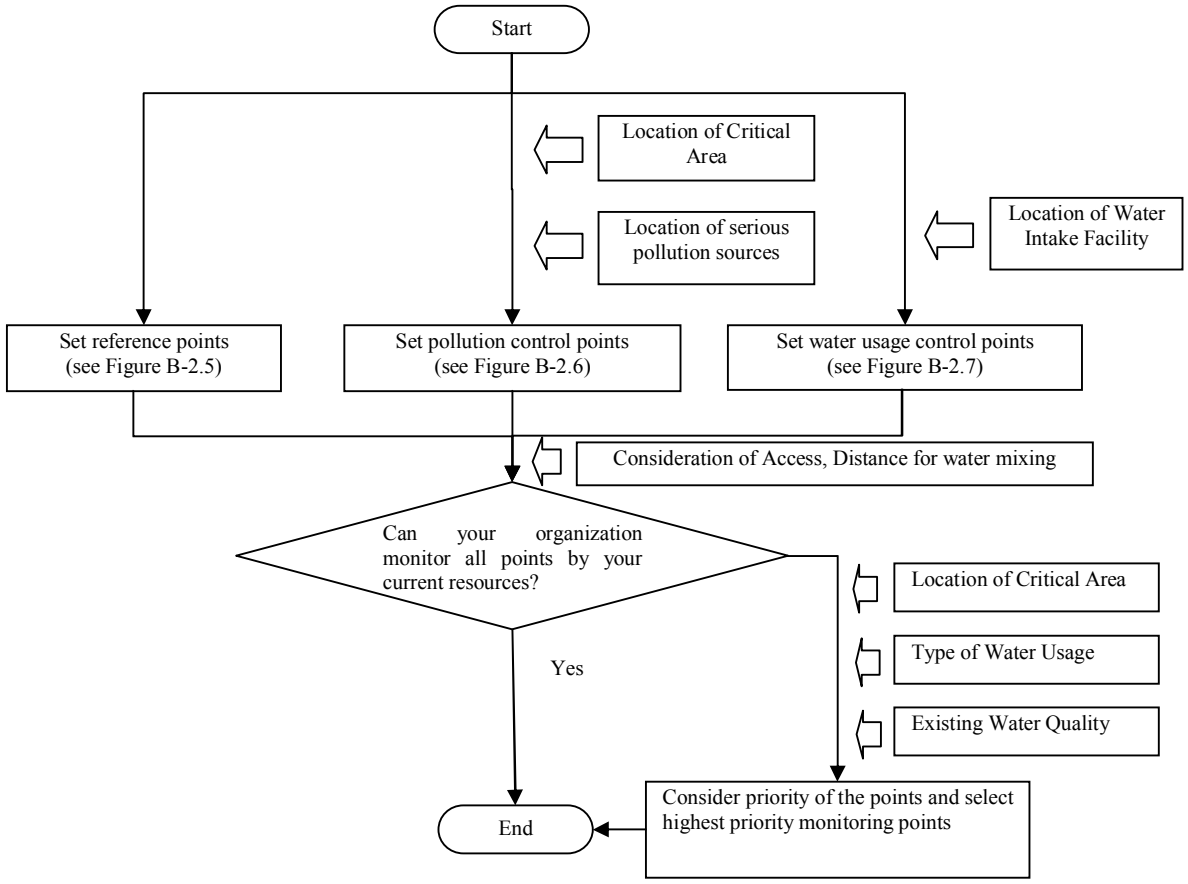
1) Upper reaches of main stream,
2) Point measuring water flow or water level,
3) Point changing water flow condition, such as upstream and downstream areas at confluence point of tributary, or inflow to, and outflow from, the closed water area,
4) Estuary or lower reaches of a river, and
5) Near provincial boundary.

(2) Pollution Control Points

Each monitoring point (three categories) has a function to identify and to yield impacts of pollution. Pollution control points should especially focus on this function. In order to identify impacts caused by pollution sources such as factories, mines, hospitals, disposal sites where their leachate contain heavy metals and other toxic materials, pollution control points are set at the downstream area of pollution sources. The parameters for each control point should be selected based on the type of pollution sources.

(3) Water Usage Control Points

In order to evaluate suitability for water use, water usage control points are set at the upstream points of water intake. The parameters should be selected among those to be used for checking of applicability of specific water use purposes. Figure 3.2-3 shows the procedure for setting monitoring points.



Source: JICA Study Team

Figure 3.2-3 Procedure to Set Monitoring Points

3.3.3 Selection of Water Quality Monitoring Parameter

Monitoring parameters are set in accordance with types of water quality monitoring points.

(1) Parameters to be Monitored at Reference Points

Parameters to be monitored at reference points are shown in Table 3.2-2. The parameters from basic physical-chemical components, nutrients related to nitrogen and phosphorous, index of organic pollutants such as BOD and COD, are listed in the said table. It consists of basic components of parameters to identify the baseline and trend of water quality in river basin level. At all reference points, water discharge measurement should be carried out once during the dry season when water flow is low and stable.

Table 3.2-2 Monitoring Parameters for Reference Points

Category	Parameters to be monitored
1. Physical-chemical parameters	(1) water temperature, (2) suspended solid, (3) conductivity, (4) pH, (5) dissolved oxygen
2. Nutrients	(6) ammonia, (7) nitrate, (8) nitrite, (9) total nitrogen, (10) total phosphorus
3. Organic pollutions	(11) BOD, (12) COD

Source: JICA Study Team

(2) Parameters to be Monitored at Pollution Control Points

To monitor the impact of wastewater from pollution sources, relevant parameters should be selected considering the activities of pollution sources.

1) Industrial Wastewater

Industries use water directly and indirectly in their manufacturing processes. Industrial wastewater contains various chemicals. A monitoring program for water bodies receiving industrial wastewater

should include parameters related to the local industrial processes, especially chemicals with potential risks to human health and environment, and affect water usage.

2) Mining Wastewater

Heavy metals should be monitored on mining wastewater. Usually, mineral mining areas do not only produce heavy metals, but also other kinds of minerals. For example, the behavior of zinc in environment is similar to that of cadmium. Hence, zinc mines could also have cadmium contents. Monitoring parameters should be selected considering this kind of characteristics. In the mining area, including pyrite (FeS_2), pyrite changes ferrous sulfate ($FeSO_4$) through the mining activity, and wastewater has low pH characteristics. Since heavy metals dissolve in water with low pH condition, its concentration could increase in the produced mining wastewater.

3) Hospital Wastewater

Hospital wastewater without disinfection treatment contains various pathogens, and has infection risks. Since such risk is difficult to be monitored, the operational condition of wastewater treatment facility of a hospital should be checked. Hospital uses various types of chemicals which could contain heavy metals, and hence should be monitored.

4) Leachate from Solid Waste Disposal Site

The leachate from solid waste disposal site has high concentration of organic matters, and could contain various pollutants, including metals, organic chemicals, and pathogens. Information on the type of waste treated in the target disposal site facilitates selection of parameters to be monitored.

5) Domestic Sewerage

Domestic sewerage without treatment contains organic matters and is contaminated by human wastes. Monitoring parameters to be selected include indexes of organic pollutants such as BOD and COD. Chloride and fecal coliform should be monitored to confirm human waste contamination.

6) Irrigation Wastewater

Irrigation wastewater contains organic matters derived from application of agrichemicals, and fertilizers such as nitrogen and phosphorous, and pesticides.

(3) Parameters to be Monitored at Water Usage Control Points

Parameters to be monitored at water usage control points are selected in accordance with the purpose of water usage.

1) Domestic Water Sources

Parameters are selected based on Vietnamese standards and WHO guidelines.

2) Irrigation

Irrigation water contaminated with pathogens and toxic compounds has potential health risks to food consumers. The presence of certain inorganic ions can also affect the soil quality and growth of crops. These parameters should therefore be monitored.

3.3.4 Setting Water Quality Monitoring Period and Frequency

The water quality monitoring periods and frequency should be planned as follows:

(1) In each water quality monitoring point, sampling should be carried out at least four times a year to monitor the yearly trend of water quality.

(2) Depending on the resources for water quality monitoring and water usage condition, the monitoring frequency should be increased to 12 times a year.

All implementing bodies of water quality monitoring are required to unify their sampling period and frequency in a basin-wide level in order to understand the baseline and trend of water quality.

3.4 Practical Training of the Guideline for Water Quality Monitoring

In the course of the Study, VST requested JST to conduct practical training on the monitoring guideline to verify applicability and to obtain lessons learned for actual introduction of the monitoring system in the river basin. Through further discussion with VST, the following practical training plan was prepared and implemented in the Study.

3.4.1 Sharing of Water Quality Monitoring Program and Preparing Recommendations on Future Water Quality Monitoring Program

(1) Objectives

Among CEM and DONREs implementing water quality monitoring in the Cau river model area, their monitoring plans have not shared. To arrange duplicate water sampling points, integrate time of sampling and monitoring parameters, sharing monitoring plans is important for efficient and accurate monitoring activities. However, as above mentioned, CEM and DONREs do not share their monitoring plan currently. This matter seems to be due to the not aware of the benefits of sharing plans and lack of experiences. Therefore, JST proposed to hold a meeting to introduce monitoring plan among three monitoring bodies as a first step.

(2) Activity

1) Assistance on Preparation of Draft Water Quality Monitoring Plan by Bac Kan DONRE

The Bac Kan DONRE prepared a draft water quality monitoring plan for upper reach of Cau river basin. The JST assisted Bac Kan DONRE to prepare draft water quality monitoring plan for Cau river basin in 2009. The first draft plan had been prepared by Bac Kan DONRE. Hereafter, JST commented the plan to reflect the concepts recommended in the Monitoring Guideline, and discussed with Bac Kan DONRE. As a result of discussion, the first draft plan was modified as follows:

a) A reference monitoring point was set at upstream area of Bac Kan town,
b) Monitoring frequency was increased, and
c) Monitoring points in and around Bac Kan town were reviewed, and re-planned considering objectives of monitoring.

2) Holding a Meeting with Concerned Stakeholders for Discussing Water Quality Monitoring M/P in Cau river basin from 2010 to 2015

A meeting was held to review the draft water quality monitoring plan to be implemented by CEM/VEA from 2010 to 2015 on 17th November, and JST assisted to hold the meeting. Eighteen (18) participants were attended the meeting from VEA, CEM, 6 concerned DONREs, and concerned research institutes. The CEM/VEA presented the draft plan, and participants discussed on the plan. Major discussion points in the meeting are as follows.

(a) There could be several overlapping monitoring points with DONREs. The CEM replied that each DONRE has different objectives on monitoring activity, so some monitoring points may be overlapped.

(b) The number of monitoring points seems too many, and it is necessary to identify priority on each proposed monitoring points. The CEM replied that it planned to cover water quality affected by possible regional development from 2010 to 2015. Consequently, the number of sub-basins and monitoring points would be large. When the plan is specified by yearly monitoring plan, these will be reviewed and selected among the proposed ones.

(c) Clarification of objectives on monitoring parameter and point are necessary. The CEM replied to add description in it.

3.4.2 Sharing Water Quality Data in the Model Area

(1) Objectives

Currently, monitoring results of DONREs are reported to CEM once a year, but there is no feedback from CEM to DONREs. For DONRE, the data of CEM monitored in their province is effective to grasp pollution condition. And the data must have a very important mean for Bac Kan DONRE who has seldom monitored their water quality. So, JST proposed mutually data sharing using the data base system that had been already developed by CEM.

(2) Activity

On 17th and 18th November 2009, the Information and Technology (IT) section of CEM conducted a technical training for introducing the system and shared the CEMs' data to Thai Nguyen DONREs. The latest system was installed in Thai Nguyen DONRE, and training of inputting data was provided to fifteen (15) officers. The same training is planned for Bac Kan DONRE in December 2009.

3.4.3 External Quality Control

(1) Objectives

The CEM and Thai Nguyen DONRE have implemented monitoring activities for a few years. Bac Kan DONRE has not implemented regular monitoring activities, but they are planning to do so from 2011 by employing a subcontractor. For the sharing of monitoring data in the future, analysis methods of each laboratory should be unified. Hence, all laboratories should obtain the same results when the same samples are analyzed.

This external quality control (QC) program is implemented to confirm the accuracy of analysis quality between concerned laboratories. This is executed by comparing analysis results after each laboratory is provided with the same samples.

(2) Activity

1) Program

The external QC program was implemented as follows.

Table 3.4-1 Preliminary Information for External Quality Control Program

<table>
<tr><td>1. Name of this test:</td><td>Sample Distribution: 13 Oct. 2009
Deadline of submitting analysis result: 27 Oct. 2009</td></tr>
<tr><td>2. Schedule:</td><td>(1) Sample No.1(River water sample), (2) Sample No.2(Standard Sample)</td></tr>
<tr><td>3. Analysis Sample</td><td>Analyzing parameters are as follows.
Sample No.1 (River water sample)
2 glass bottle (1Lx2), 1 bottle for heavy metal analysis and 1 bottle for COD analysis
<table>
<tr><td>Heavy metals:</td><td>(1) Cd , (2)Pb, (3)Zn</td><td>HNO3 is added to pH<2</td></tr>
<tr><td>Organic Matters:</td><td>(4)COD</td><td>H2SO4 is added to pH<2</td></tr>
</table>
Sample No.2 (Standard sample)
1 glass bottle (1L)
<table>
<tr><td>Heavy metals:</td><td>(1)Cd , (2)Pb, (3)Zn</td><td>HNO3 is added to pH<2</td></tr>
</table></td></tr>
<tr><td>4 Parameters:</td><td>Analysis methods are selected in the following methods. Before implementation of this program, JST teach the critical point for the following analysis to laboratory staff.
<table>
<tr><td rowspan="3">Heavy metals:</td><td>(1)Cd</td><td>TCVN6197:1996 or APHA3500-Cd</td></tr>
<tr><td>(2)Pb</td><td>TCVN6193:1996 or APHA3500-Pb</td></tr>
<tr><td>(3)Zn</td><td>TCVN6193:1996 or APHA3500-Zn</td></tr>
<tr><td>Organic Matters:</td><td>(4)COD</td><td>TCVN6491:1999 or APHA5220</td></tr>
</table></td></tr>
<tr><td>5.Analysis method:</td><td>Detection Limits are set as follows.
<table>
<tr><td rowspan="3">Heavy metals:</td><td>(1)Cd</td><td>0.003mg/L*</td></tr>
<tr><td>(2)Pb</td><td>0.01 mg/L*</td></tr>
<tr><td>(3)Zn</td><td>0.25 mg/L*</td></tr>
<tr><td>Organic Matters:</td><td>(4)COD</td><td>5mg/L *</td></tr>
</table>
*This Detection Limit is set as a half of Water quality standard of river water (A-1 level).</td></tr>
</table>

6.Detection Limit:	Range of the value of each parameter is expected to be as follows. Parameter / Expected Range of Value(mg/L) / Sample No.1 / Sample No.2 (1)Cd: n.d. – 0.02 mg/L* / 0.003 – 0.30 mg/L (2)Pb: n.d. – 0.30 mg/L* / 0.01 – 0.40 mg/L (3)Zn: n.d. – 1.0 mg/L* / 0.25 – 10.0 mg/L (4)COD: n.d. - 100 mg/L * / - *Sample No.1 is water taken from Cau River. This range of value was monitored in past surveys.
7 Range of the Value:	The following four (4) laboratories participated in the program. CEM, Thai Nguyen DONRE Laboratory, VAST/IET, Joint Stock Environmental Analysis & Technology (Sub-contractor of Bac Kan DONRE)
8. Participants	Sample Distribution: 13 Oct. 2009 Deadline of submitting analysis result: 27 Oct. 2009

Source: JICA Study Team

2) Result

Analysis results of laboratories on the external QC program are summarized in Table 3.4-2. Since the names of the four laboratories are confidential, they are listed in the table below as Laboratory A-D.

Table 3.4-2 Analysis Result of Sample No.1 (River water Sample)

	Cd(mg/L)	Pb(mg/L)	Zn(mg/L)	COD(mg/L)
Laboratory A	<0.003	<0.01	<0.025	<6
Laboratory B	<0.003	<0.01	0.030	<5
Laboratory C	<0.003	<0.01	<0.025	<5
Laboratory D	<0.003	<0.01	<0.025	5.2

Source: JICA Study Team

Analysis results of sample No.2 (standard sample) are listed in Table 3.4-3, and Z-score of the results are calculated as shown in Table 3.4-4. It revealed that QC activities of concerned laboratories are satisfactory and thus, should be maintained.

Table3.4-3 Analysis Result of Sample No.2 (Standard Sample)

	Cd(mg/L)	Pb(mg/L)	Zn(mg/L)
Laboratory A	0.024	0.065	0.44
Laboratory B	0.020	0.098	0.46
Laboratory C	0.025	0.071	0.50
Laboratory D	0.022	0.074	0.36
Reference Value	0.025	0.075	0.50
Standard Deviation	0.002	0.014	0.059

Source: JICA Study Team

Table3.4-4 Z-score of Analysis Result of Sample No.2

	Cd(mg/L)	Pb(mg/L)	Zn(mg/L)
Laboratory A	0.4	0.7	1.0
Laboratory B	**2.2**	-1.6	0.7
Laboratory C	0.0	0.3	0.0
Laboratory D	1.3	0.1	**2.4**

Source: JICA Study Team

The Z score is calculated using the following formula:

$$Z = (A - R) / SD$$

Where,

Z: Z score
A: Analysis Result
R: Reference value
SD: Standard Deviation

The results of Z score are interpreted as follows.

/Z/< 2 = Satisfactory
2</Z/<3=Questionable
/Z/> 3 = Unsatisfactory.

The Z score of Cd in Laboratory B and Zn in Laboratory D show that the analysis results are "Questionable". "Questionable" means that the data can be adopted as monitoring result but its reliability is lower than one designated as "Satisfactory". To decrease "Questionable" data, each laboratory should check the following matters. After implementation of this external quality control program, JST reported the condition to each organization.

a) Is analytical SOP observed soundly?
b) Are used reagents kept under required condition and controlled to avoid usage of expired one?
c) Are analytical equipments maintained regularly to check their condition?
d) Are there any gaps of analytical skill among laboratory staff, and is the lab provide necessary training program to the staffs?

3.5 Discussions with the Vietnamese Side related to Monitoring Guideline

3.5.1 Technical Discussions in Mini-workshops

In order to obtain comments from Vietnamese experts for the preparation of the monitoring guideline, several mini-workshops were held as shown in Table 3.5-1. Comments and recommendations obtained are shown in Table 3.5-2.

Table 3.5-1 Mini-Workshop for Output-1

No.	Date	Venue	Attendance	Organization
1	23 Sep.2008	VEPA	16	VEPA, CEMDI, VAST/IET, MOST, HMEC, Hanoi Univ., Thai Nguyen Province, VST, and JST
2	17 Oct. 2008	VEPA	18	VEPA, CEMDI, MOST, HMEC, Hanoi Univ., Thai Ngyen Province, VST, and JST

Source: JICA Study Team

Table 3.5-2 Comments and Recommendations in Mini-WS for Output-1

Mini-workshop	Comments and Recommendations	Actions taken by VST/JST
1st mini-workshop	1) A concept and objective of the draft Monitoring Guidelines were supported by the participants of the mini-workshop. To apply the proposals, the guideline should show more particular guidance on how to design the system under the concept.	1) Flowcharts showing the process for designing water quality monitoring system were added.
	2) Some proposals and other information in the draft guideline were too detailed. To design the water quality monitoring system with this guideline smoothly, description should be revised reflecting CEMDI and DONREs opinions.	2) Through consultation with CEMDI and Thai Nguyen DONRE, descriptions of the monitoring guideline were reviewed and revised.
	3) Current available resources should be evaluated and measures for capacity development should be described.	3) Required resources for proposed water quality monitoring system were clarified in the technical manual attached with the monitoring guideline.
	4) Concrete proposals were expected on a number of sampling points, number of samples to be taken and frequency of sampling.	4) Proposals on monitoring points, parameters, and frequency of sampling in the model area were described in the guideline.
	5) Japanese experiences should be applied to the guideline.	5) Japanese experiences cannot always be applied directly due to differences in background and requirements. Consequently, the experiences were applied and reviewed to determine applicability in Vietnam.
2nd mini-workshop	1) The 2nd draft monitoring guideline was significantly improved.	1) The 2nd draft was subject to finalization .
	2) Definition of key words should be clarified.	2) Footnotes were added for the key words.
	3) Existing manuals and circulars should be reconfirmed and followed, and the administrative reform of VEPA should be revised.	3) The guideline was reviewed by VEA and CEMDI.
	4) Wordings of Vietnamese version should be reviewed and revised, if necessary.	4) The guideline will be elaborated by the local experts.

Note: CEMDI is former name of CEM.
Source: JICA Study Team

3.5.2 Workshop

The following workshop was held to disseminate the draft version of the guideline.

Table 3.5-3 Workshop for the Monitoring Guideline

Date	Venue	Attendance	Organization
22 Dec. 2008	Hanoi	61	VEPA、CEMDI、MONRE、VAST、MOST、HMEC、MARD、JICA、Hanoi University, Bac Kan DONRE, Thai Nguyen DONRE, Vinh Phuc DONRE, Bac Ninh DONRE, Bac Giang DONRE, Hai Duong DONRE, NGO, local consultant, VST, JST, mass media

Source: JICA Study Team

In the workshop, contents of the monitoring guideline were presented by VST and JST. An expectation related to the official application of the guideline was presented by VEA. The main discussion points during the workshop are presented in Table 3.5-4. Details of contents were compiled in the discussion record attached at the end of this Report.

Table 3.5-4 Workshop for the Monitoring Guideline

Comments and Recommendations	Actions taken by VST/JST
(1) Wording of Vietnamese version should be improved.	(1) Vietnamese version was reviewed by JST and VST.
(2) The monitoring guideline was expected to be applied for various river conditions such as those in tidal areas.	(2) For applying the monitoring guideline to various conditions, JST expected the Vietnamese side's continuous efforts.
(3) Considering limited resources in DONRE, efficiency of outsourcing should be reviewed.	(3) JST recommended the development of DONRE capacity, considering that the principals designated by MONRE requested for the former to have their own laboratories.
(4) Monitoring system on accidental case of mining area should be considered because the model area covers many mining area.	(4) JST recommended that risk management plans of mining areas would deal for such monitoring.

Source: JICA Study Team

3.6 Capacity Development Conditions of Output-1

3.6.1 Assessment of Baseline Capacity

(1) Questionnaire Survey for Capacity Assessment

The VST and JST prepared a questionnaire for evaluating the capacities concerning Output-1. The questionnaire targeting directors and staff of three organizations (CEM, Bac Kan DONRE, and Thai Nguyen DONRE) was distributed in July 2008. It was then collected in February 2009 for checking of initial achievement of capacity development. The contents of the questionnaire are shown in Table 3.6-2 and 3.6-3. The questionnaire Form-A consists of questions to the individual capacity of each staff, while questions in Form-B are intended to the director and manager of the organizations evaluating the capacity at organizational level. The numbers of answers to the questionnaires collected are shown in Table 3.6-1.

Table 3.6-1 Number of Answers for the Questionnaire

Organization	Number of answer	
	Director/Manager	Technical Staff
CEM	1	10
Bac Kan DONRE	2	4
Thai Ngyen DONRE	1	12

Source: JICA Study Team

(2) Result of Baseline Capacity Assessment

Results of this evaluation are summarized in Table 3.6-2 and Table 3.6-3.

The following results are found based on preliminary analysis of the questionnaires.

1) The interest in the Study was very high for both the manager and the technical staff. However they cannot share much time for the Study.

2) The manager and staff of CEM are confident that they can implement the business by themselves.

3) The items where the evaluation rating is relatively low are: the ability to collect information about a source of pollution (question 1-1-5); the ability to review the water quality monitoring (question 1-1-8); the ability to lead water quality monitoring activity to DONRE staff (question 1-1-9), and the ability to teach water quality monitoring activity to new staff (question 1-1-13).

4) Based on comparison of answers among the three organizations, the rating for Bac Kan DONRE appears lower than others. It means that they are not confident with their abilities in performing water quality monitoring.

5) In question 1-2-6, the average of the answer and recovery rate is worse than the other questions. It means that DONREs are not willing to send their report to CEMDI.

6) About the questions related to laboratory matters, only the laboratory staff of Thai Nguyen replied. Most answers are over 3.0. It means that they are certain of their capacity on laboratory management, especially concerning wastewater treatment skills (question 1-3-10).

7) There are two types of comments obtained as reasons for protecting Cau River. One is that "Cau River is polluted" and the other is "Cau River should be cleaned for sustainable water resource use". Some staff in Thai Nguyen mentioned the importance of sustainable use for six provinces (question 0-14).

8) Most people believe that the highest protection level is suitable for Cau River.

Table 3.6-2 Result of Questionnaire of Output-1 (Form-A)

No	Question	CEMDI 10 persons		Thai Nguyen DONRE 12 persons		Bac Kan DONRE 4 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
0. General Items related to the Study							
0-1	Do you know the objectives and contents of the Study?	3.8	100	2.3	100	3.0	100
0-2	Is the Study useful for your daily job in general?	4.3	100	2.6	100	3.5	100
0-3	Do you have interest in the Study?	4.8	100	3.3	100	4.3	100
0-4	Do you have time for co-working with the JICA Study Team (JST)?	3.9	100	2.7	100	3.3	100
0-5	Is it necessary for you to conduct co-working with JST in the Study?	4.4	100	3.5	92	4.3	100
0-6	Do you clearly know your job mandates in the office?	4.6	90	4.6	100	5.0	100
0-7	Do you have enough communication with your directors and managers?	4.2	90	4.1	100	3.3	100
0-8	Does your office and section conduct enough job performance required by the mandate?	4.8	100	4.7	100	3.8	100
0-9	Does your office and section have enough capability (staff and equipment) required by the mandate?	4.3	90	4.0	100	3.3	100
0-10	Do you receive enough technical training and support from your directors and managers?	4.1	90	4.0	100	3.3	100
0-11	Do you receive enough financial support from your directors and managers?	3.1	90	3.8	100	2.8	100
0-12	Do you receive enough technical support from VEPA/MONRE?	3.8	90	3.0	92	3.8	100
1. Items related to the Output-1 (Water Quality Monitoring System)							
1.1 Questions for CEMDI							
1-1-1	Can you set objective of Water Quality Monitoring (WQM) plan?	4.1	100	-	-	-	-
1-1-2	Can you select WQM stations?	4.2	100	-	-	-	-
1-1-3	Can you set frequency of WQM activities?	4.2	90	-	-	-	-
1-1-4	Can you select analyzed parameters depending on the type of samples?	4.3	80	-	-	-	-
1-1-5	Can you collect data and information related to target pollution sources of WQM?	3.7	90	-	-	-	-
1-1-6	Do you receive WQM results from DONRE every year?	3.4	100	-	-	-	-
1-1-7	Can you prepare WQM plan?	4.1	90	-	-	-	-
1-1-8	Can you review and revise WQM plan?	3.8	90	-	-	-	-
1-1-9	Can you instruct for improvement of WQM activity to DONRE staff?	3.7	90	-	-	-	-
1-1-10	Can you conduct data management using computer?	4.0	100	-	-	-	-
1-1-11	Can you prepare a report and data book using WQM records?	4.1	80	-	-	-	-
1-1-12	Can you prepare the annual report for WQM activity?	4.2	90	-	-	-	-
1-1-13	Can you train of WQM activity to new staff?	3.8	90	-	-	-	-
1.2 Questions for Monitoring Section of DONRE							
1-2-1	Can you set objective of Water Quality Monitoring (WQM) plan?	-	-	4.0	75	5.0	25
1-2-2	Can you select WQM stations?	-	-	4.1	75	3.0	25
1-2-3	Can you set frequency of WQM activities?	-	-	4.2	75	3.0	25
1-2-4	Can you select analyzed parameters depending on	-	-	4.3	75	1.0	25

No	Question	CEMDI 10 persons		Thai Nguyen DONRE 12 persons		Bac Kan DONRE 4 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
	the type of samples?						
1-2-5	Can you collect data and information related to target pollution sources of WQM?	-	-	4.2	75	3.0	25
1-2-6	Do you send WQM results to VEPA every year?	-	-	2.3	58	3.0	25
1-2-7	Can you prepare WQM plan?	-	-	4.1	75	3.0	25
1-2-8	Can you review and revise WQM plan?	-	-	3.4	75	1.0	25
1-2-9	Can you conduct data management using computer?	-	-	4.0	75	1.0	25
1-2-10	Can you prepare a report and data book using WQM records?	-	-	4.0	75	3.0	25
1-2-11	Can you prepare the annual report for WQM activity?	-	-	4.1	75	5.0	25
1-2-12	Can you train of WQM activity to new staff?	-	-	4.2	75	5.0	25
1.3 Questions for Analysis Section of DONRE							
1-3-2	Can you carry out calibration and O/M of equipment for field measurement?	-	-	3.8	33	-	-
1-3-3	Can you conduct a field sampling appropriately by yourself, especially for industrial wastewater sampling?	-	-	4.3	33	-	-
1-3-4	Can you do field measurement and recording of sampling?	-	-	4.5	33	-	-
1-3-5	Do you revise the sampling manual based on your experiences?	-	-	3.8	33	-	-
1-3-6	Can you conduct QC practices in sampling?	-	-	4.3	33	-	-
1-3-7	Can you review and revise SOPs for sampling?	-	-	3.8	33	-	-
1-3-8	Do you have enough practical skill in analysis of each parameter?	-	-	4.5	33	-	-
1-3-9	Do you have enough knowledge of treatment to avoid interferences?	-	-	4.3	33	-	-
1-3-10	Do you handle and treat laboratory wastewater after analysis?	-	-	2.5	33	-	-
1-3-11	Do you clean up and keep tidying of laboratory?	-	-	4.0	33	-	-
1-3-12	Can you conduct QA/QC practices in analysis?	-	-	4.3	33	-	-
1-3-13	Can you review and revise SOPs for analysis?	-	-	3.5	33	-	-
1-3-14	Do you revise the analytical guideline based on your experiences?	-	-	3.5	33	-	-

N/A= No Answer

0-13	Why do you need to protect Cau River?
	CEM: - To protect environment - Because it affects the environment and daily life - Some areas in Cau river basin are polluted Thai Nguyen DONRE: - Cau river has the role of irrigation, water equalization and flood drainage, so it needs protection - Cau river is seriously polluted - Cau river is necessary water source for residents - Cau river flows through 6 Northern provinces and supplies domestic and production water for residents - Cau river is the big river which provides water for agriculture, forestry and industry and harmonizes climate in the two riversides - Cau river provides water for domestic and production activities in many provinces - Environment is polluted so much - To ensure a healthy environment for future generations - As it is the water supply source Bac Kan DONRE: - We protect the river so that the river can serve the demand of human and creatures - To ensure the sustainable development - Because of managing environment and enjoying the benefits from Cau river - Because of managing environmental protection field and enjoying the benefits from Cau river
0-14	What protection level is suitable for Cau River?
	CEM: - Very necessary - Conduct frequent monitoring to supervise water quality, control discharge sources - It's the best that Cau River meets standard for domestic water - It's necessary to develop an automatic supervising system Thai Nguyen DONRE: - At the best level - At the highest level (2persons reply same comment) - At necessary level - At the highest level to ensure that the water is not polluted - Very necessary - As best as we can - At 4th level (if there are 5 level) - Necessary Bac Kan DONRE: - To the maximum level - At highest level - Depend on the management authority, protect from upstream to downstream - Depend on specific area with specific level

Source: JICA Study Team

Table 3.6-3 Result of Questionnaire of Output-1 (Form-B)

No	Question	CEMDI 2 persons		Thai Nguyen DONRE 1 person		Bac Kan DONRE 2 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
0. General Items related to the Study							
0-1	Do you know the objectives and contents of the Study?	5.0	100	5.0	100	2.0	100
0-2	Is the Study useful for your daily job in general?	5.0	100	4.0	100	3.0	100
0-3	Do you have interest in the Study?	5.0	100	4.0	100	4.5	100
0-4	Does your staff have time for co-working with the JICA Study Team (JST)?	4.5	100	3.0	100	4.5	100
0-5	Is it necessary for your staff to conduct co-working with JST in the Study?	5.0	100	4.0	100	4.5	100
0-6	Does your staff clearly know his/her job mandates in the office?	4.5	100	4.0	100	4.5	100
0-7	Do you have enough communication with your staff?	5.0	100	4.0	100	4.5	100
0-8	Does your office and section conduct enough job performance required by the mandate?	5.0	100	5.0	100	4.5	100
0-9	Does your department have enough capability (staff and equipment) required by the mandate?	4.5	100	4.0	100	4.0	100
0-10	Do you receive enough technical training and support from PPC?	N/A	0	3.0	100	3.0	100
0-11	Do you receive enough financial support from PPC?	N/A	0	3.0	100	3.0	100
0-12	Do you receive enough technical support from VEPA/MONRE?	4.5	100	4.0	100	2.5	100
1. Items related to the Output-1 (Water Quality Monitoring System)							
1.1 Questions for CEMDI							
1-1-1	Does your office establish water quality monitoring system?	5.0	100	-	-	-	-
1-1-6	Does your office prepare annual monitoring plan?	5.0	100	-	-	-	-
1-1-7	Does your office properly select monitoring parameters?	4.5	100	-	-	-	-
1-1-8	Can your office manage monitoring data?	5.0	100	-	-	-	-
1-1-9	Can your office prepare monitoring report?	5.0	100	-	-	-	-
1-1-10	Does your office coordinate with other lab and institute related to monitoring works?	5.0	100	-	-	-	-
1-1-11	Does your office receive enough support from IET/VAST?	2.0	50	-	-	-	-
1-1-12	Does your office have enough capability to train other staff in DONRE related to monitoring works?	5.0	100	-	-	-	-
1.2 Questions for DONRE							
1-2-1	Does your office establish water quality monitoring system?	-	-	4.0	100	N/A	0
1-2-5	Does your office prepare annual monitoring plan?	-	-	4.0	100	N/A	0
1-2-6	Does your office properly select monitoring parameters?	-	-	4.0	100	N/A	0
1-2-7	Can your office manage monitoring data?	-	-	3.0	100	N/A	0
1-2-8	Can your office prepare monitoring report?	-	-	3.0	100	N/A	0
1-2-9	Does your office coordinate with other lab and institute related to monitoring works?	-	-	3.0	100	N/A	0
1-2-10	Does your office receive enough support from IET/VAST?	-	-	3.0	100	N/A	0
1-2-11	Does your office have enough capability to train other staff in DONRE related to monitoring works?	-	-	3.0	100	N/A	0
1-2-12	Can your office conduct water quality analysis in the lab?	-	-	5.0	100	N/A	0
1-2-13	Does your office have lab O/M manual?	-	-	5.0	100	N/A	0
1-2-14	Does your office manage lab in accordance with the lab O/M manual?	-	-	4.0	100	N/A	0
1-2-15	Does your office have SOP in the lab?	-	-	N/A	0	N/A	0
1-2-16	Does your office receive enough budgets for monitoring?	-	-	3.0	100	N/A	0
1-2-17	Does your office conduct QA/QC activities?	-	-	4.0	100	N/A	0

N/A= No Answer

0-13	Why do you need to protect Cau River?
	CEM: - To protect environment and natural resources Thai Nguyen DONRE: - Cau river affects lives and social economic development of Thai Nguyen Bac Kan DONRE: - Work in the environmental state-management field (2persons reply same comment)
0-14	What protection level is suitable for Cau River?
	Thai Nguyen DONRE: - At high level

Source: JICA Study Team

3.6.2 Achievement in this Study

The JST considered that the following capacity development activities have been adopted through the Study.

1) Officers of CEM/VEA co-worked with JST in finalizing the Guideline for Designing Water Quality Monitoring System at River Basin Level, and presented the its concept in a workshop. The officers improved their comprehension on designing water quality monitoring system.
2) The CEM/VEA planned to hold a meeting with concerned DONREs, VEA and local experts, to discuss the water quality master plan for 2010 to 2015. CEM/VEA experienced discussing the planned water quality monitoring system with concerned stakeholders, for sharing and coordinating an ideal water quality monitoring system.
3) The Bac Kan DONRE prepared a draft water quality monitoring plan in 2009, reflecting the concepts of the monitoring guideline on planned monitoring points and frequencies. The officers concerned on water quality monitoring in Bac Kan DONRE improved their comprehension in designing the water quality monitoring system.

Table 3.6-4 shows the comparison results of capacity assessment between the initial and final phases of Output-1, based on the questionnaire surveys to CEM/VEA, Bac Kan DONRE, and Thai Nguyen DONRE. As a result of the survey, the following trends are realized.

1) Officers of Bac Kan and Thai Nguyen DONREs considered that their capacity for preparing and reviewing water quality plans has been improved.
2) On the other hand, officers of Bac Kan and Thai Nguyen DONREs considered that their capacity for training new staff has not been improved.
3) Based on the questionnaire survey, it was observed that improvement of capacities of CEM/VEA officers was not significant.

Table 3.6-4 Comparison of Self-Capacity Assessment Results

No	Question	CEM/VEA				Thai Ngyen DONRE				Bac Kan DONRE			
		Intial Phase 10 persons		Final Phase 9 persons		Initial Phase 12 persons		Final Phase 5 persons		Initial Phase 4 persons		Final Phase 4 persons	
		Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
1.1 Questions for CEMDI													
1-1-7	Can you prepare WQM plan?	4.1	90.0	3.6	100.0	-	-	-	-	-	-	-	-
1-1-8	Can you review and revise WQM plan?	3.8	90.0	3.3	90.0	-	-	-	-	-	-	-	-
1-1-9	Can you instruct for improvement of WQM activity to DONRE staff?	3.7	90.0	3.4	90.0	-	-	-	-	-	-	-	-
1-1-13	Can you train of WQM activity to new staff?	3.8	90.0	3.5	90.0	-	-	-	-	-	-	-	-
1.2 Questions for Monitoring Section of DONRE													
1-2-7	Can you prepare WQM plan?	-	-	-	-	4.1	75.0	4.6	100.0	3.0	25	4.5	25
1-2-8	Can you review and revise WQM plan?	-	-	-	-	3.4	75.0	4.6	100.0	1.0	25	4.5	25
1-2-12	Can you train of WQM activity to new staff?	-	-	-	-	4.2	75.0	3.4	100.0	5.0	25	3.5	25

Source: JICA Study Team

3.6.3 Further Challenge

After the Study, it is recommended to address the following challenges:

1) Continue the trial activity to determine the effect of the monitoring guideline in designing water quality monitoring system, and initiate revisions as necessary, and
2) Implement trainers training program to improve the capacity to train new officers.

4. Development of Pollution Source Inventory (PSI) Guideline (Output-2)

The following activities were implemented under Output 2.

a) Development of provisional inventory form and verification of its practicality,
b) Implementation of PSI survey as sub-contract work under the supervision of VST and JST,
c) Setting of pollution load analysis methods,
d) Expanding a GIS Database (GIS-DB) for the Cau River model area and preparation of experimental pollution load map, and
e) Preparation of PSI Guideline.

4.1 Development of Provisional Inventory Forms

(1) Listing target facilities for the PSI survey

A long list of target facilities which are potential water pollution sources was prepared based on information provided by Bac Kan and Thai Nguyen DONRE. The target facilities were divided into six categories considering the characteristics of industrial sub-sectors, namely, factory, mining area, craft village, livestock facility, hospital, and solid waste dumping.

(2) Preparation of provisional PSI survey form

For the implementation of the preliminary PSI survey, a provisional survey form was prepared by the industrial sub-sectors. The form was revised, incorporating the survey results.

(3) Selection of facilities for the preliminary survey

For the target facilities to be subject to preliminary survey, 12 facilities were selected and are located in Bac Kan and Thai Nguyen Provinces. The table below shows the facilities selected for the preliminary survey.

Table 4.1-1 List of Target Facilities for Preliminary PSI Survey

Province	Category	Name of the target facility after meeting
Bac Kan	1. Factory	1. De paper manufacture – Bac Kan Forestry Processing Company (Bac Kan Town) (listed in Decision 64) 2. Cam Giang Iron factory (Cam Giang commune) 3- De paper manufacture – Công ty cổ phần B&H Joint Stock Company (Nong Ha commune, Cho Moi District) (xã Nông Hạ, huyện Chợ Mới)
	2. Mining Area	1. Sy Binh iron mining (new company, changing ownership)
	3. Hospital	1. General Hospital of Bac Kan - Nguyễn Thị Minh Khai precinct - Bắc Kạn Town (listed in Decision 64)
	4. Solid Waste Disposal Site	1. Khuoi Mat solid waste dumping site, Huyen Tung commune, Bac Kan Town
	Sub-Total	***6 Facilities***
Thai Nguyen	1. Factory	1. Thai Nguyen Export Paper Mill 2. Coke Coal Factory in Thai Nguyen Iron industrial zone - (listed in Decision 64)
	2. Mining Area	1. Trai Cau Iron Mining
	3. Craft village	
	4. Livestock Facility	1. Farm of Mrs. Mai at Soi Vang hamlet
	5. Hospital	1. Central General hospital Thái Nguyên – Thai Nguyen City (listed in Decision 64)
	6. Solid Waste Disposal Site	1. Da Mai Solid Waste Disposal - Thái Nguyên City
	Sub-Total	***6 Facilities***
	Total	**12 Facilities**

Source: JICA Study Team

(4) Holding of Explanatory Meeting in Bac Kan and Thai Nguyen DONRE

Prior to the implementation of the PSI survey, explanatory meetings were held for rehearsal and demonstration of the survey in Bac Kan and Thai Nguyen DONRE on 25-26 September, 2008. The objectives of the meetings were:

1) To explain the PSI survey,
2) To conduct discussions through source survey and form of provisional survey form, and
3) To prepare preliminary source survey.

(5) Implementation of the preliminary PSI survey

The preliminary PSI survey was carried out to the selected facilities above mentioned using the provisional survey form, and was completed in the middle of October 2008.

(6) Revision and Modification of the PSI form

Effectiveness of the provisional form prepared prior to the commencement of the preliminary survey was verified through the process of the preliminary survey. The inventory forms were revised and improved for use in the detailed survey.

(7) Preparation of Cover Letter

Together with revision and modification of the PSI format, a letter was prepared to request better cooperation activities from the selected pollution source facilities during the PSI survey. The cover letter is the key for conducting the PSI survey because it introduces its purpose as per the initial contact. Without such letter, the attached questionnaire might be discarded or neglected by the target facilities. Moreover, this letter could be a means of re-contacting the target facilities by DONRE staff. To ensure high response rate to the questionnaire, the letter was issued under VEA, and includes the following descriptions:

1) Applicable regulations to respond,
2) Confidentiality provisions,
3) Purpose of questionnaire,
4) Respectful request for cooperation in filling out the questionnaire,
5) Due date for the return of completed questionnaires,
6) Name of contact agency, staff in charge, and telephone number,
7) Rationale for asking for what may appear to the source to be redundant information, and
8) Finalization of the PSI Survey Form.

The PSI survey form, i.e. questionnaires for the source survey, was finalized based on the progress of the regular PSI survey. The form for the six types of pollution sources was finalized. Types of pollution source form are given below. The finalized survey forms are attached in the Annex-2, "Guideline on Pollution Source Inventory Development for Water Environment Management at River Basin Level".

1) Factory,	2) Mining area,	3) Craft village,
4) Livestock,	5) Hospital, and	6) Solid waste dumping site

4.2 Implementation of PSI Survey

In order to collect data and information from point pollution facilities, the PSI survey was conducted experimentally under the Study.

4.2.1 Objectives and Survey Area

The objectives of the PSI survey are:

1) To collect data and information on pollution sources for the planning and implementation of a water environment management plan at the river basin level, and

2) To obtain lessons learned during the PSI survey.

The PSI survey area covers the upstream basin of Cau River (upstream area from the Cong River confluence point) covering Bac Kan and Thai Nguyen Provinces.

4.2.2 Survey Procedure

(1) Selecting Target Facility List

The target facilities surveyed in the detailed PSI survey were classified into three categories according to the importance and/or the influence to water environment, namely, highest priority category, higher category, and others. The selection and classification of the facilities criteria is shown in Table 4.2-1.

Table 4.2-1 Criteria for Categorizing Target Facilities

Category	A. Highest Priority	B. Higher Priority	C. Others
1. Factory	- Factories targeted by Decision No. 64 - Factories along Cau River - Large scale factories (Bac Kan: VND 1 billion/yr ≤ turnover; Thai Nguyen: VND 10 billion/yr ≤ turnover) belonging to the following sectors • Basic metal manufacturer • Fabricated metal manufacturer • Machinery and equipment manufacturer • Food products and beverage manufacturer • Paper manufacturer • Textile manufacturer • Tanning enterprise	- Medium scale factories (Bac Kan: VND 0.5 billion/y ≤ turnover < VND 1 billion/yr; Thai Nguyen: VND 1 billion/yr ≤ turnover < VND 10 billion/yr) belonging to the sectors shown left - Large factories (Bac Kan: VND 1 billion/yr ≤ turnover; Thai Nguyen: VND 10 billion/yr ≤ turnover) belonging to other sectors than those shown left	Other factories (Bac Kan: turnover < VND 0.5 billion/yr; Thai Nguyen: turnover < VND 1 billion/yr)
2. Mining area	Mining areas along Cau River	Mining areas along tributary of Cau River	Other mining areas
3. Craft village	Craft villages along Cau River.	Craft villages along tributary of Cau River	Other craft villages
4. Livestock facility	Facilities targeted by Decision No. 64	Stockbreeding facilities along Cau River	-
5. Hospital	Facilities targeted by Decision No. 64.	Community hospitals along Cau River	-
6. Solid waste disposal Site	Facilities targeted by Decision No. 64	Solid waste disposal site along Cau River	-

Source: JICA Study Team

As a result of the finalization of the list, a total of 208 facilities in the Cau River model area were selected. The number of target facilities is shown below.

Table 4.2-2 Number of Target Facilities by Category and by Province

Category	Province	Priority			Total
		Highest	Higher	Others	
Factory	Thai Nguyen	24	22	64	110
	Bac Kan	10	3	6	19
	Sub-Total	**34**	**25**	**70**	**129**
Mining area	Thai Nguyen	23	2	0	25
	Bac Kan	2	3	8	13
	Sub-Total	**25**	**5**	**8**	**38**
Craft village	Thai Nguyen	1	10	13	24
	Bac Kan	0	0	0	0
	Sub-Total	**1**	**10**	**13**	**24**
Livestock facility	Thai Nguyen	0	1	0	1
	Bac Kan	0	1	0	1
	Sub-Total	**0**	**2**	**0**	**2**
Hospital	Thai Nguyen	4	6	0	10
	Bac Kan	1	0	0	1
	Sub-Total	**5**	**6**	**0**	**11**
SW dumping site	Thai Nguyen	1	1	0	2
	Bac Kan	1	1	0	2
	Sub-Total	**2**	**2**	**0**	**4**
Total	Thai Nguyen total	53	42	77	172
	Bac Kan Total	14	8	14	36
	Thai Nguyen, Bac Kan total	**67**	**50**	**91**	**208**

Source: JICA Study Team

(2) Implementation of Direct PSI Survey

The PSI survey was implemented through direct interview surveys on pollution sources. Different measures were adopted in accordance with the level of priority of pollution sources as shown in Figure 4.2-1.

1) Survey on Highest Priority Targets

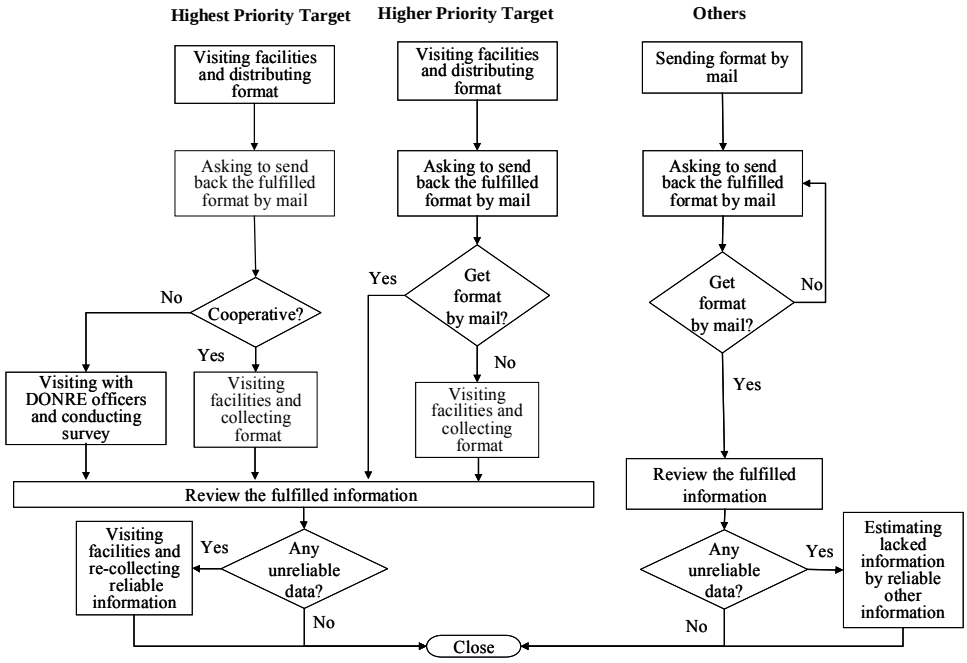
The PSI survey forms were directly distributed to and collected from the highest priority target pollution sources. In case a target facility was not cooperative, the surveyors obtained assistance from Bac Kan and Thai Nguyen DONRE in order to proceed with the survey.

2) Survey on Higher Priority Targets

The PSI survey forms were directly distributed to higher priority target pollution sources. In case the target facility cannot fill up the form within the same day, they were requested to send the filled up form later by mail. For the target facilities that did not send the filled up form, the surveyors returned to the facilities, and directly collected the forms.

3) Survey on Other Targets

The inventory survey forms were distributed by mail. The target facilities were asked to fill the form by telephone. They were then requested to send back the filled-up form by mail.



Source: JICA Study Team

Figure 4.2-1 General Procedure of PSI Survey

4.2.3 Lessons Obtained through Survey

The following lessons were obtained through the conduct of the PSI survey:

(1) Non-cooperative targets were found. To implement the survey smoothly, a legal base requirement should be clarified with target facilities.

(2) Most target facilities did not provide wastewater quality monitoring data. Additionally, the craft villages did not have information on the amount of water use. To collect required information, both direct and indirect measures should be adopted at the same time, such as usage of existing reports, and indirect information collecting measures introduced in page 13 of the guideline.

(3) The officially issued list of factories and other pollution sources did not exactly provide the latest information consisting of name and contact address of the target facilities. To prepare a long list of the target facilities, it was necessary to interview DONRE.

(4) Low awareness of interviewees on pollution control hindered to collect reliable information. An awareness-raising campaign on pollution sources for environmental managers should be carried out.

(5) Based on the experiences of the survey, some information such as amount of wastewater fee can not be collected by direct survey due to lack of information management system in the target

facilities. Such information could be obtained by the indirect survey. Direct survey and indirect survey have advantages and disadvantages, so both surveys should be carried out together to collect required information. The direct data collection should be applied in priority, and secondary data should be use (i) for supplementary data to direct (primary data) collection method; (ii) for reference; and (iii) for cross-check of reliability of direct data collected. Table 4.2-3 shows examples of the data/information that can be collected by secondary survey.

Table 4.2-3 Examples of Data/Information Collected by Secondary Survey

Source	Data/Information
Report of EIA/EPC/EPP	• Pollutant/Speciation data/information • General facility data/information • Facility activity data/information: Facility activity data is the data and information that presents conditions and/or status of operations of concerned facility, such as kind and amount of products, water consumption, quantity and quality of wastewater, etc. • Pollution load data/Pollution load unit
Published literatures	• General wastewater data/information • General facility data/information • Other related information
Census and statistics	• General wastewater data/information • General facility data/information • Other related information: total products, socio-economic status, and material consumption
Extrapolation	• Pollution load data/Pollution load unit • Pollutant/Speciation data/information

4.3 Setting of Pollution Load Analysis Methods

Through the collection of information and consideration of pollution load analysis methods applied in Vietnam, VST and JST decided that the pollution load unit system on point source developed by the Center for Consultancy and Technology Transfer on Safe Water and Environment (CTC) is suitable to be applied to the Cau River model area. Details of the system are described hereunder.

4.3.1 Pollution Load Unit System of CTC on Point Sources

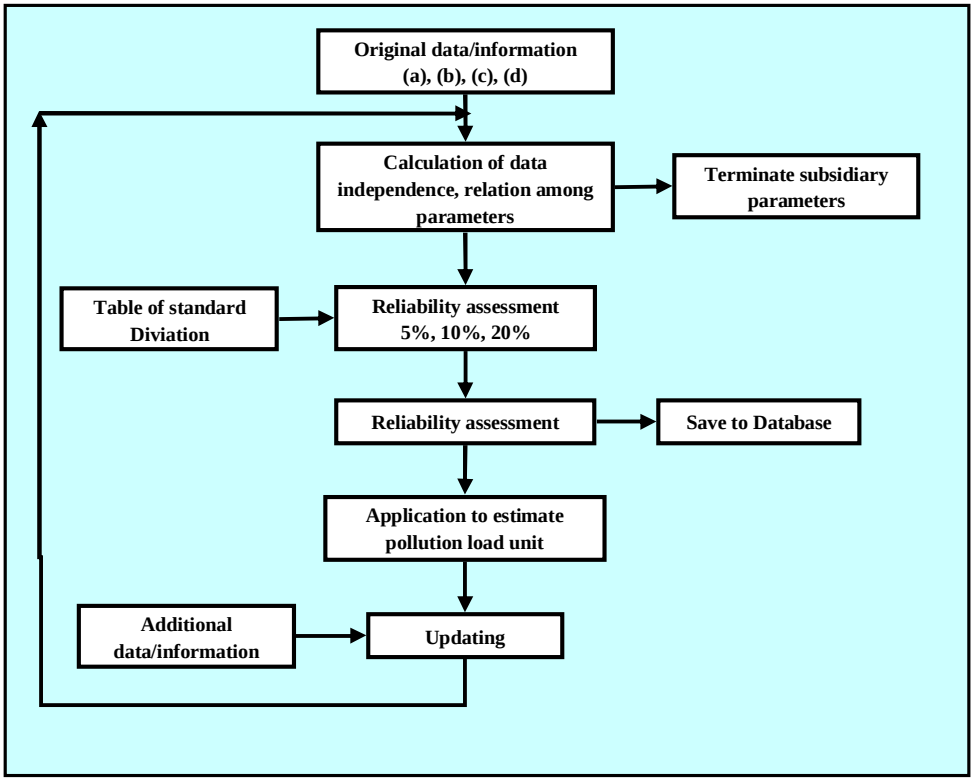
(1) General

This system is originally established by CTC to develop the coefficient of wastewater fee collection norm for the implementation of Decree No. 04 (superseded by Decree No. 67). Results of the calculation and estimate were accepted by the Scientific Committee of MONRE in 2007. The system consists of methodologies for calculating and estimating volume of wastewaters and pollutant discharge loads. Pollution parameters or pollutants dealt with in this system are chemical oxygen demand (COD), biochemical oxygen demand (BOD), suspended solids (SS), total nitrogen (T-N), total phosphorous (T-P) and ammonia (NH4). The origin and source of data and information of the system are:

1) Foreign materials/documents on industrial discharge,
2) Vietnamese documents on industrial discharge,
3) EIA reports of factories, and
4) Standard data

(2) Processing of data and information

Data and information used in the system are processed statistically to verify reliabilities. The diagram below shows the statistical treatment process of the data and information.



Source: CTC report, Dec., 2008

Figure 4.3-1 Statistical Treatment Process of Data/Information

(3) Pollution source category

Normally, pollution sources can be divided into two categories, namely point source and non-point source. As a point source, CTC takes up industrial sectors, and classifies them into ten groups. Table 4.3-1 shows the industrial sectors which CTC adopted.

Table 4.3-1 Classification of Pollution Load Units of CTC

Category	Group (SP)	Group No. (SP No.)	Sector
Point Source	1	1 - 130	Dye and Textile Industry
	2	131 - 224	Paper and pulp
	3	225 – 269	Tanning
	4	270 – 439	Chemical, wash - cleaning , fertilizer, insecticide, rubber, plastic
	5	440 – 550	Mechanics, mechanical manufacture, Metallurgy
	6	551 – 583	Mine ores, building materials, sift, coal, Thermo-electricity
	7	584 – 640	Fruit and vegetable, cooking oil
	8	641 – 696	Animal husbandry, meat processing, sea food
	9	697 – 813	Food product, alcohol, beer, soft drink, milk, sugar
	10	814 - 868	Grain processing, starch, cultivation
Non-Point Source			Non-point Objects (Agriculture, Industrial Zone, Urban Area)

Source: CTC report, Dec., 2008

(4) Pollution load unit adopted

Pollution load units are ratios that relate discharges of pollutant to an activity level of pollution source such as amount of product produced, or amount of wastewater discharged. Pollution load units are usually expressed as the weight of pollutant divided by a unit weight, volume, number, or duration of the activity discharging the pollutant. Considering the contents of pollution source activities in the area, CTC adopted various types of units to denote pollution load unit. Table 4.3-2 summarizes the types of pollution load units and their codes adopted in CTC's pollution load unit system.

Table 4.3-2 Unit of Pollution Load of adopted by CTC (Point Source)

Code	Unit of Activity	Pollution Load Unit	Classification No.
M^3NT	Amount of wastewater [m^3]	[Kg /M^3NT]	8
CN/CA	Worker shift	[Kg /CN.CA]	2
T.SP	Products [ton]	[Kg/T.SP]	1
T.NL	Raw material [ton]	[Kg/T.NL]	3
CN/NGAY	Worker Day	[Kg/CN.NGAY]	7
HADAT	Production area [ha]	[Kg/HADAT]	5
VNUOI	Number of animal	[Kg/VNUOI]	4
10^3CH	Number of bottles [1,000 bottles]	[Kg/10^3CH]	6

Source: CTC report, Dec., 2008

4.3.2 Pollution Load Units on Other Sources

(1) Domestic Wastewater

A pollution load unit on domestic wastewater designated by TCVN is applied as shown in Table 4.3-3

Table 4.3-3 Unit of Pollution Load of Domestic Wastewater

Unit: g/parson*day

Parameter	Unit of Pollution Load	(Reference) Unit of Pollution Load Designated by the Japanese Guideline for Development of River Basin Level Sewage System (1999)
BOD	65	58
SS	60-65	17

Source: TCVN 51-2008, Drainage system and Works – Design Standard, Ministry of Construction, 2008

(2) Non-point Sources

There is no pollution load unit for non-point sources in Vietnam. Hence, the corresponding unit adopted in Japan or in other developed countries will be used in the Study.

4.3.3 Calculation of Pollution Load

The calculation of the released pollution loads from a certain source is based on the use of appropriate pollution load units, which reflect the existing relevant experiences from the measured performance of similar sources. Each pollution load unit is defined as the normalized released pollutant load expressed in kilogram per unit of activity of the particular source under consideration.

It should be noted that pollution load units are generally developed assuming that no control device or no wastewater treatment facility is in place. These are referred to as “uncontrolled pollution load units”. However, pollution load units are sometimes derived from data obtained from facilities with control device or wastewater treatment facility in place. Where controls or treatment facilities are used, their efficiencies should be taken into account. In addition to the performance of the control device or wastewater treatment facility at a pollution source, the regulatory agencies, such as MONRE or DONRE, normally conduct discharge control programs such as wastewater discharge fee. Therefore, in order to estimate or calculate pollution loads to the environment, two concepts should be introduced. One is the efficiency of the control device or wastewater treatment facility, and the other is the effectiveness of discharge control programs, called “rule effectiveness”. This is a generic term for identifying and estimating the uncertainty in discharge estimates caused by familiar and uncertainties in discharge control programs. It is a measure of the extent to which a rule actually achieves its designed discharge reduction.

Taking into account the definition or meaning of the pollution load unit as well as the efficiency of the controls or treatment facilities and the rule effectiveness, pollution discharges can be calculated by multiplying the pollution load unit with the corresponding pollution source activity level as shown below.

The basic pollution load discharge estimation equation

$$D = A \times PLU \times (1 - R \times RE)$$

where:

D = **pollution load** discharge estimate for the process
A = activity level of pollution source
PLU = pollution load unit assuming no control
R = Removal efficiency of control device
RE = rule effectiveness

As shown above, to calculate discharges using pollution load units, four basic inputs of estimation algorithms (A, PLU, R, and RE) are required to compute pollution load. These are defined as follows:

- A: Activity information for the process as specified by the relevant pollution load unit;

- PLU: Pollution load unit assuming no control device or no wastewater treatment facility is in place (uncontrolled pollution load unit);

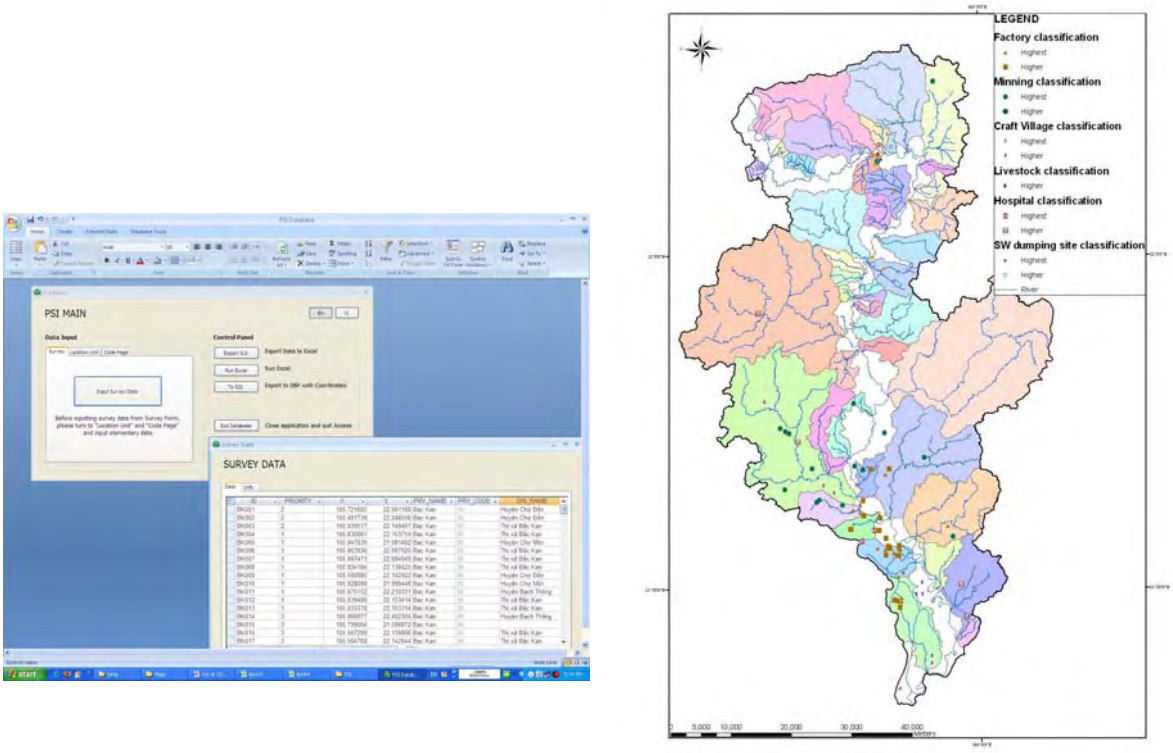
- R: Removal efficiency of control device (expressed in percent); R equals zero if no control device is in place;

- RE: Rule effectiveness, an adjustment to R to account for failures and uncertainties that affect the actual performance of control.

4.4 Expanding a GIS Database (GIS-DB) for the Cau River Model Area and Preparation of Experimental Pollution Load Map

(1) Database

Although the existing GIS database operated by VEA is to be revised in the Ic/R, the GIS database on pollution sources in the Cau River basin was not found. Thus, the preliminary database of pollution sources confirmed by the PSI survey was prepared. For the preparation of the database, facilities of Microsoft Access were used. The input data on the database can be exported to Microsoft Excel, and utilized by the GIS application software, ArcGIS.



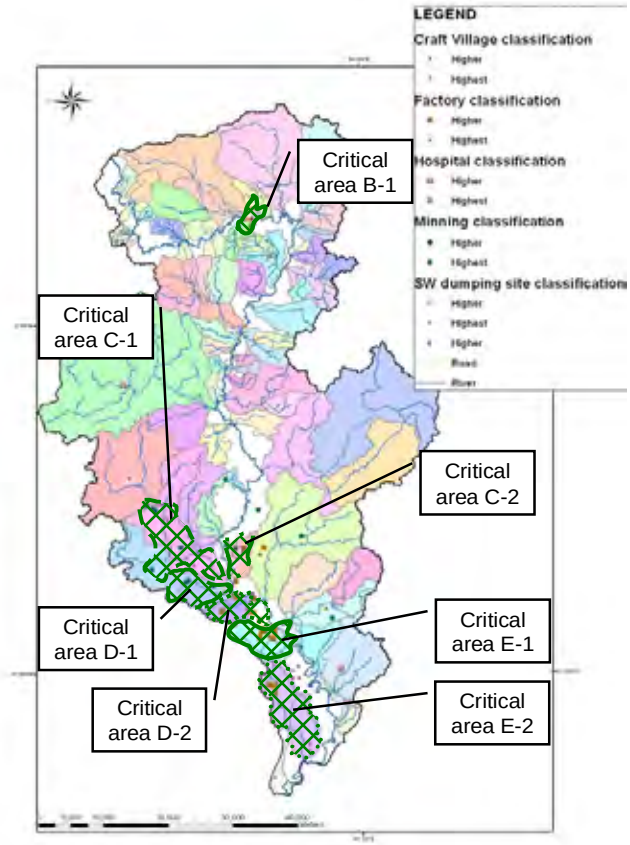
Source: JICA Study Team

Figure 4.4-1 Example of GIS Map using Prepared GIS Database

(2) Experimental Pollution Load Map

Based on the PSI survey results stored in the database, an experimental pollution load map was prepared. The map has the following information:

1) Location of water pollution sources designated as highest priority in the PSI survey,
2) Location of provisional critical areas identified by the location of pollution sources, and
3) Area with risks on water utilization considering river water flow condition.



Critical Area	Explanation	Major Pollution Sources		Prioritized Parameters of Pollution Control
		Point Source	Non-Point Source	
B-1	Bac Kan Town, manufacturers and mining areas are located.	-Facilities identified by Decision No.64/2003/QD-TTg and Circular No. 07/2007/TT-BTNMT -Households in Bac Kan Town	-Agricultural land	BOD, COD, SS
C-1	Mining areas are concentrated.	-Mining areas	-Agricultural land	Hg, Pb, As, Cd
C-2	Mining areas are concentrated.	-Mining areas, -Manufacturers	-Agricultural land	Hg, Pb, As, Cd
D-1	Mining areas are concentrated.	-Facilities identified by Decision No.64/2003/QD-TTg and Circular No. 07/2007/TT-BTNMT -Manufacturers, -Mining areas	-Agricultural land	BOD, COD, SS, Hg, Pb, As, Cd
D-2	It is the central area of Thai Nguyen City. Manufacturers are concentrated.	-Facilities identified by Decision No.64/2003/QD-TTg and Circular No. 07/2007/TT-BTNMT -Manufacturers, -Hospitals -Households in Thai Nguyen City	-	BOD, COD, SS
E-1	Manufacturers are concentrated in the outskirt of Thai Nguyen City.	-Facilities identified by Decision No.64/2003/QD-TTg and Circular No. 07/2007/TT-BTNMT -Manufacturers, -Hospitals -Households in urban area	-Agricultural land	BOD, COD, SS
E-2	Manufacturers and industrial park are located.	-Facilities identified by Decision No.64/2003/QD-TTg and Circular No. 07/2007/TT-BTNMT -Manufacturers, -Industrial park -Craft village, -Households in urban area	-Agricultural land	BOD, COD, SS

Source: JICA Study Team

Figure 4.4-2 Experimental Pollution Load Map

4.5 Development of the Pollution Source Inventory Guideline

(1) Definition and Clarification of Scope of PSI

The first task to be conducted in the PSI development procedure is to define and clarify the scope of the inventory including its end use. The scope of the PSI was set up as follows:

Table 4.5-1 Scope of River Basin PSI

Pollutant	Source Category	Discharge Source	Geographical Boundary
• BOD • COD_{Cr} • NO_3 • NO_2 • NH_3 • PO_4 • SS • Other pollutants as required	• Point pollution source • Non-point pollution source	• Factory • Mining area • Craft village • Livestock facility • Hospital • Solid waste dumping site • Domestic wastewater • Irrigation wastewater • Natural area	• Cau river basins (Cau river model area upstream area from Cong river confluent point)
Inventory Use			
Use for the management and control of river-basin-wide water quality by relevant personnel of the central and local agencies within the framework of the Cau River Master Plan.			

Source: JICA Study Team

(2) Collection of Data and Information

Collection of data and information is the key in developing the river basin PSI. Since it involves large volume and various kinds of data and information, the collection method should be conducted effectively and smoothly. Consequently, suitable collection methods should be selected taking into account the type of pollution sources targeted, end use of inventory, and available resources. Sources of data and information can be divided into two categories: direct collection at pollution sources and indirect collection. Each source contains the following:

1) Direct Collection

- ❑ Source survey,
- ❑ Source inspection,
- ❑ Source test data, and
- ❑ Direct monitoring

2) Indirect Collection

- ❑ Report of EIA, EPC, and EPP
- ❑ Published literatures,
- ❑ Census and statistics,
- ❑ Discharge model,
- ❑ Estimation/calculations of pollution load unit, and
- ❑ Extrapolation

Data and information needed for developing the PSI are to be gathered through sources mentioned above. Normally, it is difficult to gather all these from one data source. Therefore, an integrated use of the data and information from more than two sources is required.

3) Source Survey

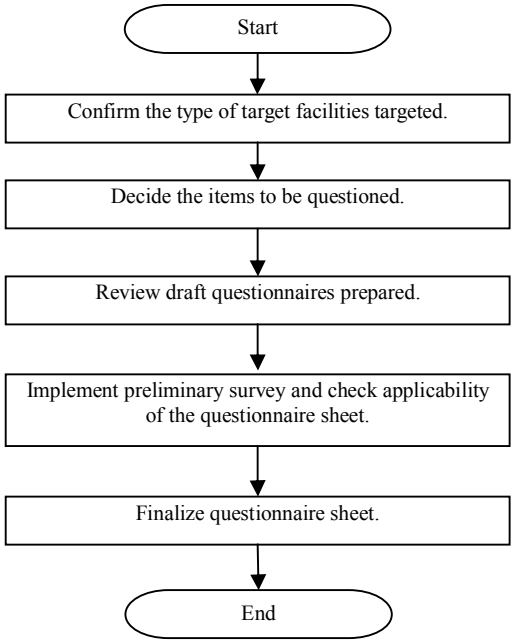
(a) Preparatory Work

A source survey is a measure to directly collect information to obtain reliable information. However, to implement the source survey effectively, sufficient preparatory work should be implemented, including the following tasks.

- ❑ Listing target facilities,
- ❑ Classification of target facilities, and
- ❑ Meeting with target facilities for explanation and demonstration.

(b) Preparation of Pollution Source Survey Form

Before implementation of the pollution source survey, survey forms should be prepared depending on the type of target facilities. The process for preparation of the questionnaire sheet can be executed through the following steps.



Source: JICA Study Team

Figure 4.5-1 Process of Preparation of Questionnaire Sheet

Items to be included in the questionnaire are shown in Table 4.5-2.

Table 4.5-2 Example of Items to be Questioned

Basic information	name of factory, name of manager, name of the person in charge of environmental management, address and contract address of enterprise, type of activity, established year, number of employee, amount of production and its trend, GPS coordination
Production process	name of products, raw materials and amount of usage, amount of water usage, scale, operation condition and pattern (daily and seasonal) of production process discharging pollutants, flowchart of the process
Wastewater	type and concentration of discharged pollutants, amount of discharged wastewater and its trend, discharge point of wastewater, operation condition of existing wastewater treatment facility, future plan to construct wastewater treatment facility, wastewater quality analytical result, record of illegal wastewater discharge

Source: JICA Study Team

The following viewpoints are for check adequacy of the format.

Table 4.5-3 Viewpoints to Check Adequacy of Source Survey Format

Items to be Reviewed	Viewpoints for Review
Availability of the format on each industrial sector	-Format is required to be able to record various pollutants discharged from each industrial sector (Main industrial sectors in the model area in Cau river basin are steel industry, food industry, and automobile parts manufacturing industry)
Possibility to collect required information by the format	-Format is need to collect required information for estimation of important data when target enterprise does not have statistical data (For example, when target enterprise does not have statistical data of water usage amount, it should be estimated by other information such as operated hours of water pump.)
Convenience on inventory surveyor	-Format is expected to have functions for collection of necessary information rapidly, checking unreliable data easily, and user-friendly for surveyor and interviewee.
Securing accuracy of collected important information	-Format is expected to have functions to clarify important information to collected, to be able to required supplemental information, and support fresh inventory surveyors.
Easy to extract unreliable data	-Format is expected to be easy to check unreliable data in the field, and to have supplemental questions to re-collect reliable data.

Source: JICA Study Team

(3) Compilation and Arrangement of Data

1) Digitization of Information

In order to process, sort, retrieve, analyze and update, the following collected information should be digitized.

- ❑ Other information besides data such as name of district, type of industrial sector, category of pollution sources, business type, and so on,
- ❑ Figures to be grouped into several categories for convenience of data analysis, and
- ❑ Geographical information.

2) Form of River Basin PSI

The data needed for developing the river basin PSI is drawn from a wide range of sources. The responsible agency for the development of the PSI may specifically collect some of the data. The collected data and information are recorded and stored in the form of spreadsheets. The prepared spreadsheets are manipulated for processing stored data and used for managing the river basin water quality. The structure of the PSI is prescribed according to its end use. The data elements that should be subject to inventory in the PSI are summarized below.

Table 4.5-4 Data Elements to be Inventoried in River Basin PSI

Data Element		Recorded by:	Data Element		Recorded by:
Location	Province	Name, Code	Discharge information	Flow rate of wastewater	m^3/day, etc.
	City/Town/District	Name, Code		Wastewater treatment facility	Code (Type of facility)
	Ward/Town/Commune	Name, Code		Destination of wastewater	Code
	Latitude	x coordinate		Sampling data	Date
	Longitude	y coordinate		pH	Concentration
Source information	Pollution source category	Name, Code		EC	Concentration
	Industrial type	Name, VSIC		TDS	Concentration
	Major products	Name, Amount		BOD_5	Concentration
	No. of employee	No. of employee		COD_{Cr}	Concentration
	Area of source	Hectare		NO_3-N	Concentration
	Annual turnover	Milln. DON, Code		NO_2-N	Concentration
	Business type	Capital type code		NH_3-N	Concentration
	River basins	River basin Code		TKN	Concentration
	Data/Info. source	Code		PO_4	Concentration
	EIA/EPC	Yes/No, Date		SS	Concentration
-	-	-		T-Coliform	Concentration
-	-	-		T-Cr	Concentration
-	-	-		Cr(III)	Concentration
-	-	-		CN	Concentration
-	-	-		Pb	Concentration
-	-	-		Other pollutants as required	Concentration

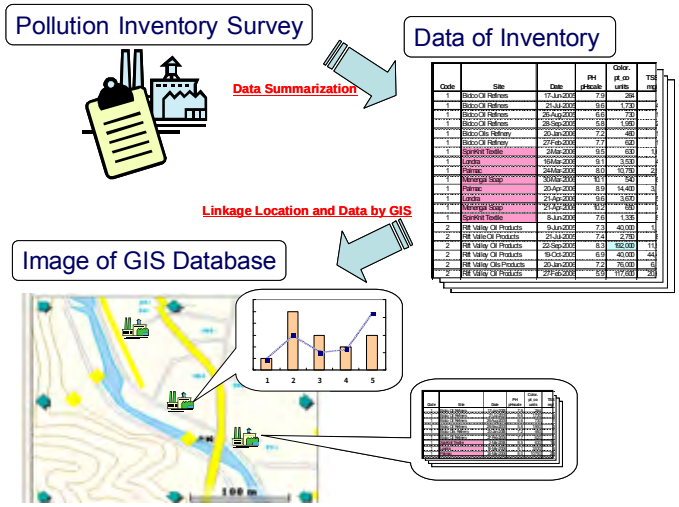
Source: JICA Study Team

3) Arrangement of Data for River Basin PSI

Arrangement of data for river basin PSI should be easily understandable to determine the pollution control approach. In addition, as mentioned in Section 4.5-(3)-1) above (Digitization of Information), linkage between PSI and GIS is a crucial function for understanding information on pollution in river basin visually and spatially. This guideline shows the following examples of data summarization using GIS:

- Linkage between PSI and GIS,
- Pollution load level in each area, and
- Grasping status of facilities which discharge effluent exceeding water quality standard

A method of linkage between pollution sources and GIS is very simple. GIS can load the database including location information (Latitude: X and Longitude: Y) on pollution source. In addition, GIS can read all information from the loaded database.



Source: JICA Study Team

Figure 4.5-2 Linkage between Pollution Source Inventory and GIS

4) Data Management and River Basin PSI Application

The river basin PSI established can be used for the following objectives.

- Estimate regional pollution load for formulating concrete action plans of a river basin management plan and evaluating their effectiveness,
- Specify important targets to be addressed by applicable pollution control measures, and
- Grasp of generated pollution load for collection of environmental protection fee.

4.6 Discussions with the Vietnamese Side for Preparing Pollution Source Inventory (PSI) Guideline

4.6.1 Technical Discussions in Mini-workshops

The PSI Guideline was prepared through a discussion with the concerned organizations and departments in VEA, such as the Department of Pollution Control. To enhance the applicability of the PSI Guideline, the Vietnamese side recommended holding of mini-workshops for discussion with external local experts. The Vietnamese version of the PSI Guideline was also reviewed by external local experts. The PSI Guideline was drafted in December 2008, and finalized in January 2009.

(1) Approach for the Preparation of the PSI Guideline

The guideline was prepared considering the following:

- Clarification of objectives of PSI development, and
- Clarification of applicable approaches on how to develop the PSI to achieve its objectives.

Table 4.6-1 Mini-WS for Output-2

No.	Date	Venue	Number of Participants	Participated Organization
1	16 December 2008	VEA	20 people	VEA, CEM, VAST/IET, MONRE, JICA, VST, JST, local consultant implementing the inventory survey
2	12 January 2009	VEA	20 people	VEA、CEM、Vietnam Academy for Water Resource、VST、JST、local consultant implementing the inventory survey

Note: CEMDI is former name of CEM.
Source: JICA Study Team

Table 4.6-2 shows the comments and recommendations obtained during the mini-workshops. The details of the comments and recommendations are shown in the discussion records attached to this report.

Table 4.6-2 Discussion in Mini-WS for Output 2

Mini-WS	Comments and Recommendations	Actions taken by VST/JST
1st mini-WS	(1) The structure of the draft PSI Guideline looked like a research report and it seemed not corresponding to be used for the guideline. Descriptions should be revised for users such as DONRE officers, for easy understanding of the proposals and instruction for the Inventory Guideline. (2) The technical guideline should be more specific for the following contents: 1) Ways to secure the reliability of the information collected, 2) How to utilize the information collected, 3) Calculation method of pollution load, 4) Preparation of GIS map of pollution sources, and 5) Application for estimation of self-purification capacity (3) The PSI Guideline should include the innovated approaches for inventory surveys with the use of new terms. For users, the explanation of the definition of new terms should be more particular. (4) The process to prepare the inventory survey form should be described.	(1) The structure of the guideline was revised, and key points of each section were highlighted as a text box at the top of each section. (2)Descriptions of the requested items were revised, and added to each section. (3)For each section, explanation of the new terms was highlighted. (4)Based on the inventory survey implemented, the process to prepare PSI survey forms is added.
2nd mini- WS	(1) For finalizing the 2nd Draft PSI Guideline, the following should be considered: 1) Type of inventory survey form that can collect reliable information 2) Concrete procedure on quality control of collected information 3) Training of inventory surveyors (2) Scattered pollution source information collected by each donor and organization should be collected and unified. (3) Description of Vietnamese legislations related to the inventory survey should be reviewed and revised if necessary.	(1) The PSI survey form was revised to collect reliable information easily, such as clarification of units. The process of quality control was attached with the guideline. Description on the training of inventory surveyors was added. (2) Unifying the information of pollution sources in the river basin level was emphasized. (3) Description was reviewed and revised.

Source: JICA Study Team

4.6.2 Workshop

After the consultation on the PSI guideline during the PCU meeting on 20 January 2009, a workshop to disseminate the guideline was held on 24 February 2009. The guideline was explained by JST after the presentation of PSI survey results by PCD of VEA in the Cau River basin in 2008. In the workshop, there were 66 participants including all DONRE in the Cau River basin who discussed the PSI guideline. Comments and recommendations are summarized in Table 4.6-3.

Table 4.6-3 Discussion in WS for Output-2

Comments and Recommendations	Actions taken by VST/JST
(1) It was pointed out that the selection and setting priority of targets to be surveyed were very important in order to collect the important information of pollution sources. (2) The technical terms used in Vietnamese translation should be properly reviewed. (3) The importance of wastewater quality analysis was pointed out to check the reliability of the monitoring data reported by the target facilities. (4) The capacities of the pollution control officers should be enhanced for effective guideline implementation. (5) A manual for front-staff collecting pollution source information was recommended to be prepared for providing clear and understandable instruction.	All comments will be considered when trial usage of the Inventory Guideline is carried out, and the experiences obtained through the trial survey will be used to improve the guideline.

Source: JICA Study Team

4.7 Practical Training related to PSI Survey

The following activities were implemented as the practical training under Output 2 of the Inventory Guideline on Pollution Source Inventory for the Development of Water Environment Management at the River Basin Level.

(1) Survey on pollution sources by CEM using the Inventory Guideline
(2) Survey on pollution sources with external resources under the supervision of VEA and DONRE using the Inventory Guideline
(3) Training on the operation of PSI database prepared during the Study

4.7.1 Survey on Pollution Sources by CEM using the Inventory Guideline

(1) Objective

CEM/VEA planned to implement the PSI survey in Nhue River basin in 2009. A practical training on the Survey Inventory Guideline was conducted for its efficient application.

(2) Activity

From August to October 2009, JST discussed with CEM/VEA and provided suggestions for the preparation and implementation of the PSI survey. Two discussion meetings were held to lecture on the Inventory Guideline as shown in Table 4.7-1. Based on the discussion and suggestions, CEM/VEA planned the survey to be finished in December 2009.

Table 4.7-1 Discussion Meeting for Lecture of Inventory Guideline for CEM/VEA

No	Date	Objective	Venue	Number of Participants
1	1 Oct 2009	Lecture on inventory survey methods	CEM/VEA	10
2	12 Oct 2009	Lecture on utilization of survey results – pollution load estimation-	CEM/VEA	12

Source: JICA Study Team

(3) Result

CEM/VEA targeted the following pollution sources for the inventory survey.

1) Factories
2) Industrial parks
3) Craft villages
4) Hospitals
5) Solid waste dumping site
6) Domestic wastewater

The above target facilities were prioritized by the following criteria.

1) Criteria 1: The facilities listed in Decision 64 or the targeted areas for the environmental inspection by VEA and DONRE from 2005-2009.
2) Criteria 2: The six major production types in the Nhue River basin are: food processing, livestock and slaughter, dyeing and textile, paper and paper recycling, metal producing and refining, recycling, and chemical industry.
3) The service area coverage of the activities in accordance with type of pollution sources are as follows:
   (a) All IPs in Nhue River basin
   (b) Factory: in Nhue River basin: (Hanoi: turnover > 10 billion dong/year; Ha Nam: turnover > 4 bil/year; Ha Tay (old): >4 bil/year)
   (c) Hospital: district medical station with the number of patient beds > 10 in Nhue River basin
   (d) Craft villages all in Nhue River basin
   (e) Solid waste dumping site area >500m^2
   (f) Domestic Wastewater volume >5 m^3/day

CEM/VEA planned to implement the survey by direct source survey with prepared questionnaire forms. An example is shown in Box 4.7-1.

Box 4.7-1 Example of Questionnaire for Direct Source Survey by CEM/VEA

QUESTIONNAIRE FOR PRODUCTION FACILITY

I. General information

1. Name of production facility:
2. Address:

- Province/City
- District:
- Commune/ ward:
- Hamlet/ village/ street:

3. Co-ordinate: Latitude: Longtitude:

4. Tel: Fax: Website:

II. Information about production facility

1. Establishment year:

2. Business license/operation license No:

3. Production field:

4. Type of Ownership:

☐ State ☐ Joint-stock company ☐ Limited liability company

☐ Joint-venture ☐ 100% of foreign investment ☐ others

5. Total area (area of provided land): (m^2)

6. Total of staffs and workers : (person)

7. Total annual turnover : VNĐ (2008)

8. Operation condition:

Operation status	**Year 2009**			
	Quarter I	Quarter II	Quarter III	Quarter IV
8.1. Total of average working days in the quarter				
8.2. Average working hours (hour/day)				

9. Material consumption for production

9.1. Water			
Urban water supplying net : …….m^3/day (month)		Water for production:…….m^3/day (month)	
Underground water from drilled well::…….m^3/day (month)		Cooling water: ……m^3/day (month)	
Water from river, stream, lakes, ponds: ……m^3/day (month)		Domestic water:……..…...m^3/day (month)	
Other water sources: …… m^3/day (month		Water for other purposes: ……..m^3/day (month)	
Total: ……... m^3/day (month)		Total: …….. m^3/day (month)	
water usage flow: m^3/day (month)	Maximum	Average	Minimum

9.2. Average electricity consumption:: .....(kWh/mont			
9.3. Type of power	Oil:……(liter/month)	Coal:……..(ton/month)	Gas:……(ton/ month)
9.4. Materials	1)……..(……/month)	2)……..(……/month)	3)……..(……/month)
	4)……..(……/month)	5)……..(……/month)	6)……..(……/month)
	7)……..(……/month)	8)……..(……/month)	9)……..(……/month)
9.5. Chemicals	1)……..(……/month)	2)……..(……/month)	3)……..(……/month)
	4)……..(……/month)	5)……..(……/month)	6)……..(……/month)
	7)……..(……/month)	8)……..(……/month)	9)……..(……/month)
10. Main products	1)……..(……/month)	2)……..(……/month)	3)……..(……/month)
	4)…….(……/month)	5)……..(……/month)	6)……..(……/month)
	7)……..(……/month)	8)……..(……/month)	9)……..(……/month)

10. Diagram of production technology (use arrow-line to connect the major parts of the map)

III. Environmental information

1. Wastewater

1.1. Total wastewater flow: (m^3/day; m^3/month)

a. Production wastewater: (m^3/day; m^3/month)
b. Domestic wastewater: (m^3/day; m^3/month).
c. Other wastewater (if any): (m^3/day; m^3/month).

1.2. Facility has wastewater and rainwater separating system:

☐ Yes ☐ No

1.4. Facility has wastewater treatment system:

☐ Yes ☐ No

a. Description of treatment system (with arrows describing main phases of treatment technology)

b. Type of wastewater treatment facility:

☐ neutralization/ regulation	☐ froth floatation	☐ sand filtering	☐ oil splitting
☐ deposition	☐ Active carbonate absorbent	☐ Active sludge	☐ dripping filter
☐ Aerobic lake	☐ Fermentation, anaerobic	☐ Other treatment	

1.5. Facility conducts periodic wastewater self-monitoring :

☐ Yes ☐ No ☐ sometimes

a. Facility of Mr./Mrs. Submits self-monitoring report to DONRE:
☐ Yes ☐ No
b. Monitoring frequency (time/year).
c. Monitoring results: *(Please attach the monitoring result with this questionnaire)*
d. Monitoring and analyzing units

1.6. Wastewater receiving source:

☐ Wastewater drainage system of IP ☐ Natural lakes/ ponds ☐ Irrigation channels

☐ Contaminated water drainage system in residential areas ☐ River/stream ☐ Soil absorbent

Clarify the name of receiving source:

3. **Solid waste**

3.1. Total of discharged solid waste (kg/day; kg/month)

a. Waste from production activities:(kg/day; kg/month)
b. Domestic waste:(kg/day; kg/month)
c. Hazardous waste:(kg/day; kg/month)

3.2. Is solid waste classified at sources? :

☐ Yes ☐ No

Type of classification:

3.3. Solid waste treatment

☐ Transportation contract with urban environment company (clarify name of the company):
☐ Self transportation to common landfill site
☐ Landfill in factory's area
☐ Other method (detailed description):

4. Environmental protection fee

Factory paid an amount of wastewater fee (VND/month)

COD ……...VND/month	TSS……VND/month	Hg……VND/month
Pb……VND/month	As……VND/month	Cd…… VND/month
Total……...VND/month		

5. Environmental Authorization

- EIA report	☐ Yes	☐ No	☐ Not requested
- EPC	☐ Yes	☐ No	
- EPP	☐ Yes	☐ No	
- Register of waste's owner	☐ Yes	☐ No	
- Water exploitation and usage license	☐ Yes	☐ No	
- Wastewater discharge license	☐ Yes	☐ No	
- ISO 14001	☐ Yes	☐ No	

INVESTIGATOR — *(Name and signature)*

INFORMATION PROVIDER — *(Name and signature)*

4.7.2 Supplemental PSI Survey using the PSI Guideline

(1) Objective

During the study, the PSI Survey verified the effectiveness of survey forms used for the collection of primary data/information, and also revealed the limitation of the direct collection of data/information. On the other hand, some of the target facilities had no direct data/information about pollution discharges from the facilities. Some of the data providers have restricted access to data/information because it was either confidential, unpublished, or have not yet been finalized. This means that the direct collection of data/information will not necessarily mean getting the full data/information in order to develop a complete PSI. In this way, the data and information needed for developing a PSI should be gathered by both direct and indirect collection. In order to seek for better solutions against current difficulties of the PSI, this practical training aims at the following objectives:

1) To confirm available secondary data/information for development of PSI,
2) To collect secondary data/information related to point source pollution by indirect collection method and to obtain knowledge and experiences on the advantages, restrictions, and lessons learned from the applied methods, and
3) To apply the knowledge and experiences to the finalization of the PSI Guideline.

(2) Activity

This training activity is being implemented by sub-contract work supervised by VEA and the JICA Vietnam office. The survey area is identified as the critical areas in the model area. The contents of the activity are:

1) To assess the difficulty of direct survey,
2) To identify the available information sources for indirect survey, and
3) To identify collectible information by indirect survey.

(3) Results

This training activity is on-going, and to be finalized in December 2009. So far, the following issues were identified.

1) Difficulty of Direct Survey
   (a) Wastewater quantity and quality data are difficult to be collected.

(b) Due to lack of knowledge by the enterprises themselves, some information related to environmental management are unreliable.
(c) Units of the collected data are not consistent due to lack of experience of the target enterprises to answer the questionnaire for the development of PSI.

2) Available Information Sources for Indirect Survey
   (a) Report of EIA/EPC/EPP,
   (b) Published literatures,
   (c) Census and statistics,
   (d) Inspection reports on pollution sources by provincial DONRE
3) Available Information by secondary survey
   (a) Wastewater quantity and quality,
   (b) Authorized enterprises activity data, and
   (c) Authorized information on the status of environment management activities by the enterprises.

4.7.3 Training on Operation of PSI Database Prepared under the Study

(1) Objective

Under Output 2, the PSI database in the model area was developed. This practical training was implemented to improve the prepared database by reflecting the expected users such as VEA and DONRE.

(2) Activity

Demonstration meetings of the prepared PSI database were conducted based on the schedule as shown in Table 4.7-2. Through the demonstration meetings, the following comments were provided.

1) Input interface should be more user-friendly,
2) Export function is expected to increase, and
3) Information for future expansion of the database should be provided.

Table 4.7-2 Demonstration Meeting for PSI Database

No	Date	Venue	Number of Participants
1	9 Sep 2009	Department of Waste Management and Environment Amelioration/VEA	7
2	16 Sep 2009	Thai Nguyen DONRE	18

Source: JICA Study Team

Considering the above comments, the PSI database was modified. A database manual was then prepared in both English and Vietnamese versions. The modified database was distributed to VEA, Bac Kan and Thai Nguyen DONRE.

Source: JICA Study Team

Figure 4.7-1 Modified PSI Database (Improved Input Interface)

4.8 Capacity Development Condition of Output-2

4.8.1 Assessment of Baseline Capacity

(1) Questionnaire Survey for Capacity Assessment

The VST and JST prepared a questionnaire for evaluating the capacities concerning Output 2. The questionnaire targeting directors and staff of the four organizations (PCD/VEPA, RBMD/VEPA, Bac Kan DONRE, Thai Nguyen DONRE) was distributed in July 2008, and collected in February 2009 for checking the initial achievement of the capacity development level. The contents of the questionnaire are attached in Table 4.8-2 and 4.8-3. The questionnaire Form A contains questions on the individual capacity of each staff, and the Form B contains questions to the director and manager of the organizations on evaluating the capacity of its organizational level.

The collected number of questionnaires on capacity assessment is shown in Table 4.8-1.

Table 4.8-1 Number of Answers on Questionnaire for Output-2

Organization	Number of answer	
	Director/Manager	Technical Staff
PCD	2	9
River Basin Management Department	1	5
Thai Nguyen DONRE	1	12
Bac Kan DONRE	2	4

Source: JICA Study Team

(2) Result of Baseline Capacity Assessment

Results of this evaluation are summarized as in Table 4.8-2 and Table 4.8-3.

The following results are found by preliminary analysis of the questionnaire.

1) The Bac Kan and Thai Nguyen DONRE officers evaluated their own capacities on formulating inventory survey lower than VEA (question 2-1-1、2-2-1、2-3-1).

2) Officers of PCD considered that updating of their own pollution source database should be carried out more frequently (question 2-1-3、2-1-4).

3) Officers of VEPA expected DONRE to provide information more than current condition (question 2-1-6). Officers of Thai Nguyen DONRE relatively recognized VEPA's expectation, but officers of Bac Kan DONRE generally thought that current status of information sharing with VEPA (question 2-3-5) is enough.

Table 4.8-2 Result of Questionnaire of Output-2 (Form-A)

No	Question	PCD/VEPA 9 persons		RBMD/VEPA 5 persons		Thai Nguyen DONRE 12 persons		Bac Kan DONRE 4 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
0. General Items related to the Study									
0-1	Do you know the objectives and contents of the Study?	2.2	100	4.2	100	2.3	100	2.8	100
0-2	Is the Study useful for your daily job in general?	2.2	100	4.2	100	2.6	100	3.5	100
0-3	Do you have interest in the Study?	2.7	100	4.4	100	3.3	100	4.0	100
0-4	Do you have time for co-working with the JICA Study Team (JST)?	2.7	100	3.8	100	2.8	100	3.3	100
0-5	Is it necessary for you to conduct co-working with JST in the Study?	2.9	100	4.4	100	3.7	92	4.0	100
0-6	Do you clearly know your job mandates in the office?	4.3	100	4.4	100	4.6	100	5.0	100
0-7	Do you have enough communication with your directors and managers?	3.8	89	4.3	80	4.2	100	3.5	100
0-8	Does your office and section conduct enough job performance required by the mandate?	4.4	100	4.2	100	4.8	100	4.5	100
0-9	Does your office and section have enough capability (staff and equipment) required by the mandate?	4.0	100	3.8	100	3.9	100	3.3	100
0-10	Do you receive enough technical training and	4.4	89	3.8	100	4.0	100	4.0	100

No	Question	PCD/VEPA 9 persons		RBMD/VEPA 5 persons		Thai Nguyen DONRE 12 persons		Bac Kan DONRE 4 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
	support from your directors and managers?								
0-11	Do you receive enough financial support from your directors and managers?	3.8	100	3.4	100	3.8	100	2.3	100
0-12	Do you receive enough technical support from VEPA/MONRE?	3.7	100	3.3	80	2.9	92	3.8	100
2. Items related to the Output-2 (Pollution Source Inventory)									
2.1 Questions for Pollution Control Division in VEPA									
2-1-1	Can you prepare inventory survey plan?	4.2	100	-	-	-	-	-	-
2-1-2	Do you have inventory survey format?	3.7	100	-	-	-	-	-	-
2-1-3	Do you have water pollution source database?	2.6	100	-	-	-	-	-	-
2-1-4	Do you update water pollution source database?	2.4	89	-	-	-	-	-	-
2-1-5	Can you formulate inspection plan based on the inspection manual?	3.6	100	-	-	-	-	-	-
2-1-6	Do you receive inspection results from DONRE every year?	1.7	89	-	-	-	-	-	-
2-1-7	Can you instruct for improvement of actual inspection methods to DONRE staff?	3.6	100	-	-	-	-	-	-
2-1-8	Can you calculate surcharge amount to be collected based on Decree No.67?	3.3	89	-	-	-	-	-	-
2-1-9	Can you calculate pollution load (t/day) based on water quality and wastewater discharge?	2.8	100	-	-	-	-	-	-
2-1-10	Do you have unit pollution load by each pollution source including non-point source?	1.8	78	-	-	-	-	-	-
2-1-11	Can you prepare water pollution source control plan based on the estimated result of pollution load?	2.9	89	-	-	-	-	-	-
2-1-12	Can you train DONRE to implement inventory survey and inspection?	3.7	100	-	-	-	-	-	-
2.2 Questions for River Basin Management Division in VEPA									
2-2-1	Do you have information related to water pollution source?	-	-	3.4	100	-	-	-	-
2-2-2	Do you provide information related to water pollution source to Pollution Control Division?	-	-	3.8	100	-	-	-	-
2-2-3	Did you conduct inventory survey?	-	-	2.3	80	-	-	-	-
2-2-4	Did you conduct inspection?	-	-	2.2	100	-	-	-	-
2-2-5	Do you have pollution source database?	-	-	2.6	100	-	-	-	-
2-2-6	Do you update and upgrade pollution source database?	-	-	2.4	100	-	-	-	-
2-2-7	Is it necessary to share information of pollution source for you?	-	-	5.0	100	-	-	-	-
2.3 Questions for DONRE									
2-3-1	Can you prepare inventory survey plan?	-	-	-	-	3.4	42	4.3	75
2-3-2	Do you have inventory survey format?	-	-	-	-	2.6	42	4.0	75
2-3-3	Do you have pollution source database?	-	-	-	-	2.4	42	3.3	75
2-3-4	Do you update water pollution source database?	-	-	-	-	2.4	42	2.0	75
2-3-5	Do you inform and report pollution source inventory data to VEPA?	-	-	-	-	1.7	25	5.0	75
2-3-6	Can you formulate inspection plan based on the inspection manual?	-	-	-	-	3.0	25	5.0	50
2-3-8	Do you revise the current inspection manual based on your experiences?	-	-	-	-	3.3	25	1.7	75
2-3-9	Can you calculate surcharge amount to be collected based on Decree No.67?	-	-	-	-	2.3	33	1.0	50
2-3-10	Can you calculate pollution load (t/day) based on water quality and wastewater discharge?	-	-	-	-	3.4	42	2.0	75
2-3-11	Do you have unit pollution load by each pollution source including non-point source?	-	-	-	-	2.7	25	1.7	75
2-3-12	Can you prepare water pollution source control plan based on the estimated result of pollution load?	-	-	-	-	3.0	42	2.0	75
2-3-13	Can you train staff in charge for implementation of inventory survey and inspection?	-	-	-	-	2.6	42	2.0	75
2-3-14	Do you receive enough technical training on inventory survey and inspection?	-	-	-	-	2.0	25	3.3	75
2-3-15	Do you receive enough financial support on inventory survey and inspection from your directors and managers?	-	-	-	-	2.3	25	2.7	75

N/A= No Answer

0-13	Why do you need to protect Cau river?
	PCD: - Cau river is polluted (3persons reply same comment) - Cau river is seriously polluted - Cau river is an important water source that provides water for domestic use and irrigation - Cau river is polluted by industrial zones - Cau river is more and more polluted - Cau river is seriously polluted - Cau river is an important river in the Northern area RBMD: - Cau river should be protected to protect ecological environment and stabilize socio-economy - To recover ecological environment and basin culture - This is a inter-provincial river which has significant effects on human lives and it also has many serious environmental issues and it Thai Nguyen DONRE: - To ensure the clean and safety water source - Cau river is seriously polluted - Cau river is an important and useful water source for domestic and production use Bac Kan DONRE: - to achieve sustainable development - State management in field of environmental protection
0-14	What protection level is suitable for Cau river?
	PCD: - Cau river must be protected at suitable level so that Cau river water can be used as domestic water - As much as possible - At necessary level so that Cau river can serve the demand for domestic activities of residents - At the maximum level - To make Cau river as pure as before - Cau river is not protect yet, so it should be protected for domestic use - To meet TCVN - Clean and meet TCVN RBMD: - Cau river should be protected gradually - To make river water quality meeting requirements for socio-economic development - At highest level - At gradual speed, to be suitable for socio-economic situation of Vietnam Thai Nguyen DONRE: - At highest level - At highest level - Very necessary Bac Kan DONRE: - At highest level - Depend on characteristics of each area

Source: JICA Study Team

Table 4.8-3 Result of Questionnaire of Output-2 (Form-B)

No	Question	CEMDI 2 persons		RBMD/VEPA 1 person		Thai Nguyen DONRE 1 person		Bac Kan DONRE 2 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
0. General Items related to the Study									
0-1	Do you know the objectives and contents of the Study?	4.0	100	5	100	5.0	100	2.0	100
0-2	Is the Study useful for your daily job in general?	3.0	100	4	100	4.0	100	3.0	100
0-3	Do you have interest in the Study?	4.5	100	5	100	4.0	100	4.5	100
0-4	Does your staff have time for co-working with the JICA Study Team (JST)?	4.5	100	4	100	3.0	100	4.5	100
0-5	Is it necessary for your staff to conduct co-working with JST in the Study?	5.0	100	4	100	4.0	100	4.5	100
0-6	Does your staff clearly know his/her job mandates in the office?	5.0	100	5	100	4.0	100	4.5	100
0-7	Do you have enough communication with your staff?	5.0	100	5	100	4.0	100	4.5	100
0-8	Does your office and section conduct enough job performance required by the mandate?	5.0	100	5	100	5.0	100	4.5	100
0-9	Does your department have enough capability (staff and equipment) required by the mandate?	4.0	100	5	100	3.0	100	4.5	100
0-10	Do you receive enough technical training and support from PPC?	5.0	100	N/A	0	3.0	100	3.0	100
0-11	Do you receive enough financial support from PPC?	4.0	100	N/A	0	3.0	100	3.0	100
0-12	Do you receive enough technical support from VEPA/MONRE?	5.0	100	3	100	2.0	100	2.5	100
2. Items related to the Output-2 (Pollution Source Inventory)									
2.1 Questions for Pollution Control Division in VEPA									
2-1-4	Does your division have inventory survey plan?	5.0	100	-	-	-	-	-	-

No	Question	CEMDI 2 persons		RBMD/VEPA 1 person		Thai Nguyen DONRE 1 person		Bac Kan DONRE 2 persons	
		Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)	Average	Response rate(%)
2-1-5	Does your division have inventory survey format?	5.0	100	-	-	-	-	-	-
2-1-6	Does your division have water pollution source database?	5.0	100	-	-	-	-	-	-
2-1-7	Does your division have inspection plan?	5.0	100	-	-	-	-	-	-
2-1-10	Does your division have figures of pollution load unit?	5.0	100	-	-	-	-	-	-
2-1-11	Does your division have water pollution source control plan based on the estimated pollution load in Cau river basin?	5.0	100	-	-	-	-	-	-
2-1-12	Does your division have training plans for DONRE for improvement of inventory survey and inspection?	5.0	100	-	-	-	-	-	-
2.2 Questions for River Basin Management Division in VEPA									
2-2-1	Does your division have information related to water pollution source?	-	-	3.0	100	-	-	-	-
2-2-2	Does your division provide information related to water pollution source to Pollution Control Division?	-	-	4.0	100	-	-	-	-
2-2-3	Does your division conduct inventory survey?	-	-	3.0	100	-	-	-	-
2-2-4	Does your division conduct inspection?	-	-	2.0	100	-	-	-	-
2-2-5	Does your division have pollution source database?	-	-	3.0	100	-	-	-	-
2-2-6	Does your division update and upgrade pollution source database?	-	-	2.0	100	-	-	-	-
2-2-7	Is it necessary to share information of pollution source for your division?	-	-	5.0	100	-	-	-	-
2.3 Questions for DONRE									
2-3-4	Does your organization have inventory survey plan?	-	-	-	-	3.0	100	N/A	0
2-3-5	Does your organization have inventory survey format?	-	-	-	-	1.0	100	N/A	0
2-3-6	Does your organization have water pollution source database?	-	-	-	-	2.0	100	N/A	0
2-3-7	Does your organization have experience to exchange pollution source inventory data with MONRE?	-	-	-	-	2.0	100	N/A	0
2-3-8	Does your organization have inspection plan?	-	-	-	-	3.0	100	N/A	0
2-3-11	Does your organization have figures of pollution load unit?	-	-	-	-	3.0	100	N/A	0
2-3-12	Does your organization have water pollution source control plan based on the estimated result of pollution load due to wastewater discharge in Cau river basin?	-	-	-	-	1.0	100	N/A	0
2-3-13	Does your division have training plans for DONRE for improvement of inventory survey and inspection?	-	-	-	-	1.0	100	N/A	0
2-3-14	Does your organization receive enough technical training on inventory survey and inspection?	-	-	-	-	1.0	100	N/A	0
2-3-15	Does your organization receive enough financial support on inventory survey and inspection from your directors and managers?	-	-	-	-	2.0	100	N/A	0

Source: JICA Study Team

4.8.2 Achievement in this Study

(1) Evaluation by JST

The JST considered that the following capacity development have been adopted throughout the Study for Output-2.

1) The Bac Kan and Thai Nguyen DONRE experienced to prepare and implement the PSI survey through the survey implemented in the model area.
2) The VEA, Bac Kan and Thai Nguyen DONRE learned the processes to calculate pollution load and estimate future water quality projection through Output 2, 4 and 5.
3) The CEM/VEA improved their capacity to implement PSI survey through the discussion with JST on how to prepare the inventory survey in Nhue River basin under the practical training.

(2) Evaluation by Counterpart

Table 4.8-3 shows the comparison results of the capacity assessment between the initial and final phase of Output-2 based on the survey questionnaires from VEA and Thai Nguyen DONRE. As a result of the survey, the following trends are found.

1) The officers in both VEA and Thai Nguyen DONRE evaluated that their capacity for calculating pollution load has improved.
2) The officers in Thai Nguyen DONRE evaluated that their capacity for preparing water

pollution source control plan based on the estimated pollution load has been enhanced.

3) Officers in both VEA and Thai Nguyen DONRE considered that their capacity to prepare inventory survey plan has not been changed.

Table 4.8-4 Comparison of Self-capacity Assessment Results

No	Question	PCD/VEPA DWMEA/VEA				Thai Ngyen DONRE			
		Intial Phase (PCD/VEPA) 5 persons		Final Phase (DWMEA/VEA) 2 persons		Initial Phase 12 persons		Final Phase 6 persons	
		Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
2 Questions for VEA									
2-1-1	Can you prepare inventory survey plan?	4.2	100.0	3.0	100.0	-	-	-	-
2-1-9	Can you calculate pollution load (t/day) based on water quality and wastewater discharge?	2.8	100.0	3.5	100.0	-	-	-	-
2-1-11	Can you prepare water pollution source control plan based on the estimated result of pollution load?	2.9	88.9	2.5	100.0	-	-	-	-
2-1-12	Can you train DONRE to implement inventory survey and inspection?	3.7	100.0	2.0	100.0	-	-	-	-
2.3 Questions for DONRE									
2-3-1	Can you prepare inventory survey plan?	-	-	-	-	3.4	41.7	3.3	100.0
2-3-10	Can you calculate pollution load (t/day) based on water quality and wastewater discharge?	-	-	-	-	3.4	41.7	3.8	83.3
2-3-12	Can you prepare water pollution source control plan based on the estimated result of pollution load?	-	-	-	-	3.0	41.7	3.5	100.0
2-3-13	Can you train staff in charge for implementation of inventory survey and inspection?	-	-	-	-	2.6	41.7	2.6	83.3
2-3-14	Do you receive enough technical training on inventory survey and inspection?	-	-	-	-	2.0	25.0	3.0	66.7

Source: JICA Study Team

(3) Further Challenge

After the Study, it is recommended to implement the following challenges:

1) Continue the trial activity to apply the inventory guideline to prepare the PSI survey plan, and to implement the plan, and
2) Expand awareness in calculating pollution loads, and use them in the preparation of the pollution control plan.

5. Consideration of Pollution Control Approaches for Water Environment Management (Output-3)

5.1 Framework of Output-3 Study

The Study covers a series of associated genres like water quality monitoring, pollution source inventory survey, water environment management planning, coordination mechanism, etc. Among these, the theme of Output-3 is "pollution control approaches and their supporting measures" (simply referred to as "pollution control approaches").

In the participation of concerned members of the VST and JST, the mini-workshop for Output 3 (10 September, 2008) was held to discuss its work plan and confirmed as discussed below. In the discussion, the VST side stated that Output-3 was expected to generate outcomes useful for enforcing and promoting good pollution control systems in frontline management.

(1) Objectives

On the basis of the immediate objectives of the Study as confirmed in the Inception Report, the specific objectives of Output-3 have been defined as follows:

a) To consider pollution control approaches applicable to water environment management in Vietnam, including necessary supporting measures, thereby developing a report presenting the consideration processes and results (Objective 1);
b) To review sections concerned with the compliance inspection of wastewater discharge regulation in the existing inspection manual, thereby making recommendations for its upgrading (Objective 2); and
c) To conduct on-the-job training (OJT) for VST staff in terms of technologies associated with pollution control approaches, so as to strengthen their administrative capacity (Objective 3).

(2) Work Items

The study on pollution control approaches (Objective 1) and review of inspection manual (Objective 2) are comprised of a number of steps to achieve its objectives, as follows:

a) Survey and analysis of current status (Item 3-1);
b) Examination of existing pollution control approaches (Item 3-2);
c) Reinforcement of pollution control systems (Item 3-3);
d) Preparation of study report (Item 3-4); and
e) Review of onsite inspection manual.

Besides the work items mentioned above, it was confirmed that the No. 4 workshop should be held in Thai Nguyen in order to share the experience of good practice and policy direction in pollution control.

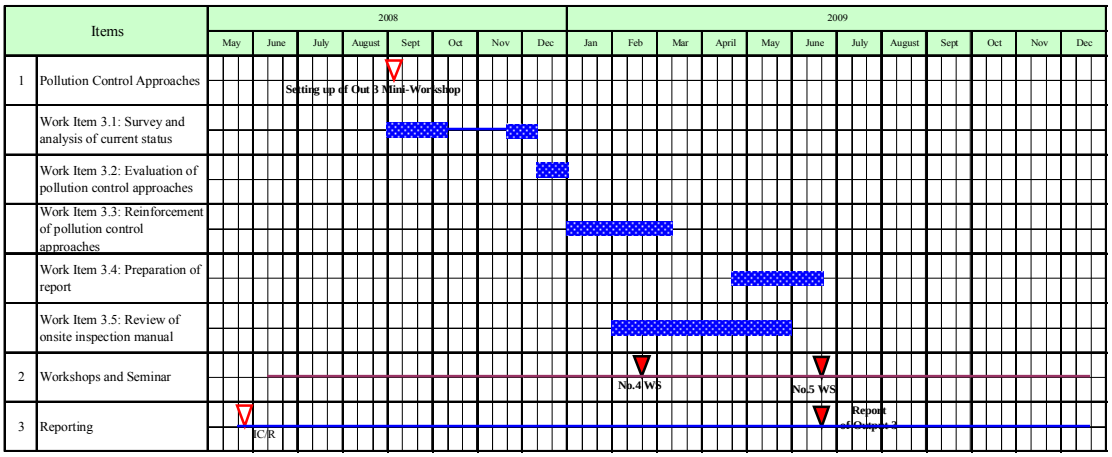
(3) Work Schedule

The work schedule of Output 3 has been confirmed as shown in Figure 5.2-1. This schedule has been adjusted in light of the whole project's schedule modified in the second year. As shown, the preparation of the study report (Item 3-4) is to be completed in late June 2009.

5.2 Study on Pollution Control Approaches (Objective 1)

5.2.1 Achievement Status of Output-3 Study

The study on pollution control approaches (Item 3-1 to 3-4) has been carried out along the work schedule and has been completed, as described below:



Source: JICA Study Team

Figure 5.2-1 Work Schedule of Output-3

1) Collection of Data and Information (Item 3-1)

The reconnaissance for direct observation was repeated for the sites of pollution sources, water courses and work places of pollution control functions in the provinces of Thai Nguyen, Bac Kan, Bac Ninh, etc. In parallel, the data and information on laws and regulations, policies and strategies, project reports, etc. were gathered to clarify the present situation of pollution control.

Besides, a series of interviews took place for the water environment sector concerned with pollution control. These include the Vietnam Environment Administration's (VEA), River Basin Division, Pollution Control Division, Implementing Office for Decision 64, Center of Public Awareness Raising, Environment Technology Division, MONRE (Department of Inspection, Department of EIA & Appraisal, Department of Environment, Department of Water Resources Management), DONREs（Thai Nguyen Province DONRE, Thai Nguyen City DONRE, Bac Kan DONRE, Bac Ninh Province DONRE, Bac Ninh City DONRE, Hanoi City DONRE）and other related units (like Department of Science and Technology in Ministry of Industry and Trade, Vietnam Environment Protection Fund, Vietnam Cleaner Production Center, Environmental Police).

2) Analysis of Collected Data and Information (Item 3-2)

Collected data and information were analyzed from different aspects to assess the present status of pollution control approaches and related systems. The mechanisms and task achievements of pollution control systems were thoroughly examined under the consideration that the system performance of each pollution control can be analyzed as the outcome of Plan-Do-Check-Action (PDCA) cycle. This is in view of the task of each pollution control system, which comprises a set of tasks like "plan", "check" and "act" as performed by the central agency (VEA) and "do's", as performed by local agencies (DONREs and NRE of districts).

3) Consideration of Reinforcement Direction (Item 3-3)

Problem analysis and objective analysis with the Logical Framework Analysis (LFA) method took place by using the analysis results mentioned above. As a result, the guiding direction for reinforcement of pollution control approaches was formulated. The strategy of this guiding direction considers that the Vietnam environment management sector goes ahead to reinforce pollution control approaches and systems over the whole country. The proposed guiding direction comprised of four sets of measures encompassing a total of 11 actions.

4) Preparation of Study Report (Item 3-4)

The study report of Output-3 has been prepared, compiling collected data and information, analytical result of existing pollution control approaches and systems and proposed reinforcement

direction. Version 1 of the study report has been prepared and discussion with VST has taken place through the mini-workshops, PCU meetings and workshops (four times in total).

The VST Local Expert has reviewed the study report and provided their comments. The JST has completed the study report (Version 2), after making final modifications in response to the comments from the VST Local Expert.

The study report is comprised of the contents shown in Box 5.2-1 below.

Box 5.2-1 Contents of Study Report for Output-3

1. Introduction
2. State and Impact of River Water Pollution
3. Policy and Legal Framework of Water Environment Management
4. Institutional Framework of Water Environment Management
5. Characteristics of Pollution Sources and Existing Mitigation Measures at Sources
6. Major Past and Ongoing Projects Related with Pollution Control
7. Analysis of Existing Pollution Control Approaches
   - 7.1 Regulatory Approach
   - 7.2 Economic Approach
   - 7.3 Technical Renovation Approach
   - 7.4 Awareness Raising Approach
   - 7.5 Infrastructure Development Approach
   - 7.6 Pollution Control Approach Employed in Other Countries
8. Proposed Reinforcement Direction of Pollution Control Approaches
   - 8.1 Issues of Existing Pollution Control Approaches
   - 8.2 Framework of Reinforcement for Pollution Control Approaches
   - 8.3 Proposed Actions of Reinforcement
   - 8.4 Timeline Framework of Reinforcement
9. Conclusion

5.2.2 Survey of Current Status

The results of the study are summarized, hereinafter.

(1) State and Impact of River Water Pollution

Inland waters (river waters and lake waters) in Vietnam are significantly polluted with domestic and industrial wastewater especially in major urban areas. Meanwhile, in some rural areas, inland waters are threatened by wastewater discharge from agricultural activities and craft industry villages. Around the urban center of Thai Nguyen City, Cau River shows serious pollution due to the discharge of wastewater from industries, households and commercial/service facilities and mining. Although there are no visible signs, the polluted river poses high risks to human health in the Cau River basin, leading to high infection from water-borne diseases in the region.

(2) Policy and Legal Framework of Water Environment Management

The National Strategy for Environmental Protection (Decision No. 256/2003/QD-TTg) and other national policies states necessary and appropriate basic directions of the water environment management of Vietnam, encompassing urgent agenda and challenges over a long-term basis. However, they lay down only a few specific strategies for supporting measures (human resources, facilities, budgets, technologies, etc.) which are required for the realization of such basic policies in many cases. The amended Law of Environmental Protection (LEP) advocates the introduction of river basin management approach and suits of related decrees have been promulgated just recently. Hence, the environment management sector in Vietnam has started to incorporate the river basin management approach into the water environment management.

Said LEP, which was further amended (promulgated in 2005), is comprehensive and has a forward-addressing character, stipulating wide-ranging approaches of management and control. It addresses economic, citizen-participatory, information and other issues, as well as specific environmental

requirements for pollution facilities. However, the promulgations of specific derivative documents (decrees, decisions, circulars, etc.) which are supposed to guide their enforcements deviated mainly to the regulation with the "command and control" type, and to the collection of wastewater fees.

(3) Institutional Framework of Water Environment Management

As the result of the reorganization taken place in September 2008, the organizational structure of Vietnam Environment Administration (VEA, former VEPA) has been strengthened significantly, incorporating the function of policy and strategy, EIA & appraisal, inspection, etc. Regarding the water pollution control, it is highly expected that the reorganized VEA will fulfill its tasks as a specialized agency of environment management in a more unitary administrative way.

Specialized environment management agencies at the local level (like DONREs, divisions of Natural Resources & Environment (NRE) in districts and officers in charge in communes) are frontline agencies. Though they are positioned to frontline players to directly enforce the state environment management at site, they are still so deprived of sufficient institutional capacity (number of assigned staffs, individual professional knowledge and skills, budget and facilities/equipment) that there are many unattended activities. In the organizational hierarchy of Vietnam's administration, DONREs are placed at specialized management agencies in provinces which are administratively instructed from PPC and, at the same time, professionally from VEA. In fact, they often face difficulties in getting appropriate supporting necessary for their managements from both PPC and VEA, in terms of administrative decision-makings and professionally specialized advices, respectively.

(4) Characteristics of Pollution Sources and Existing Mitigation Measures at Sources

Given the characteristics and distribution of pollution sources in Vietnam, such pollution sources are classified into point sources and non-point sources. Point sources are further classified into manufacturing industries (outside and inside of industrial parks), craft village industries, mining industries, households and commercial/service facilities, solid waste disposal sites, medical facilities and livestock facilities. Meanwhile, non-point sources comprise agricultural lands.

Features of manufacturing industries in Vietnam are that: a) large numbers of state-owned enterprises are operating, accounting for some 40 % of Vietnam's GDP, and b) large numbers of enterprises (some 3,400, reportedly) are located in industrial parks with 71 locations, nationwide. Another feature of industries in Vietnam is that many small-scale or household industries concentrate in craft village of some 1,500 sites, nationwide. These craft village industries play a predominant role to regional economies under the Government's aids. The Cau river basin accommodates various manufacturing industries, such as: metallurgy, steel manufacturing, machinery manufacturing, paper production, food processing, etc. Mining industries are operated in Thai Nguyen province and many craft village industries in Bac Ninh and Bac Giang provinces.

The environmental awareness level of pollution generators in all industries of manufacturing, mining and craft village are very low, resulting into the ignorance of environment-related rules and regulations, and thereby resulting into inactive environmental behaviors. As such, the sense of social responsibility is rarely recognized by enterprises, contributing to many unauthorized operations under the environmental authorization by EIA or EPC. Many enterprises have little felt the responsibility for complying with environmental regulations, so that most of them (reportedly 70-90 %) are not equipped with appropriate wastewater treatment plant and discharge wastewater without treatment. Besides, most of enterprises have been scarcely interested in the application of cleaner production (CP) technologies and environmental management system (EMS) to reduce the pollution loads generated in production process lines.

Domestic wastewater generated from households and commercial/service facilities are discharged into water course without treatment in all urban centers in Vietnam. Pilot swage treatment plants are going to be operated in Ho Chi Minh City and Hanoi City, at last. Although some craft villages are confirmed to exert acute environmental impacts to regional water courses, they are not subject to the treatment. Meanwhile, massive chemicals and fertilizers are nationwide used for vast agricultural lands without special care of their consequences. Education and awareness raising for farmers on

preventive guidance and/or instruction for excessive usage of chemicals and fertilizers have been little reported.

(5) Past and Ongoing Projects Related with Pollution Control

The achievement status of the Decision 64 plan (Decision No. 64/2003/QD-TTg) is limited with an unsatisfied level as of 2008. Nevertheless, the nationwide implementation plan of Decision No. 64 has brought about such valuable opportunities where Vietnam experiences testing of various water pollution control approaches/systems as a policy enforcement instrument. The environment management sector can use such experiences to carry out policy enforcement in the future. Meanwhile, MONRE (under World Bank's assistance) is now implementing a "project for improving institutional capacity for water pollution control in Vietnam" to ensure the enforcement of environment-related laws and regulations on water pollution control. This project is remarkable from the viewpoint of: a) handling new approaches to encourage enterprises' self-supporting actions along with information disclosure, and b) producing a number of handbooks which are useful for sustainable implementation.

The Vietnam and Canada Environment Project (VCEP) with CIDA had been implemented for about a decade starting from the middle of 1990_s. MOSTE (the former ministry responsible for environment management) and MONRE which were in the starting phase of environment management had benefited in many aspects from VCEP. VCEP fulfilled significant roles the formulation of management basis in policy and implementation of water pollution control in Vietnam. Other projects assisted by foreign institutes (like PCDA with DANIDA, SEMLA with SIDA, etc.) also have contributed to the development and activation of water pollution control approaches. Despite such massive supports of foreign institutions, the environment management of Vietnam still lacks enough capacity to deal with various issues happening in actual fields.

5.2.3 Analysis of Existing Pollution Control Approaches

The study analyzes mechanisms and related activities of existing pollution control approaches and pertaining systems which Vietnam is applying (or will apply in the future) as common instruments for pollution control measures. As a result, numbers of fundamental weaknesses and constraints associated with existing pollution control approaches have been identified.

The amended LEP integrates almost all water pollution control approaches and pertaining systems necessary for actual policy enforcement. Hence, on the bases of the context of the amended LEP, this study categories pollution control approaches into: regulatory, economic, technical renovation, awareness raising and infrastructure development approach, furthermore, setting up numbers of pollution control systems pertaining to respective approaches, as follows:

Regulatory approach:	Environmental authorization and compliance, environmental inspection and check, administrative sanction and license granting.
Economic approach:	Wastewater fee, preferential loan, preferential land use and preferential tax.
Technical renovation approach:	Promotion of CP application, promotion of environment-related service and awarding of good practice.
Awareness raising approach:	Environmental performance rating, environmental information disclosure, and awareness raising and guiding for agricultural activities.
Infrastructure development approach:	Sewerage system development

Source: JICA Study Team

(1) Regulatory Approach

The existing regulatory approach (with the "command and control" type) in Vietnam is weak in regulating pollution discharge from pollution sources, thereby overlooking many and continuous noncompliance with the environmental regulations. This is caused mainly by lack of environmental awareness and sense of social responsibility of enterprises. At the same time, it is implied that the environment management sector cannot overcome such situation due to various reasons, like improper practices in the management and lack of institutional capacity, ambiguous decision-making by top layers, etc. Recently, collaborative inspection with the environmental police indicates some effects in enforcing inspection against rigid enterprises which are non-cooperative with the environment management.

(2) Economic Approach

Existing economic approach in Vietnam is still at the beginning stage with no remarkable effects to reduction of water pollution, leaving a number of challenges. Among others, the mechanism for wastewater fee needs to be modified to expand the collection coverage (especially for industrial wastewater) and to exert an economic incentive effect. At the same time, some localities need the strengthening of their institutional capacity to perform secure appraisal of wastewater fee. The preferential land use and tax have not been activated.

(3) Technical Renovation Approach

The technical renovation approach has not been so far incorporated into activities of the environment management sector in Vietnam, despite the emphatic stipulation in the amended LEP and other national policies. The promotion of CP technology has been carried out mainly by the Ministry of Industry and Trade (MOIT) and other ministries with assistance from foreign institutions. The main issue for the environment management sector is how to incorporate technical renovation approach into its activities, in combination with other pertinent systems.

(4) Public Awareness Raising Approach

Public awareness-raising approach is still under promotion in Vietnam. A number of pilot projects containing the environmental performance rating were tried in the past with the assistance of international institutions, but these have been not sustained. Now, VEA is once again making efforts to restart this system. Meanwhile, VEA has initiated publicizing a part of the environment information in some occasions, but such practices are assessed to lack consistent policy and strategy.

(5) Infrastructure Development Approach

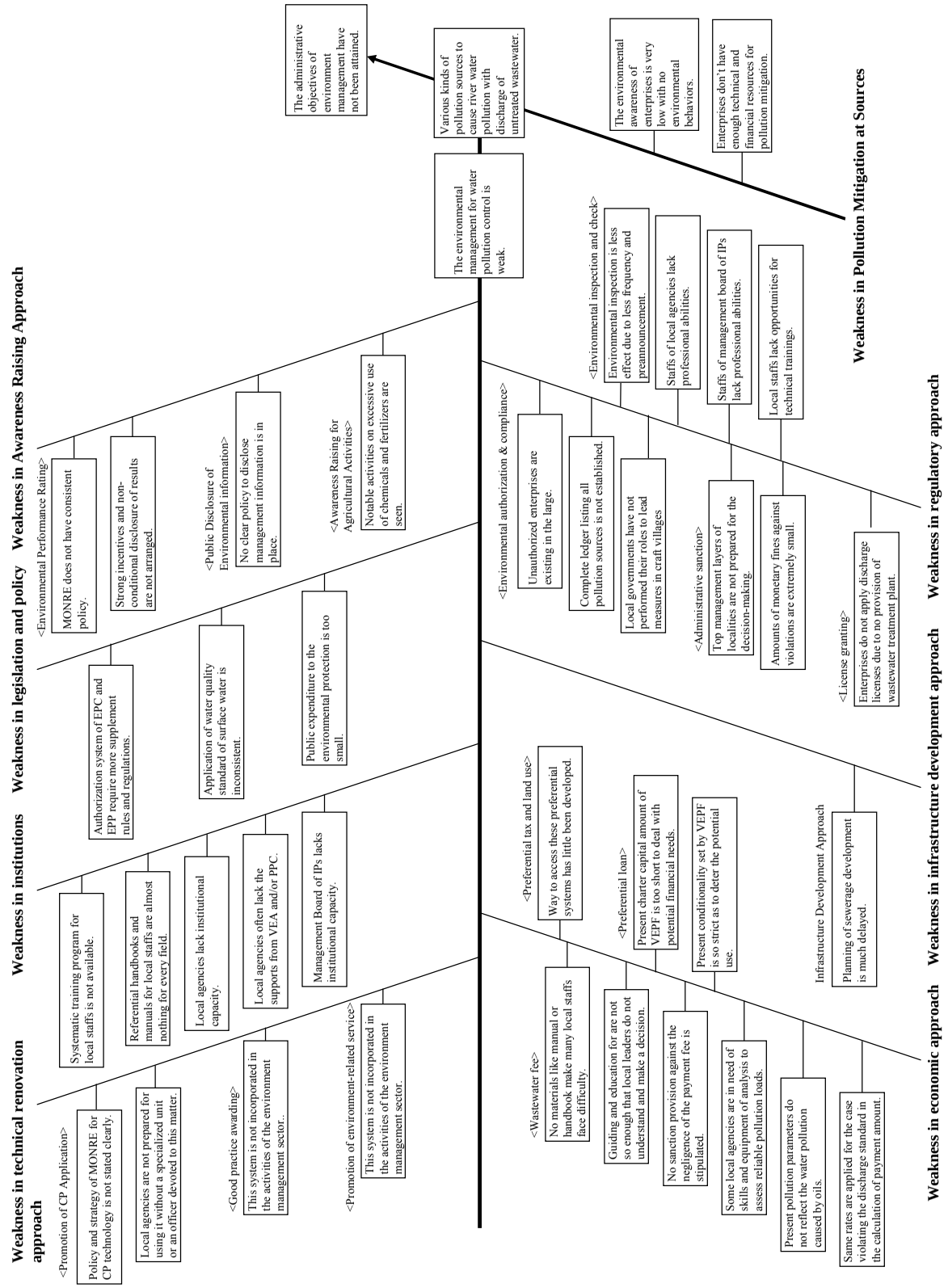
Incorporation of the infrastructure development approach into sewerage development is much delayed in Vietnam. Apart from the development target raised in several documents of the government's policy, there is no realistic and specific development plans in Vietnam. The challenge which the environment management sector is facing is how to start actions necessary for examining sewerage development plan in cooperation with the construction sector, in accordance with a budgetary scheme.

Besides the existing approaches in Vietnam, pollution control systems employed in other countries are studied for comparison with the ones used in Vietnam. An example is the Laguna Lake Development Authority (LLDA) in the Philippines, and of other different countries method on wastewater fee system; example of Indonesia's and the Philippines' environmental performance rating system; and example of Japan's, the Philippines' and Thailand's environment supervisor system.

5.2.4 Proposed Reinforcement Direction of Pollution Control Approaches

(1) Problem Analysis

Problem analysis, which was conducted by integrating challenges clarified before, has brought a series of issues in the reinforcement of pollution control approaches and pertinent systems. These issues, which are derived from the aspect of both pollution control approaches' objectives and of the concerned parties' roles, are extracted and identified. Figure 5.2-1 shows the problems identified in the analysis and the cause and effect relationship among them.



Source: JICA Study Team

Figure 5.2-2 Problem Analysis Tree for Water Pollution Control

(2) Prime Challenges in Water Pollution Control

The Prime Minister Decision No. 256/2003/QD-TTg (National Strategy for Environmental Protection until 2010 and Orientation toward 2020) has stated that environmental protection is crucial for the sustainable development of socio-economy in Vietnam. This national strategy has promulgated basic policies and guidelines for environmental protection, setting up suit of specific issues such as responses to increasing pollution loads, overcoming environmental deterioration and providing good quality environment to people. Also, said national strategy has advocated basic strategies towards the year of 2010 and 2020, accompanied by specific targets. In the reinforcement of water pollution control approaches, Vietnam environmental management sector should be called for pursuing the objectives and basic strategies set up in the national strategy.

Some 10 years till the year of 2020 have been phased into three (3) stages: the initial stage, the mid-term stage and the final stage. Based on the results of survey and examination on river water pollution and management in Output-3, prime challenges of water pollution control in each stage may be characterized, as follows:

Initial stage: (Expeditious response to worsening water environment)	To prevent worsening of water environment by taking expeditious responses against serious and major pollution sources. To this end, thorough pollution management should be taken, by means of an upgraded regulatory approach and a part of systems in economic approach with strengthened enforcement capacity.
Mid-term stage: (Maintaining of water environment quality meeting with the National Standards)	To maintain the water environment quality to meet the national standards by thoroughly managing all pollution sources which will discharge increasing pollution loads due to the socio-economic development. To this end, the environment management sector should achieve effective and efficient pollution control nationwide, by ensuring strengthened institutional management capacity both at the central and local levels, and by means of newly incorporated pollution control approaches.
Final stage: (Improvement of water environment with socialized environment management)	To establish high-level water pollution control so as to respond to increasing and diversified pollution loads which could be caused by further development of the socio-economy. To this end, socialized environment management should be realized, accompanied by self-supporting management, close cooperation among the environment management sector, pollution generators and common citizens, and application of diverse pollution control approaches.

Source: JICA Study Team

(3) Purpose of Reinforcement

In developing the reinforcement direction to respond to prime challenges as a sustained initiative (divided into three stages), the JST proposes to lay down three basic principles, as follows:

Policy mix principle:

The policy mix principle implies that Vietnam water pollution control mobilizes diverse pollution control approaches (not just a single approach). For the moment, the regulatory approach is positioned to be utilized as the main tool. However it is increasingly important to activate and combine different approaches to complement each other for realizing the “carrot and stick” method.

Participatory principle:

Signifies that Vietnam water pollution control incorporates participatory principle involving all related sectors like: pollution generators, general citizens and mass media as well as environment management agencies.

Interactive cooperation principle:

Implies that Vietnam water pollution control forms and takes advantage of the interactive cooperation among environment management agencies at all levels (VEA, PPCs, DONREs, district divisions of NRE, communes, etc.).

Purpose of reinforcement direction, namely the objective of the reinforcement, has been proposed, based on three (3) basic principles:

> *Purpose of reinforcement:*
> To realize participatory water pollution control in interactive cooperation among the environment management agencies at all levels by mobilizing activated and mixed pollution control approaches.

(4) Framework of Reinforcement Direction

As already described, almost all of the pollution control approaches pertaining to control systems are enumerated in the amended LEP, as essential instrument necessary for pollution control in Vietnam. Problems which the Vietnamese environmental sector is facing now are that some pollution control approaches and systems are either very weak or not activated in terms of enforcement. Therefore, the reinforcement of pollution control approaches requires appropriate measures for activation and/or strengthening rather than selection with the examination of applicability.

To attain the purpose of reinforcement direction, the following four specific measures are worked out and proposed:

Measure 1: To strengthen the enforcement capacity and the supporting systems of water pollution control.

Measure 1 is concerned with the enhancement of the mechanism of pollution control system, related management tools and the local agencies' implementation capacity mainly pertaining to the regulatory approach. As seen from the present inferior provision of environmental mitigation measures at pollution sources, the existing regulatory system with the type of command and control has been facing various difficulties in enforcement in the frontline.

Measure 1 is aimed to establish a secure mechanism of pollution control system and related management tools necessary for implementation. It also aims to increase the enforcement capacity of local management agencies (DONREs, district divisions of NRE, etc.) in working in the frontline in terms of general management knowledge and skills, and water quality monitoring in the laboratory. Consequently, VEA is expected to play important roles in organizing a technical training unit and in providing relevant technology transfer to local management agencies. Furthermore, PPCs are requested to fulfill their roles in making decisions regarding the procurement of laboratory facilities and others.

Measure 2: To strengthen wastewater fee system and integrated supporting system.

The Vietnam environmental management sector has made massive efforts to launch and operate economic pollution control systems with wastewater fee since 2003. Now, this wastewater fee system is becoming a characteristic policy instrument for environment management in Vietnam. It is however assessed that the existing wastewater fee does not contribute much in granting economic incentives (or disincentives) to enterprises required to pay industrial wastewater, and hence, the coverage for industrial wastewater fee is constrained. In this measure, some modifications in the present mechanism are intended to complement the system.

Together, the technical instruction and training especially related with the appraisal of discharged pollution load is made for local management agencies to operate this system appropriately. The basic function of VEPF is to provide enterprises soft loan for environmental protection, utilizing the financial resources coming from the wastewater fee and other sources.

Measure 2 aims to build up the lending capacity of VEPF by increasing its charter capital and by some modifications on the conditionality, so that enterprises with pollution facilities can access and use it with ease. Also, Measure 2 includes the establishment of integrated supporting system structured by technical as well as financial provisions, especially focusing on craft village industries. The basic aim of Measure 2 is to establish ensured financial recycling for the environmental protection, revolving around the wastewater fee system.

Measure 3: To promote self- supervising environment management by enterprises.

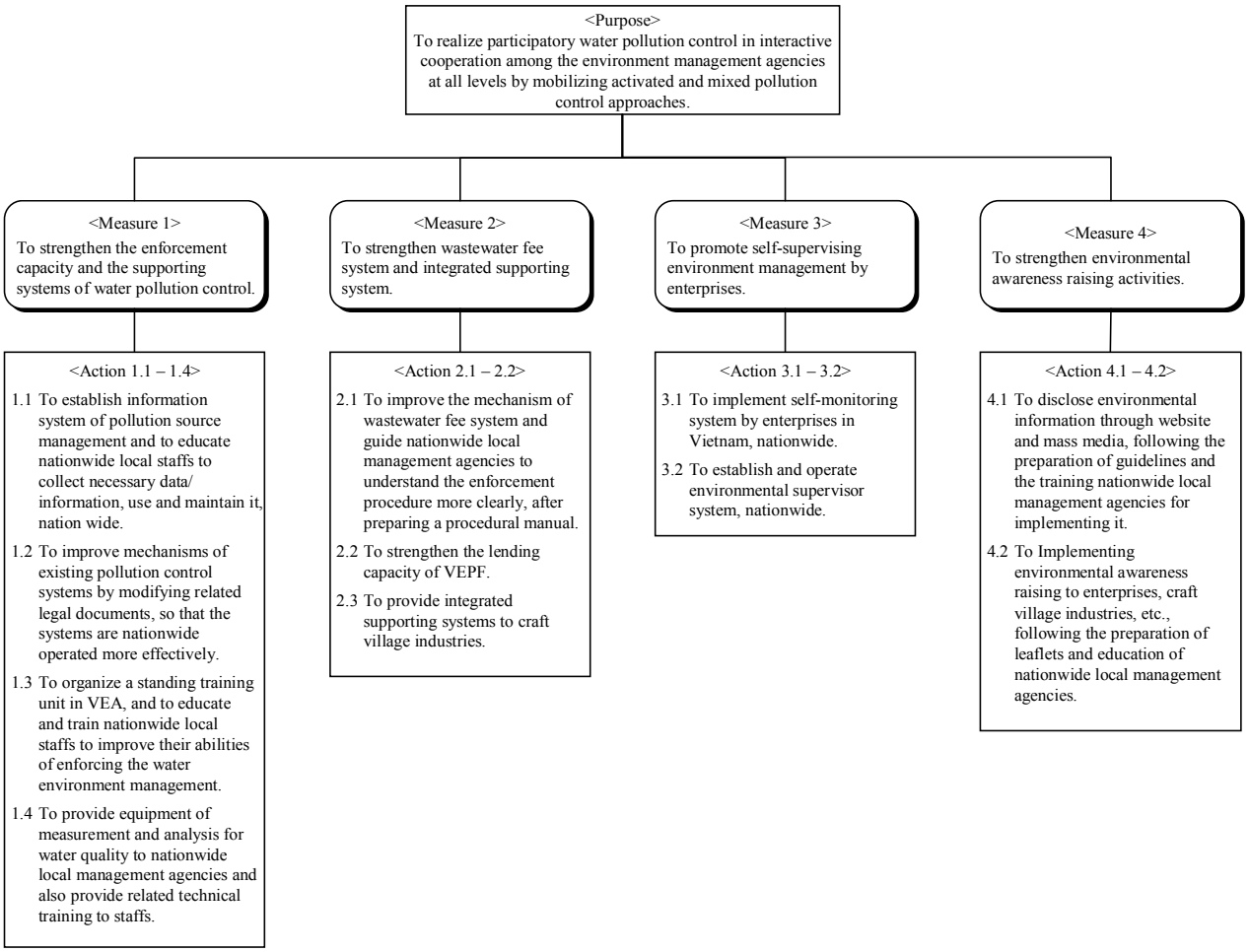
According to the amended LEP, enterprises have the responsibility for the monitoring by themselves. However, practices of the self-monitoring by enterprises are currently very modest, as seen from very a few submissions of the self-monitoring reports. Also, it has been known that most of enterprises do not have appropriate organization and personnel necessary for managing their pollution facilities. In such view, the Measure 3 aims to promote self-supporting environment management, by launching self-monitoring system and environmental supervisor system.

In Vietnam, several pilot projects of self-monitoring were experienced in the past but they have not continued. Now, the VEA project for improving institutional capacity for water pollution supported by WB/IDF is pushing forward with another scheme. By reflecting the results of these projects, some modifications should be incorporated to ensure and sustain the promotion of self-monitoring system, nationwide, before the implementation. The introduction of environmental supervisor system has been raised, following the success exempla in Japan, Thailand, etc. In this scheme, it is important that appropriate mechanism to meet the situation in Vietnam be studied and conceptualized through the basic survey and planning as the first step, before going into the implementation.

Measure 4: To strengthen environmental awareness raising activities.

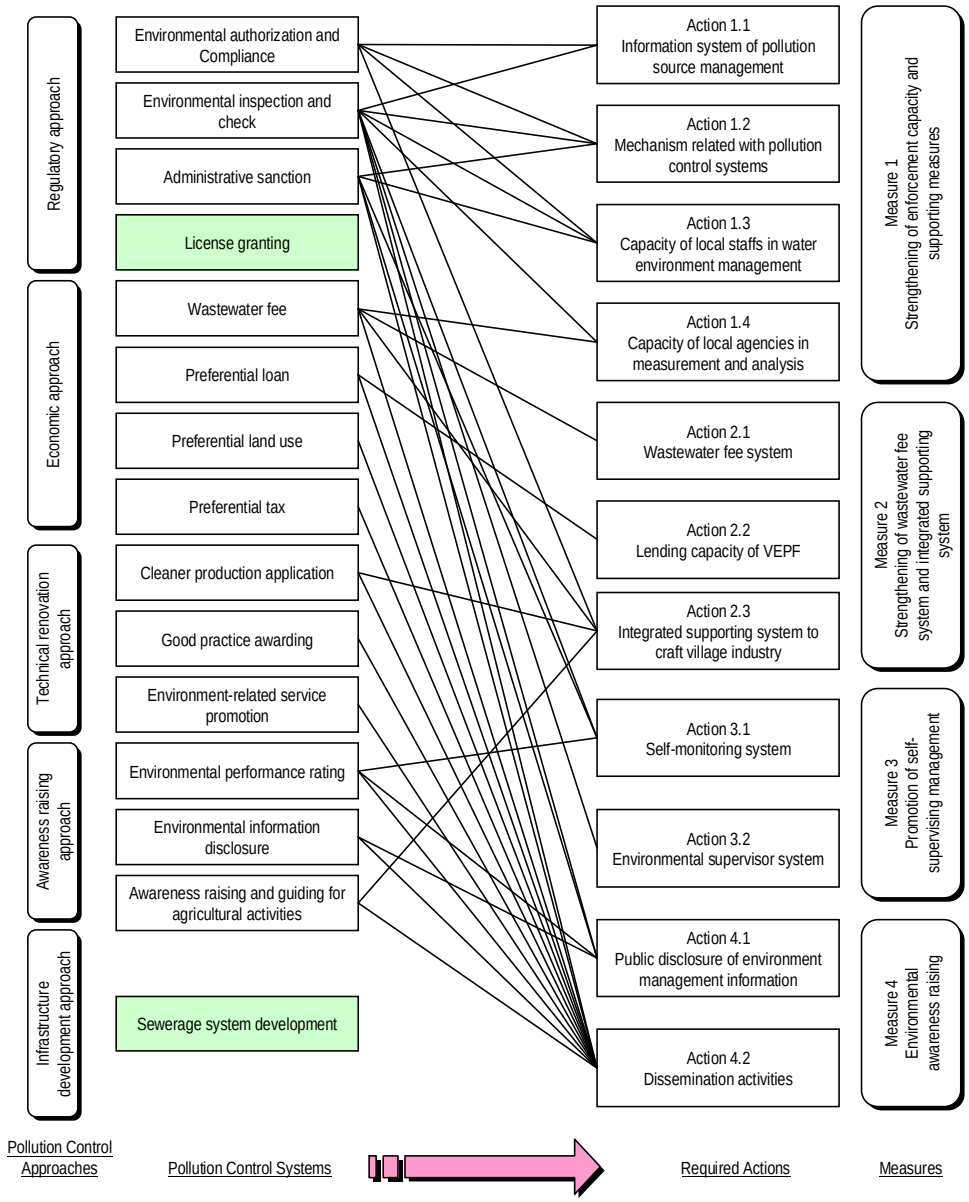
Currently, the publication of certain range of environmental information has been partly carried out at times but it is not in the unified and systematic way. Meanwhile, stakeholders (like enterprises, farmers and general citizens) are not endowed with the opportunities to get environment-related information like legal regulations, environment mitigation measures, etc. Measure 4 is aiming to publicize rating result of environmental performance and other management information, and to disseminate environment-related information to stakeholders, by way of their environmental awareness raising.

In respect of disclosure of environmental information, the results of environmental performance rating as well as environment management information are subject to the publication. To this end, guidelines are prepared first, followed by the trainings for local management agencies for the publication through mass media, website, etc. With respect to environmental awareness raising, the preparation of leaflets for concerned fields are performed, first. This is followed by trainings for specialized units or designated officers of local agencies before actual activities. By using the analysis result of existing pollution control systems, actions to be required for generating these four (4) measures have been thoroughly considered by means of the objective analysis of the Logical Framework Analysis (LFA) method. The existing pollution control systems pertaining respective approaches are designed to be reinforced with incorporated into respective proposed actions, as shown in Figure 5.2-2. The existing pollution control systems pertaining respective approaches are designed to be reinforced with incorporated into respective proposed actions, as shown in Figure 5.2-3.



Source: JICA Study Team

Figure 5.2- 3 Proposed Direction for Reinforcement of Water Pollution Control



Source: JICA Study Team

Figure 5.2-4 Incorporation of Pollution Control Systems into Proposed Actions

(5) Proposed Actions for Reinforcement

Component actions to realize the purpose of pollution control reinforcement have been examined and designed. Detailed descriptions of these proposed actions are enumerated in Table 5.2-1.

Table 5.2-1 Proposed Actions for Reinforcement of Water Pollution Control Approaches

Action 1.1: Information System of Pollution Source Management	
Objective	To establish information system of pollution source management including management ledger of pollution facilities after educating nationwide local staffs to collect necessary data/information, use and maintain it.
Justification:	Though most local management agencies have the list of enterprises with some pollution facilities, the lists cannot be used for pollution source management. Because, the existing lists are not imperfect as: a) enterprises which are not authorized by either EIA or EPC are not listed in the list; and b) data/information in the list are insufficient for management objectives. Local management agencies need the management ledger of pollution facilities which covers all of enterprises with pollution facilities and filled by data/information necessary for management objectives, so that they are supported with secure data/information of pollution sources. The management ledger of pollution facilities developed is expanded to encompass the whole river basin area, so that integrated management in the river basin is ensured as stated in Article 8 of Decree 120/2008/HD-CP. This action will be carried out by using the result of Output 2 (pollution source survey) of the JICA Study.
Component activities:	1) Basic conception on information system of pollution source management. VEA re-examines the purpose, content, data/information to be collected, method for data/information collection, method to maintain, etc., following the output of the JICA Study on the pollution source inventory survey. 2) Development of database and management ledger of pollution facilities VEA develops the form of the database of collected data/information. 3) Education and training of local staffs After establishing the time schedule, VEA educates and trains staffs of local agencies on data/information collection work, maintenance, how to use, etc., by using the manuals developed in the JICA Study. 4) Collection of data/information and preparation of database Nationwide DONREs collect necessary data/information by means of various methods and to prepare and establish database by inputting them.
Main required inputs:	Man-powers, finance and computer (with pertaining apparatus and soft-wares)
Leading unit:	Unit in VEA
Participating unit:	DONREs, nationwide.
Action 1.2: Mechanisms Related with Pollution Control Systems	
Objective	To improve mechanisms of existing pollution control systems by modifying related legal documents, so that the regulatory approach is nationwide operated more effectively.
Justification:	In the scope of the regulation systems pertaining to regulatory approach, Vietnam has established series of related regulations. Though they are employed as prime instruments in the water environment management, they are insufficient to deal with current problems in Vietnam. To make the regulatory management more effective, some modifications are raised, as following points: a) carrying out of environmental inspection, b) monetary fines in administrative sanction, c) appraisal of EPC, and d) certification of EPP.
Component activities:	1) Implementation of environmental inspection without pre-announcement Present regulations concerned specify that environmental inspection should be carried out by placing a pre-announcement to subject entities as a rule. This pre-announcement enables to entities to cover up the environmental incompliance and violations. Hence this should be changed to enable the management agencies to make the environmental inspection without pre-announcement, so that management agencies can carry out inspection when required. 2) Monetary fines in administrative sanctions Decree No. 81/2006/ND-CP stipulates monetary fines against different administrative violations. However, the amounts specified in the decree are considered to be so extremely small that it cannot deter repeated violations. The amount of monetary fines should be amended to attain their management objective. 3) Appraisal of EPC According to the regulations, enterprises which are not subject to EIA must get the registration of EPC in districts. District officers concerned must register submitted EPC, after appraise it. Because distinct criteria are not available at present and, at the same time, most of officers lack specialized knowledge and experience, it is considered for officers to have difficulty in appraising it. Appropriate criteria and/or some guidelines should be provided to ensure the appraisal of EPC. 4) Certification of EPP Decree No. 80/2008/ND-CP requires that enterprises which are not authorized by EIA or EPC and started the operation before the effect of the amended LEP (July 2006) be certified as environmental protection project (EPP). Expectedly, this EPP system enables local management agencies to make a complete authorization of pollution facilities. As of today, it is reported that only a few enterprises have completed in submitting this till now. To ensure the implementation of this EPP system, appropriate penalty provisions against enterprise which do not submit the application till the set period should be arranged. 5) Guiding local management agencies Upon completing the modifications of legal documents, the meeting and training are held to guide and ensure local management agencies' enforcement.
Main required inputs:	Manpower and finance
Leading unit:	Unit in VEA
Participating unit:	DONREs, district divisions of NRE, nationwide

Action 1.3: Capacity of Local Staffs in Water Environment Management	
Objective	To organize a standing training unit in VEA, and to educate and train nationwide local staffs to improve their abilities of enforcing the water environment management.
Justification:	In the baseline survey made by JICA Study Team, it has been revealed that most assigned staffs in local management agencies are deprived of specialized knowledge and skills necessary for enforcing pollution control systems. While district divisions of NRE are assigned for important tasks like the registration of EPC and environmental inspection, specialized abilities of their staffs were assessed to be not sufficient. Also, it has been identified that many of them has no technical background suitable for the environment management and, further, they are not endowed with opportunities for receiving training. Meanwhile, VEA which is positioned to a top specialized agency in Vietnam has no systematic program and a specialized unit to provide trainings for local staffs, now. Accordingly, it is concluded that Vietnam has no dependable training system. Hence, this action is to propose a sustainable training system for the water environment management in Vietnam.
Component activities:	1) Organizing of a standing training unit in VEA VEA organizes a standing unit devoted to the training of local staffs for the environment management, mustering specialized officers in related field. 2) Surveying and analyzing of needs of technical training The organized unit conducts the survey on training needs, and analyzes and clarifies the categories and fields necessary for training, and the number of staffs requiring the trainings. 3) Formulation of training plan The training plan covering the whole of Vietnam which includes the contents, subject trainees, timeframe, necessary finances, etc. is formulated. Based on the baseline survey, the technical trainings are foreseen to take place on: regulation of pollution control, general knowledge on water pollution and possible measures, procedure and methods of environmental inspection and check, regulations on administrative sanctions, regulations and rules of wastewater fee system, etc. 4) Preparation of training program and texts Training program including specific content and curriculum, and texts to be used for the trainings are prepared. 5) Carrying out of trainers' training Trainers' trainings to ensure the quality of trainings take place, according to need. 6) Implementation of technical training Technical trainings led by the unit in charge take place in Hanoi City and other appropriate places, at scheduled periodical frequencies.
Main required inputs:	Manpower and finance
Leading unit:	Unit to be organized in VEA
Participating unit:	Staffs of DONREs, of district division of NRE, and of communes, nationwide.
Action 1.4: Capacity of Local Agencies in Measurement and Analysis	
Objective	To establish water quality monitoring system nationwide, by providing equipment of measurement and analysis for water quality to nationwide local management agencies and also related technical training to staffs.
Justification:	This action is to improve the capacity of measurement and analysis in local management agencies. The measurement and analysis of water quality are essential for appropriately performing the water pollution control. It is assessed that various management works are not performed adequately due to lack of laboratory facilities, currently. According to the report, only 17 % of nationwide DONREs (64 locations) are equipped with their own laboratory facilities as of 2006. This implies that many DONREs are hindered from exercising their works requiring the water quality data. Among others, compliance check of wastewater against the discharge standard and appraisal of discharged pollution loads for calculating wastewater fee require water quality values to make different decisions depend on monitoring results. Things are worsening in the case of district divisions of NRE. Although their tasks include the environmental inspection and check at the sites for enterprises subject to EPC registration, almost all divisions have no measurement equipment. Even simple potable measurement apparatus should make their management works much more effective and efficient. As seen from the mentioned above, the establishment of laboratory equipment for measurement and analysis of water quality is an important issue for ensuring water environment management by local environment management agencies.
Component activities:	1) Assessment of present status of laboratory equipment and necessities The assessment of present status of laboratory equipment and necessities of measurement and analysis of water quality in DONREs and districts takes place to examine the need of laboratory equipment. 2) Provision of laboratory equipment and potable apparatus The consultations with PPCs and district PCs are taken on how to deal with this account from view point of finances. Based on the consulted financial schemes, lab equipment and potable apparatus are provided to DONREs and districts. 3) Technical training of measurement and analysis In the cooperation with concerned units in MOST, VEA leads the planning and implementation of technical training for staffs of DONREs and of district NRE divisions.
Main required inputs:	Manpower, finance and laboratory equipment and potable apparatus of water quality measurement and analysis.
Leading unit:	VEA in the cooperation with PPCs, district PCs and MOST.
Participating unit:	Staffs of DONREs and of district NRE divisions, nationwide.
Action 2.1: Wastewater Fee System	
Objective	To improve the mechanism of wastewater fee system and guide nationwide local management staff to understand the enforcement procedure more clearly, after preparing a procedural manual.
Justification:	The wastewater fee system is a prime instrument to be used for the water pollution control in Vietnam. However, the

	system has now been suffering from low collection coverage, especially for industrial wastewater, since a number of inefficient provisions in the mechanism exist. This is also because of the lack of capacity and some mislead staff in the frontline side. The fee rates in Vietnam are considered to be at a very low level, as seen in the following comparison with that of LLDA in the Philippines. This calculation is made on the assumption that wastewater discharge is 1,000 m^3/day (365 days operation a year), and BOD and COD of discharged wastewater are 20 mg/l and 50 mg/l, respectively, without the content of heavy metals. - Fees in LLDA in the Philippines: US$ 1,160 per year (US$ 1 = Peso 46.97) - Fee in Vietnam: US$ 313 per year (US$ 1 = VND 17, 484) The payment in Vietnam is very small with only 27 % of that in the Philippines. It should be considered that the collected fees are financial sources of expenses for the environment countermeasures through VEPF. As such, the fee rate should be re-examined and increased so that the system can offer stronger economic incentives to pollution generators. In addition, the system of LLDA imposes huge penalty to violators of the effluent standard, with US$ 106 a day coming up to some US$39,000 a year. While in Vietnam, there is no provision to the water quality beyond the standard, incorporation of punitive or compensation conception should be re-examined. The serious issues for industrial wastewater fee include the fact that many enterprises do not pay wastewater fees. In response to this, some sanction should be taken in the regulation against such negligence. There is no parameter of oil in the pollutant list of wastewater fee. Therefore, oil discharging enterprises like those located in Thai Nguyen Province do not need to pay, despite main pollution source in the region. Hence, the pollutant list of wastewater fee should be reconsidered. Meanwhile, the regulation of wastewater fee stipulates that all enterprises must pay fees, regardless of their sizes. Given the existence of a large number of small-scale industries like craft-village industries, this causes large workloads to staffs concerned without generating significant amount of collection. Hence, a minimum discharge (for example, 10 m^3/day) subject to exemption from payment should be set. These issues related to the wastewater fee system are packaged in this action.
Component activities:	1) Re-examination and modification of present mechanism The weaknesses mentioned above (amount of fee rate, punitive fee imposition for wastewater beyond the standard, sanction against no payers, fee for oil pollution and setting of minimum discharge) are re-examined and modified. 2) Manual for operation of wastewater fee system As other administration practices in Vietnam, MONRE had not prepared and issued any manual in order that local staff can correctly understand and enforce this system. From this view, MONRE prepares some unified and precise manual including how to appraise pollution loads and others, not only depending on the decrees concerned. 3) Implementation of training Trainings for local management staff on appraisal of discharged pollution loads and others issues related to wastewater fees led by MONRE takes place in Hanoi City and other appropriate places.
Main required inputs:	Manpower
Leading unit:	Unit in VEA
Participating unit:	Nationwide DONREs
Action 2.2: Lending Capacity of VEPF	
Objective	To strengthen the lending function of VEPF to accelerate environmental countermeasures at pollution sources.
Justification:	The Vietnam Government gives VEPF the role as a main financial supporting agency for environmental protection measures. Up to now, VEPF has played certain roles in the environmental protection measures with Decision No. 64/2003/QD-TTg, providing soft loans to five (5) projects borrowed a total of 17.5 billion VND as of 2005. However, the present lending capacity of VEPF is so limited that it forces possible many enterprises to fall in difficulty in using the finance. Also, the conditionality for the financings is too rigid for most enterprises in Vietnam. One of major reasons why the provision of necessary wastewater treatment is very low is that they are not endowed with financial sources. From that reason, it is very significant to increase the lending capacity of VEPF from the standpoint of the promotion of environmental protection measure. It is reported that the present rate of the provision of wastewater treatment plant are only 10 to 30 % and the urgent necessity in the pollution control in Vietnam is to increase this rate, drastically. To this end, it is considered that the strengthening of VEPF's lending capacity is one of the most important keys.
Component activities:	1) Increase of charter capital Just recently, the total charter capital of VEPF has been increased into 500 billion VND. Nevertheless, its charter capital it appears to be overwhelmingly modest as compared with total needs. VEPF is strengthened in its lending capacity, by pursuing more diverse finances from different lending sources including foreign government aids. 2) Moderation of the conditionality for financing Present VEPF's conditionality for mortgage, refund period, etc are very rigid for many enterprises in Vietnam. Some moderation is incorporated to extend its finance users.
Main required inputs:	Manpower and finance
Leading unit:	VEPF, Unit in VEA
Participating unit:	-
Action 2.3: Integrated Supporting System to Craft Village Industries	
Objective	To provide integrated supporting system to craft village industries by establishing integrated supporting agency.
Justification:	Notable characteristics of industries in Vietnam are that large numbers of concentrated handicraft manufacturing are operating over the whole country. There are 1,450 craft villages throughout the country, providing for more than 10 million jobs, or 29 % of the rural workforce. The Government has been eagerly promoting the development of craft villages as part of an important strategy for promoting rural economic development, increasing household income, and improving living standards in rural areas where 75 % of Vietnam's population still reside.

	The environment protection and management for craft village has been encountering many difficulties, because most industries there are small-scale. Their resources for taking environmental protection measure are very limited financially and technically. Hence, most craft village industries are using outdated equipment, and they are commonly discharging wastewater without treatment, causing serious pollution problems in the region. Meanwhile, the amended LEP (Article 38) stipulates the roles of the State management agencies associated with craft village, as follows: - The State encourages the development of handicraft villages sharing a common system of environmental protection infrastructure facilities; and - Provincial people's committees are responsible for directing, for obtaining statistics on, and for assessing the pollution levels in handicraft villages within their localities and for preparing a plan for dealing with environmental pollution in such handicraft villages by different measures. As mentioned above, the State and PPCs are required to provide appropriate supporting for craft villages' environment protection. However, effective supporting measures have little been taken till today. This action is to provide integrated supporting system which mobilizes economic incentives, technical renovations and project implementation of environmental protection, by forming a special agency devoted to the supporting of craft village industries. This a special supporting agency works for promoting environmental protection measures in nationwide craft village industries, providing diverse incentives and project implementation (like communal wastewater treatment plant and others). Hence, major roles of implementing agency include: a) surveying and consulting, b) planning and designing environmental protection measure (communal wastewater treatment plant, cleaner production, etc.), c) constructing necessary environmental protection facilities, and d) providing soft loan. For reference, in Japan, the approach of integrated supporting system as mentioned above was successfully applied to promote pollution mitigation measures especially to small-scale industry, by organizing the "Japan Environment Corporation" in 1970s.
Component activities:	1) Inauguration of integrated supporting agency Under the auspices of MONRE, a special supporting agency devoted to the supporting of craft village industries is organized, with the establishment of implementing rules and regulations. Core functions of the agency include surveying, consulting, planning, designing, construction of cleaner production and communal wastewater treatment plant and financing. This special supporting agency can be established as the shape of expanding the function of VEPF. 2) Survey of supporting needs The needs of integrated supporting are clarified through the survey of environmental and financial situations of nationwide craft villages. 3) Implementation of integrated supporting project Improvement by applying cleaner production technologies and/or by constructing wastewater treatment facilities necessary for environmental protection is consulted under the contract with certain selected craft villages. Then planning, designing and construction are performed by the special supporting agency, and at the same time, soft loan for the capital investment is provided to the association formed by craft village industries. The constructed facilities are handed over to the association and then, the association starts to refund the capital expenses to the special agency.
Main required inputs:	Manpower and finance
Leading unit:	VEA, VEPF and related ministries
Participating unit:	Craft village industries
Action 3.1: Self-Monitoring System	
Objective	To implement self-monitoring system by enterprises in Vietnam, nationwide.
Justification:	In the past, a number of pilot project including self-monitoring have been tried in Ho Chi Minh City, Hanoi City, Hai Phong City and Da Nang City. Despite such efforts, the self-monitoring system of environmental performance has not settled down and not been diffused in Vietnam. Now, VEA has been again pushing forward with self-monitoring scheme in the Project of Improving Institutional Capacity for Water Pollution Control in Vietnam supported by WB/IDF, since 2007. This project is accompanied by environmental performance rating and public disclosure (dealt with Action 4.1) as well as self-monitoring. From a long-term perspective, it is considered that the self-monitoring scheme is an essential management tool for Vietnam. It has been known that, at present, most of enterprises do not have necessary environmental protection measure like wastewater treatment plant and their environmental awareness is assessed to be very low. Under such circumstances, it appears that strong incentives and obligatory information disclosure must be arranged to ensure their participation in this scheme and to open their performance result. Therefore, the mechanism of self-monitoring system of environmental performance is subject to the careful examination, based on the result of the VEA project which is ongoing now.
Component activities:	1) Forming the mechanism of self-monitoring system Based on the result of the VEA project going on now, the mechanism of self-monitoring systems for environmental performance will be re-examined and formed, taking account of: incentive setting for good performance, sanctions for bad performance, obligatory disclosure of rating result, etc. 2) Preparation of handbook The VEA project has already prepared the handbook associated with the operation and management of self-monitoring system of environmental performance. After reviewing this, the handbook on newly formed mechanism should be formulated. 3) Provision of measurement equipment of water quality Simple equipment like potable apparatus is provided to participant enterprises, if necessary. 4) Training of staffs of DONREs The technical trainings by VEA take place to transfer and instruct the standard procedure on self-monitoring of environmental performance for staffs of DONREs. 5) Implementation of self-monitoring nationwide The implementation of self-monitoring system of environmental performance is nationwide launched and operated under the management of DONREs.

Main required inputs:	Manpower, potable apparatus for water quality measurement.
Leading unit:	VEA in the preparation phase and nationwide DONREs.
Participating unit:	Enterprises
Action 3.2: Environmental Supervisor System	
Objective	To establish and operate environmental supervisor system, nationwide.
Justification:	In this Action, the introduction of environmental supervisor system is proposed. This is because the environmental supervisor system may enhances the sense of social responsibility of enterprises, though the amended LEP in Vietnam not enumerates it in its requirement, It is widely reported that environmental awareness and sense of social responsibility of enterprises in Vietnam are very low. In addition, the result of the baseline survey shows that most enterprises, even in large-scale ones, do not have a specialized organization devoted to the operation and maintenance of the environmental protection facilities. It is implied that no responsible function is one of hindrances to deter enterprises from paying the environmental considerations to the problems generated by them. As founded in other countries (Japan, Thailand and the Philippines), assigning specialized function in factory contributes much to not only appropriate operations of environmental protection facilities but also enhancement of the environmental awareness and relevant environmental technology and knowledge of the whole enterprise. As such, this system is expected to improve environmental protection measures in Vietnam. From that reason, the introduction of environmental supervisor system to Vietnam is raised as a long-term initiative. The essence of environmental supervisor system is comprised of: a) granting national certification to successfully pass official examination, and b) regulating enterprises to obligatorily setup a specialized unit with a certified supervisor.
Component activities:	1) Design of mechanism and basic planning The baseline survey is carried out precisely to clarify and analyze the existing status and issues of the organization, operation & maintenance, etc. of enterprises. After examining the feasibility of the application of environmental supervisor system to Vietnam, the mechanism and necessary supporting measures are designed and basic schedule is planned. 2) Setting up of unit in charge A unit devoted to the establishment and execution of the environmental supervisor system is set up in VEA. 3) Formulation of executive plan The executive plan is formulated to set up the road map showing preparatory works, start-up and operation of the system. 4) Preparation and implementation The environmental supervisor system is started and operated, nation wide.
Main required inputs:	Manpower and finance
Leading unit:	Unit in VEA
Participating unit:	MOST, academic institutes, etc.
Action 4.1: Public Disclosure of Environment Management Information	
Objective	To disclose environmental information through website and mass media, following the preparation of guidelines and the trainings for nationwide local management agencies for implementing it.
Justification:	The main purpose of environmental information disclosure is to raise the environmental awareness of general citizens, to press environmental compliance of enterprises, and to encourage good practices.. Till now, environmental management information has been partly publicized in a number of ways in Vietnam. For example, MONRE publicizes periodically the State of the Environment on its website and the water pollution case of Vedan is often opened through newspaper, TV, etc. However, the present publications are only sporadic and the coverage of opened information is limited to only the general characters. This action intends to disclose specific data/information on environment management like: status of environmental compliance, performance rating, and inspection result. The information disclosure is carried out through not only mass media, and also other opportunities like environment-related forum. This action includes the development of guidelines for implementation and the training for local management agencies.
Component activities:	1) Preparation of guidelines The guidelines showing criteria, procedural method, etc. for information disclosure are prepared in the fields of: a) environmental performance rating, b) good practice awarding, and c) environment management information. In respect of item a), the VEA project for improving institutional capacity for water pollution control in Vietnam has been preparing a guideline and this is reviewed and used. 2) Training of staffs The technical trainings take place to transfer and instruct the standard procedures and necessary advices to staffs of local management agencies. 3) Implementation of environmental performance rating and good practice awarding. Based using the guideline, DONREs nationwide implement environmental performance rating, by processing the result of self-monitoring and also implement the selection of good practice winners by gathering data/information. 4) Implementation of environmental information disclosure DONREs implement environmental information disclosure for: a) environmental performance rating, b) good practice awarding winner, and c) environment management information, through mass media and websites.
Main required inputs:	Manpower and finance.
Leading unit:	Unit in VEA and nationwide DONREs
Participating unit:	-

Action 4.2: Environmental Dissemination Activities	
Objective	To implement environmental awareness raising to enterprises, craft village industries, etc., following the preparation of leaflets and education of local management agencies.
Justification:	It is the fact that the environmental awareness of stakeholders (enterprises, craft village industries, farmers, etc.) in Vietnam is very low. Hence, one of inevitable challenges for the environment management sector is how to raise their environmental awareness. Together, it is assessed that enterprise and craft village industries require information like: environmental regulations, application of cleaner production, application of EMS, access method to preferential loan, preferential land use, preferential tax and service provider associated with environmental protection measures. Meanwhile, farmers should be provided with information like: how to use and storage chemicals appropriately and how to use fertilizers in the environment-friendly way. This action starts with the preparation of leaflets necessary for dissemination. Following the trainings for local management agencies, local management agencies implement the dissemination in the region. DONREs are required to organize a specialized unit devoted to the dissemination in this action.
Component activities:	1) Preparation of dissemination leaflet Concerned unit in VEA prepares necessary leaflet, like: a) environmental regulations, b) application of cleaner production, c) application of EMS, d) access method to preferential loan, e) access method to preferential land use, f) access method to preferential tax, g) information on service provider associated with environmental protection measures, and h) utilization of chemicals and fertilizer. VEA needs to cooperate with the agriculture sector (under MARD) in preparing leaflets for chemicals and fertilizers. The VEA project for improving institutional capacity for water pollution control in Vietnam has been preparing handbooks for cleaner production and access method to preferential loan. These outputs can be used after reviewing. 2) Setting of specialized unit in charge of dissemination DONREs are required to organize a specialized unit devoted to the dissemination in this action. District divisions of NRE are required to designate officers devoted to this matter. 3) Training for local management agencies The training for local management agencies (nationwide DONREs and district divisions of NRE) is held to transfer the content of leaflets and to instruct how to push forward with the dissemination. 4) Implementation of dissemination The specialized unit of DONREs and officers of district divisions of NRE carry out the dissemination, following the implementing plan made by them.
Main required inputs:	Manpower and finance
Leading unit:	Unit in VEA, partly in the cooperation with MARD, nationwide DONREs and district divisions of NRE.
Participating unit:	Enterprises, craft village industries and farmers

Source: JICA Study Team

(6) Timeframe of Reinforcement Action

The proposed reinforcement direction is not of a character with an executive project plan precisely elaborated including the quantitative aspect, but is an attempt which indicates the guiding direction of reinforcement for water pollution control approaches in the future. Hence, instead of a precise time schedule, only indicative framework of timeline has been discussed in the period of ten years with three stages, as shown in Figure 5.2-4. Among the proposed actions, some which cover all 64 provinces will take a long time. Therefore, it is proposed that such actions be implemented according to the priority order, determined based on geographical urgencies.

Because the reinforcement covers the whole Vietnam, it requires a large amount of resources (human, financial, facilities/equipment, etc.) and certain significant time. Hence, actual required time for the reinforcement should be examined, based on the intended achievement degree and allowable input of resources.

With the three stages corresponding to some ten years towards 2020, each stage in the indicative timeframe may be outlined through the following characteristics, from the viewpoint of pollution control approaches:

a) Initial stage (expeditious response to worsening water environment)

Thorough pollution management will be taken against major and serious pollution sources. To this end, regulatory approach (based on "command and control") and a part of systems in economic approach (wastewater fee and preferential loan) should be strengthened as prime policy enforcement tools.

b) Mid-term stage (maintaining water environment quality in accordance with the national standards)

All pollution sources which will discharge increasing pollution loads along the socio-economic development areas are managed through the national standards. To this end, regulatory and economic approaches with sufficient management capacity, both at the central and local levels should be established and operated to ensure effective and efficient pollution control nationwide, and new pollution control approaches/systems should be considered.

c) Final stage (improvement of water environment with socialized environment management)

The high-level water pollution control is established and operated to respond to increasing and diversified pollution loads which will be caused by further growth of the socio-economy. Consequently, awareness-raising approach with self-supporting environmental management and participatory management with close cooperation among the environmental management sectors, pollution generators and general citizens should be promoted to substantiate socialized environmental management.

Year	2010		2020
National Strategy for Environmental Protection until 2010 and Orientation toward 2020 (Decree No. 256/2003/QD-TTg)	Target in 2020: 1. 80% establishments certified by ISO 14001. 2. 100% provision of wastewater treatment system in urban centers and industrial zones.		
Proposed Reinforcement for Pollution Control Approach	Initial Stage	Mid-Term Stage	Final Stage
	Expeditious response to worsening water environment	Maintaining of water environment quality at the national standard	Improvement of water environment by socialized environment management
<Measure 1> To strengthen the enforcement capacity and the supporting systems of water pollution control			
Action 1.1: Information system of pollution source management			
Action 1.2: Mechanism related with pollution control systems			
Action 1.3: Capacity of local staffs in water environment management			
Action 1.4: Capacity of local agencies in measurement & analysis			
<Measure 2> To strengthen wastewater fee system and integrated supporting system			
Action 2.1: Wastewater fee system			
Action 2.2: Lending capacity of VEPF			
Action 2.3: Integrated supporting system to craft village industries			
<Measure 3> To promote self-supervising environment management by enterprises.			
Action 3.1: Self-monitoring system			
Action 3.2 Environmental supervisor system			
<Measure 4> To strengthen environmental awareness raising activities			
Action 4.1: Public disclosure of environment management information			
Action 4.2: Environmental dissemination activities			

Source: JICA Study Team

Figure 5.2-5 Timeframe of Reinforcement Direction for Water Pollution Control Approaches

(7) Required Resources

The reinforcement requires the input of resources like human resources, equipment and materials and finances. The quantities and qualities of necessary resources must be examined precisely on individual actions and how they should be provided, principally in a way of self-sufficiency with a strong ownership of Vietnam. However, in view of the urgency of the reinforcement of water pollution control, it is crucial that Vietnam environmental management sector be appropriately supported by foreign aids in terms of essential resources.

5.2.5 Conclusion

The JICA Study Team proposes the reinforcement direction, studying underlining issues in pollution control approaches/systems as policy enforcement tools. The water pollution control approaches and pertaining systems are reinforced by ensuring the implementation of a series of proposed direction. This direction is commonly applied to the whole of Vietnam, and indicates a guiding direction or a strategy which Vietnam pollution control approaches will go along in the coming future. The proposed reinforcement direction lays down a total of 11 actions to produce four (4) measures, as follows:

Measure 1: Strengthening of enforcement capacity and supporting measures	Action 1.1: Information system of pollution source management
	Action 1.2: Mechanism related with pollution control systems
	Action 1.3: Capacity of local staffs in water environment management
	Action 1.4: Capacity of local agencies in measurement and analysis
Measure 2: Strengthening of wastewater fee and integrated supporting system	Action 2.1: Wastewater fee system
	Action 2.2: Lending capacity of VEPF
	Action 2.3: Integrated supporting system to craft village industries
Measure 3: Promotion of self-supervising management	Action 3.1: Self-monitoring system
	Action 3.2: Environmental supervisor system
Measure 4: Promotion of environmental awareness raising	Action 4.1: Public disclosure of environmental management information
	Action 4.2: Dissemination activities

In accordance with the Agreement between JICA and MONRE, it is not the case that Output 3 proposes executive project/program for implementing the reinforcement of pollution control approaches/systems. Instead, Output 3 indicates a basic direction along which the environment management sector goes forward, from the prolonged period. Hence, any relevant party can use the outcomes derived from Output 3 (even partly), in any way for any purpose.

One of elemental targets of the proposed direction is that the pollution control in Vietnam realizes the combination of diverse control systems, based on policy mix approach along with activation of individual system, not depending on a single pollution control approach/system. Regarding individual control approach/system, respective ones are activated and enhanced in the framework of the reinforcement proposed in this study. Based on these, Table 5.2-2 enumerates the objectives and functions of individual approaches/systems to be achieved in the reinforcement. In this table, a total of six (6) approaches accompanied by a total of 17 systems including integrated supporting system and environmental supervisor system are shown.

Table 5.2-2 Objectives and Functions of Individual Approach/System

Pollution Control Approaches	Pertaining Systems	Objectives and Functions
Regulatory approach	Environmental authorization & compliance system	All pollution generators are authorized by the environment management authorities through EIA or EPC (or EPP) and their environmental protection measures to comply with environmental protection requirements are defined.
	Environmental inspection & check system	Environmental inspection and check are carried out by the environment management authorities to examine the compliance status, when necessary.
	Administrative sanction system	Strict administrative sanctions against pollution generators violating the requirements for environmental protection are imposed to deter repeated violations.
	License granting system	Licenses for mineral exploitation, wastewater discharge to water sources and others are granted by the authorities, inspections are conducted and penalties are imposed to violators. (The industrial sector and the water resources sector leads these system)
Economic approach	Wastewater fee system	Wastewater fees according to pollution loads are collected from all pollution generators of domestic wastewater or industrial wastewater, and the economic incentive for reducing pollution load is given to pollution generators of industrial wastewater. Further, penalties are imposed to pollution generators unwilling to pay or not meeting the effluent standards.
	Preferential loan system	Enterprises taking environmental protection measures can use preferential loans through VEPF with fund capitals coming from collected money, Governmental budget and other sources.
	Preferential land use system	Preferential treatments on land use for environmental protection measures are given by the authority.
	Preferential tax system	Preferential treatments in taxation for environmental protection measures are given by the authority.
Technical renovation approach	CP application system (including EMS)	The application of cleaner production to reduce pollution load in production lines is promoted. (Mainly the production sector leads this system)
	Good practice awarding system	Good practices are diffused by periodical recognition for less-pollution technologies and practices.
	Environment-related service promotion system	The information on specialized institutions of measurement & analysis of water quality, consulting, design, construction, etc. are diffused.
Awareness raising approach	Environmental performance rating system	Environmental performance of enterprises are assessed and rated based on self-supporting monitoring, and its result is opened to the public.
	Environmental information disclosure system	Environment management information like water quality monitoring, good practices, incompliance and violations are opened to the public through various media.
	Awareness raising system	The awareness of pollution generators (production manufacture, craft village industries, etc.) and the general public are enhanced through various dissemination activities.
Infra structure development	Sewerage system development	Sewerage facilities with treatment plant for treating and collecting urban domestic wastewater are developed. (The construction sector leads this system)
Integrated tool	Integrated supporting measure system	A special institution for providing integrated support including planning, design, construction, soft loan, etc. is established, and projects of central wastewater treatment project and others are implemented.
	Environmental supervisor system	Environment management unit led by environmental supervisor qualified by the State is established in enterprises.

Source: JICA Study Team

In accordance with the Agreement between JICA and MONRE, it is not the case that Output-3 proposes executive project/program for implementing the reinforcement of pollution control approaches/systems. Instead, Output-3 indicates a basic direction and policy enforcement tools along which the environment management sector goes forward, from the prolonged period. Hence, any relevant party can use the outcomes derived from Output-3 (even partly), in any way for any purpose.

Applicability to pollution sources	Each wastewater has different characteristics in pollutants, discharge patterns, awareness and behavior of pollution generators, etc. The considerations should be taken on whether pollution control approach/system functions effectively. Table 5.2-3 indicates general applicability to pollution sources.
Viability	Present problems and constraints of subject approach/system in the region should be clarified. Then, the viability of subject approach/system for the region should be assessed in a comprehensive, taking account of characteristics of stakeholders, institutional capacities of implementing bodies, required time schedule, necessary resources like human, financial and facilities, etc.

The reinforcement direction derived from Output 3 has been followed by more specific study in the water environment management plan for the model area of Cau River basin (Output-4), so that

applicable actions meet various characteristics of the model area comprising Bac Kan Province and Thai Nguyen Province.

Table 5.2-3 Applicability of Pollution Control Systems to Pollution Sources

Pollution Control Appraches	Pertaining Systems	Manufacturing industry	Craft village industry	Mining industry	Household & commercial/service facilities	Solid waste disposal	Medical facilities	Livestock facilities	Agriculture lands
Regulatory approach	Environmental authorization & compliance system	◎	◎	◎		◎	◎	◎	
	Environmental inspection & check system	◎	◎	◎		◎	◎	◎	
	Administrative sanction system	◎	◎	◎		◎	◎	◎	
	License granting system	◎	◎	◎		◎	◎	◎	
Economic approach	Wastewater fee system	◎	◎	◎	◎	◎	◎	◎	
	Preferential loan system	◎	◎	◎		◎	◎	◎	
	Preferential land use system	◎	◎	◎		◎	◎	◎	
	Preferential tax system	◎	◎	◎		◎	◎	◎	
Technical renovation approach	CP application system (including EMS)	◎	◎	◎			◎		
	Good practice awarding system	◎	◎	◎					
	Environment-related service promotion system	◎	◎	◎		◎	◎	◎	
Awareness raising approach	Environmental performance rating system	◎	◎	◎					
	Environmental information disclosure system	◎	◎	◎		◎	◎		
	Awareness raising system	◎	◎	◎	◎	◎	◎	◎	◎
Infra structure development	Sewerage system development		◎		◎				
Integrated tool	Integrated supporting measure system		◎						
	Environmental supervisor system	◎	◎	◎		◎	◎	◎	

Source: JICA Study Team

5.3 Review of Inspection Manual (Objective 2)

In the work plan, it was scheduled that Output 3 would recommend necessary modifications, reviewing the existing inspection manual developed by SIDA's assistance (in 2002). However, it has been learned in the course of the interview with the Inspection Department of MONRE (held in October, 2008) that MONRE has already prepared another inspection manual by its own initiative. This inspection manual is titled the "Environmental Specialized Inspection Manual", composed of contents as shown in Box 5.3-1.

The JST has reviewed the part related with water environmental inspection in the inspection manual prepared by MONRE. The MONRE-prepared manual has comprehensive contents which are necessary for actual enforcement in environmental inspections at site. The contents include the legal framework, tasks of charged units, environmental standards, preparation and procedure of inspection and necessary works after the completion of inspection. In addition, attachments to the inspection manual provide examples of typical pollution data and environmental protection measures on several industrial categories.

The review has found out that the inspection manual is provided with necessary and appropriate contents, in view of necessary environmental inspection in Vietnam and actual practices of DONREs. Hence, the JST judged that modification of the inspection manual is not necessary. As such, the VST and JST have confirmed the completion of the review and recommendation of the inspection manual.

Remarks derived from the review on the inspection manual are described in the Output-3 Report.

Box 5.3-1 Composition of Inspection Manual Developed by Inspection Department (MONRE)

1. Introduction
2. Legal Framework Related to Inspection Activities
   - 2.1 Legal documents related to general regulations on environmental protection and inspection activities
     - General introduction on legal documents on environmental inspection
     - Legal documents on inspection
     - Legal documents on administrative sanction
     - Legal documents on environmental protection
     - Principle on application of legal documents
     - Regulations and forms of treatment
     - Regulations on coercion in inspection activities
   - 2.2 State management agencies in charge of environmental protection
     - Mandate and function of environmental inspection at all levels
     - Mandate and function of environmental police
     - Compulsorily applied environmental standards of Vietnam
     - Environmental standards on land environmental protection
     - Environmental standard on aquatic environmental protection
     - Environmental standard on air environmental protection
     - Environmental standard on noise
     - Environmental standard on solid waste
3. Environmental Inspection
   - 3.1 General inspection procedures
     - Inspection preparation
     - On-site inspection
     - Inspection completion
   - 3.2 Inspection skills
     - Inspection preparation
     - On-site inspection
     - Inspection result report
     - Inspection conclusion
     - Inspection archives

Annex
- 1: Form of minutes and inspection report
- 2: Environmental standard of Vietnam
- 3: Types of environmental pollution of some typical industries
  - Food processing
  - Chemistry
  - Mineral exploitation
  - Garment and textile
  - Paper production
  - Cement production
  - Metallurgy

(Source: Department of Inspection of MONRE, "Environmental Specialized Inspection Manual, Draft", October 2008)

Source: JICA Study Team

5.4 Discussions with Vietnamese Side Related to the Output-3

5.4.1 The 4th Workshop in Thai Nguyen

(1) Overview

The 4th workshop for Output-3 (for sharing experience of good practices and policy direction in pollution control approaches) was held at Thai Nguyen City on February 20, 2009.

Based on the description of the Inception Report and the Work Plan of Output-3, the objective of the 4th Workshop is defined as:

"To share knowledge and experiences of good practices (the application of cleaner production or environment-friendly technologies) and its policies in Vietnam associated with pollution control approaches among enterprises of pollution generators, officers of MONRE (VEA), PPCs and DONREs, and stakeholders mainly in the model area."

(2) Presentations and Discussions

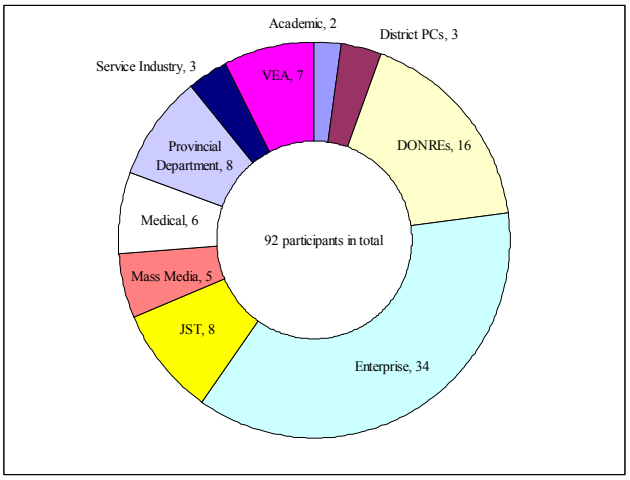
Presentations given in the workshop included variety of fields related with pollution control approaches and good practice, ranging from policy matters to actual practices for environmental protection. Speakers were comprised of many sectors such as: State environment management sector (central and local), industry sector, research and development sector and enterprises. The actual presentation program is as shown in Table 5.4-1.

Table 5.4-1 Presentations of the Workshop in Thai Nguyen

No.	Titles of Presentations	Institutes of Speakers
1	Introduction (including video display of Japanese lessons to overcome public pollution)	JICA Study Team
2	Policies and strategies associated with water pollution control of MONRE	VEA of MONRE
3	River basin management approach and pollution control	VEA of MONRE
4	Policy and demonstration projects of cleaner production and environmental management system in industries	MOIT
5	Application of cleaner production in Vietnam	VCPC
6	Financial assistance for environmental protection measures by VEPF	VEPF
7	Development of wastewater management guideline and manual in JICA Project with IET/VAST	IET/VAST
8	Theories and practical planning of wastewater treatment suitable for environment protection	CTC
9	Wastewater management experience of hospital in Bac Kan	Public Heath Department of Bac Kan Province
10	Environmental management and protection at Thai Nguyen Iron and Steel Company (TISCO)	TISCO

Source: JICA Study Team

The workshop were attended by a total of 82 persons (excluding members and assistants of JST), coming from enterprises (state-owned and private), staffs of central government, provincial and district units, academic institutes, mass media, etc., as shown in Figure 5.4-1.



Source; JICA Study Team

Figure 5.4-1 Participants in No.4 Workshop in Thai Nguyen

The following respective presentations, sharing of comments and opinions took place among speakers and participants. Major comments and opinions delivered in the workshop are as follows:

a) Regulations related legal systems in Vietnam have been set up but their actual application and effects are not sufficient;
b) Even simple method of Cleaner Production (CP) may contribute the significant improvement of environmental performance. To know this, the comparison between the necessary cost of CP and the derived benefit may be useful for facilitating the introduction of CP technologies.
c) The strengthening of basic structure and active utilization of VEPF are crucial for improving environmental mitigation measures in Vietnam;
d) The environmental protection measures of Bac Kan Hospital (subject to the Decision No. 64) was constructed by its own financial source, because they were not informed of the existence of VEPF at that time. Although the wastewater treatment plant is operated, it is not enough to deal with pathogen pollution.
e) The outcomes of the VAST/IET project should be diffused in to the whole Vietnam. To this end, confirmed certain strategies are required, clarifying the position of VAST/IET in the environmental management.
f) The TISCO is a representative and influential enterprise in Thai Nguyen region, employing as many as 6,500 persons. Hence, TISCO should be a model enterprise in environment protection in the region, introducing good environmental practices, environmental performance rating, information disclosure, etc.
g) The optimum model of wastewater treatment presented by CTC is theoretical. However, it appears that the model needs to be more understandable to be applied to actual fields.

(3) Evaluation

In the past, the opportunities for information exchange have not been provided in Thai Nguyen region. This workshop provided the first opportunity to share and exchange opinions between public and private in the field of environment management. It is expected that they maintain the setting up of such opportunity for water pollution control under combined endeavors between public and private sector.

Together, through the workshop, it is assessed that participants (especially coming from enterprise) were informed on public policy of water pollution control and good practices by the application of cleaner production. It is expected that, based on basic knowledge on policy and good practices, enterprises in the region become more attentive for process improvement, resulting into the introduction of cleaner production technologies under cooperative actions with public sectors.

5.4.2 Discussion of Study Report

(1) Mini-Workshops (No.1 and No.2)

The 1st mini-workshop was held on 29 February, 2009 in the participation of 14 concerned members (6 persons of core members from VST and 8 persons from JST), to discuss the draft of the study report. This was followed by the 2nd mini-workshop held on June 5, 2009 in the participation of 21 concerned members (13 persons from VST and 8 persons from JST), to discuss revised report. In the discussions, VST delivered many comments. Among others, major ones considered and incorporated in the review of the report are shown in Table 5.4-2.

(2) PCU Meeting

The PCU meeting was held on June 11, 2009 in the participation of 28 peoples concerned (15 persons from PCU and VST, 4 from the JICA advisory mission and 9 from JST). As one of agenda in the PCU meeting, the Output-3 Report was discussed. As a result, PCU approved that the Output-3 Report should be presented and shared to broader stakeholders as well as VEA and DONRE in subsequent No.5 Workshop. Major comments from Vietnamese side in the meeting are enumerated in Table 5.4-2.

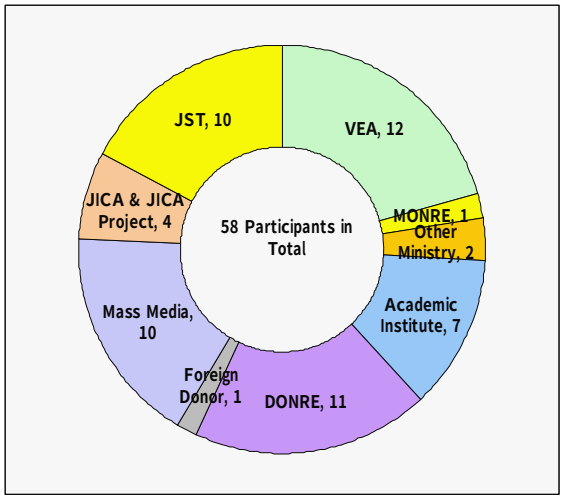
Table 5.4-2 Discussion in Mini-Workshop and PCU Meeting for Output-3 Report

Meeting	Comments and Suggestions from VST
1st Mini-Workshop (January 15, 2009)	1) The report is comprehensive and covers diverse scope. VST wishes to place a special attention at specific actions. It should be especially remarked that proposed actions are consistent with the contents described in the report. 2) It is advisable that the strategies be accompanied by closely relevant directions and actions. 3) Regarding the opening of environmental management information, further studies are required in terms of: what information should be publicized, what extent of information should be opened, to which destination information should be opened, by what means information should be opened, etc. 4) Reconsideration should be made on the usage of the technical term "Strategy". 5) Some proposed actions have been already considered by JST. On this account, close discussion between VST and JST should take place to better and refine proposed contents. 6) Many actions are proposed in the study report. Step-wise plan should be examined to ensure the achievement of reinforcement, since it is not realistic to implement proposed actions all at once. 7) The study report refers that there is no special unit dedicated to technical training in VEA. Because some kinds of trainings are executed in VEA, such situation should be discussed in the report. 8) The study report should be prepared for the distribution to not only the internal functions of VEA but also other related ministries and functions. From that sense, it should include the review of past and ongoing projects with other donors (like VCEP with CIDA, PCDA with DANIDA, etc.). 9) Some key suggestions should be incorporated to ensure the achievement of good coordination. The necessity of some training actions for realizing it should be contained, too. 10) VST wishes to be provided with detail implementation plan for proposed actions. 11) Output 3 should handle general matters on the whole Vietnam. Therefore, it is understood that more precise and concrete matters should be considered in Output-4 to study the management of the model basin, together with the feasibility of execution.
2nd Mini-Workshop (June 5. 2009)	1) The report should more clarify weaknesses in existing laws and regulations. 2) In Chapter 3, policy matters should be put before legal matters, because policies are generally placed at higher priority. 3) Organizational structures of MONRE and VEA should be modified, referring to present and actual ones. 4) The titles of ministries should be corrected, because titles of some ministries were changed along with the alteration of their mandates. 5) The section of technical renovation approaches should refer to the instruction of MOIT in 2007 and the UNIDO project for cleaner production. 6) It is considered that problems identified and pollution control approaches raised in the report are appropriate and agreeable. 7) The report should explain the methodologies and criteria which are applied to the analysis of relevant issues and proposing of reinforcement direction.
PCU Meeting (June 11, 2009)	1) The Output-3 Report appears not to contain any new approach for Vietnam, but its general contents are agreeable. As stressed in the report, it is quite necessary in Vietnam that more stringent laws enforcement (e.g. imposing fines and suspension of operation) be applied to alleviate/prevent river water pollution. 2) The results of Output-3 are expected to be applied in the model area. So, the WEMP derived from Output-4 should include more specific content for solving various issues in the model area of Cau River Basin. 3) This report should be shared to broader stakeholder of the water environment management as well as VEA and DONREs in the coming workshop.

Source: JICA Study Team

5.4.3 The 5th Workshop for Sharing Results of Output-3

The 5th Workshop was held to broadly share the study result of Output-3 to various stakeholders as well as the water environment management sector (like VEA and DONRE) on July 2, 2009. A total of 58 persons from variety of fields and sectors participated in the Workshop, including 11 persons from mass media and 8 persons of institutions not directly involved in this study, as shown in Figure 5.4-2.



Source: JICA Study Team

Figure 5.4-2 Participants in the 5th Workshop

In the Workshop, JST presented the result of Output-3 and the outlook on how to apply the Output-3's outcome into specific conditions of the model area in the study of Output-4. Following up the presentation, massive discussions took place on the water pollution control in Vietnam, referring into the study result of Output-3. Officers of VEA as the central government, DONRE as the frontline agency and representatives of private institutes express their professional opinions and suggestions, as some of them are shown in Table 5.4-3.

Table 5.4-3 Discussion in the 5th Workshop

Speakers	Comments and Suggestions
Representative of private consulting firm	1) It is agreed that the wastewater fee is increased to reserve finances necessary for water environment management. 2) Appropriate regulatory system should be laid to screen out and enhance the quality of service made by consulting organization.
Officer from MOST	1) The Report should more focus on introducing advanced law and regulation systems for pollution control in other countries and guide how to apply them to Vietnam.
Officer from PCD of VEA	1) The Study should suggest priority actions and their implementation schedule for the upcoming 3 to 4 years. 2) Action 1.1 (information system of pollution source management) is considered to be important. To achieve this, information exchange among relevant agencies is crucial. 3) A new training unit proposed is not necessary, because MONRE has a training section, already.
Officer of DONRE	1) Proposed pollution control approaches are agreeable, basically. 2) It is very crucial that other concerned organizations in the provincial level have good cooperation with DONRE to realize secure water environment management. Management Board of Industrial Park, Department of Health, Department of Construction, District Division of Natural Resources and Environment are among them. 3) Action 1.1 (information system) should be placed at the high priority, and it should focus on developing the management system of pollution source information. 4) It is recommendable to add some actions to support enterprises in the installation of wastewater treatment facilities, the introduction of CP, because most enterprises lack the technologies concerned with these fields. 5) Province of Thai Nguyen has a plan of sewerage development in the mid urban center. Applicable financial mechanism is still necessary to be considered for further development. 6) The information disclosure raised in the Report is considered to be important for the environment management, because it could apply pressure on enterprises.
Officer from VEA	1) The Report handles the consideration on pollution control from the aspect of nationwide. More specific examinations are expected to come up in the preparation of WEMP in the course of Output-4. 2) To urge enterprises to take environment protection, environment management mechanism should have not only a fine system but also an encouraging system to provide some benefits to enterprises. 3) Although it is necessary to increase wastewater fee and fines against violations, it should be done, taking account of available resources in Vietnam to implement their system.

Source: JICA Study Team

5.4.4 Review of Output-3 Report by VST Local Expert

(1) General

Review of Output-3 Report has been conducted by Local Experts of Vietnam side, aiming:

a) To review the Output-3 study result from the point of scientific and technological view, and

b) To ensure the practicability and quality of the result of Output-3 study.

Along the specific objectives mentioned above, Local Experts of Vietnam side have reviewed and checked Version 1 of Output-3 Report which was used for No.5 Workshop.

(2) Results of Local Experts' Review

As the result of the review of Output-3 Report, VST Local Experts have submitted their "Comments and Suggestions" (dated July 31, 2009) to JST. Together, the table of "Terminologies and Dictation Errors to be Corrected" has been passed by VST Local Experts.

VST Local Experts have implied in their comments that there are no particular comments and suggestions on the composition, main contents and conclusions of the Output-3 Report. However, they have made a number of comments and suggestions as described in the "Comments and Suggestions", to improve it. The comments of VST Local Experts may be categorized as follows:

a) Linguistic problems in Vietnamese translation (in the Vietnamese version),

b) Linguistic problems in English sentences (in the English version), and

c) Suggestions for modifications in particular contents (in the English version).

(3) Responses of JST to VST Local Experts' Suggestion

JST has examined the comments of VST Local Experts, very carefully. As a result, concerning the item a) and b) mentioned above, JST has corrected them in the Version 2, as VST Local Experts pointed out.

As for the item c), JST has carefully checked corresponding parts, considering each comments and suggestions made by VST Local Experts. Considerations have been made on how to respond to comments and suggestions in light of: i) necessary requirements for Output-3 Report, ii) the objectives and scope of study defined previously, and iii) the demarcation set between Output-3 (encompassing the whole Vietnam) and Output-4 (focusing on the Model Area).

As a result, some contents of Output-3 Report have been modified according to the comments of VST Local Experts. However, others have been left unchanged, because some justifiable reasons are in place in original contents. Major comments made by VST Local Experts and modifications applied by JST have been compared in Table 5.4-4. In such consideration, JST has improved and completed the Version 2 of Output-3 Report (both English version and Vietnamese version), as a final version.

Table 5.4-4 Major Comments by VST Local Expert and JST's Responses

Line No.	Comments by VST Local Expert	Responses by JST
1	Legal documents as below should be complemented.	
1.1	- Decree 88/2007/ND-CP: Drainage for urban and industrial areas. - Circular 09/2009/TT-BXD: Regulated detail contents of Decree 88/ND-CP.	These legal documents were additionally referred in the section 7.7.1 of the Output-3 Report.
1.2	- Decision 16/2008/QD-BTNMT: National technical regulation for the environment.	This Decision were referred more clearly in the section 3.5.3 of the Output-3 Report.
1.3	- National Vietnamese Standards promulgated in recent years, such as: TCVN 7382-2004, TCVN 7331-2007, TCVN 7333-2007 and TCVN 51-2008.	This Decision was additionally referred in the section 3.5.3 of the Output-3 Report.
1.4	- National Technical Regulations for Water Environment Management, such as: QCVN 01:2008/BTNMT, QCVN 08, QCVN 09, QCVN 11, QCVN 12, QCVN 13, QCVN 14 and QCVN 15.	Some regulations out of suggested ones by VST Experts have already been referred in the section 3.5.3 of the Output-3 Report. The regulations not listed in the Report were additionally referred.

Line No.	Comments by VST Local Expert	Responses by JST
2	Some sub-section titles and words may be considered to be changed to new appropriate ones and others.	
2.1	Section 3.4 "Legal System" may be changed to "Legal Document System". Section 3.4 should be complemented to introduce some other laws related with water environment management, like investment, bidding, construction, etc., including the Criminal Law.	The title of the section 3.4 of the Output-3 Report was changed to "Environmental Laws and Regulations". No particular response is taken because of the following reason. Laws and regulations directly related with water environment management have already been explained in the section 3.4 of the Output-3 Report. Other laws and regulations like investment, bidding, construction, etc., including the Criminal Law are only partly involved with water environment management, if they are applied to the water environment management. From that reason, JST have quoted only related parts of other laws and regulations.
2.2	Rename the title of the sub-section 8.4.4 from "Measure 3: Self-supporting Environment Management" to "Measure 3: Self-supervising Environment Management".	The title of the section 8.4.4 of the Output-3 Report was changed to "Self-supervising Environment Management.
3	VST local experts provide information on the current progress status in the water environment protection in detail.	Some useful specific comments among ones provided by VST local experts were additionally incorporated in the relevant sections of Output-3 Report.
4	Table 3-1 should be updated by new information in the year 2008.	Table 3-1 of the Output-3 Report was replaced by updated contents as of 2008.
5	Table 4-2 and Table 4-3 should be updated by new information from the year 2008.	Some contents in the tables were modified by new information.
6	Technical renovation approach should refer to UNIDO Project (1998, 2000 - 2004) in relation to cleaner production.	This is additionally referred in the section 7.5.2 of the Output-3 Report.
7	Regarding environment consulting organizations, some regulation for screening out incompetent organizations and for enhancing their capabilities should be set up. This issue may be added in the section 8.2.3.	The section 7.5.4 of the Output-3 Report has already referred to such issues related with specialized environment- related service in a certain level. Taking account of the VST's comment, more description was complemented to the section 7.5.4 of the Output-3 Report.
8	There are many typing and spelling errors in Vietnamese version as well as in English version. Together, some words, phrases or sentences, or paragraphs are not translated well into Vietnamese. Such parts should be corrected appropriately. (VST Local Experts separately provided JST with "List of Some Terminologies and Dictation Errors to be Corrected")	The Output-3 Reports of both English and Vietnamese version are thoroughly checked and corrected, using the list provided by VST Local Expert.
9	In the table of contents of Vietnamese version, the section 3.3 (3.3.1 and 3.3.2) is missing.	These were corrected appropriately.
10	The term should be unified as "National Technical Regulation" instead of "new quality standard" or "National Technical Norm".	In case the word indicates the title of the Vietnam regulation, "National Technical Regulation" is used. However, other words may be used, in case the word means the purpose, content or character of National Technical Regulation.

Source: JICA Study Team

5.5 Capacity Development Conditions of Output-3

(1) Overview

The prime object of the capacity development of Output-3 is to strengthen the ability of administrative management for water pollution control approaches. More specifically, the subject ability is considered to be comprised of elements as categorized into:

a) Broad understanding of environment management and pollution control approaches;
b) Specific knowledge and skills for respective pollution control systems to be applied to Vietnam; and
c) Understanding and skills related with the development of cooperative actions necessary for pollution control approaches.

It is planned that the ability of administrative management is strengthened through the co-working of the Study; including data collection/analysis, discussion of analysis data, opening of workshop, etc.

(2) Self-Assessment of Capacity before Project

Questionnaires for the self-assessment before project were distributed to PCD and RBM (River Basin Management) of VEA at the central level and DONRE of Bac Kan and Thai Nguyen at the local level. A number of questionnaires of capacity assessment collected is shown in Table 5.5-1. The

questionnaire comprises variety of questions to clarify the present status of respondents, dividing into two (2) types; one is for officers of working level as shown in Table 5.5-2 and another for directors of supervisor level as shown in Table 5.5-3.

Table 5.5-1 Number of Answers on Questionnaire for Output-3

Organization	Number of answer	
	Director/Manager	Technical Staff
PCD	1	5
River Basin Management Department	0	0
Thai Nguyen DONRE	0	11
Bac Kan DONRE	2	4

Source: JICA Study Team

According to the result of the questionnaire survey, it is summarized that members of VEA and DONRE assess their own abilities as of "before the project", as follows:

a) Apart from a few part of DONRE members, most members of VEA and DONRE answers that they have a certain amount of knowledge and skills related with all pollution control approaches. Even for several pollution control approaches which have not been enforced in Vietnam, they answer that they have relevant knowledge and skills.

b) Some members, especially in DONRE, replied that the objective of this Study is not understandable for them.

Table 5.5.-2 Result of Questionnaire Survey of Output-3 Capacity Assessment before Project (for Working Level)

No	Question	PCD/VEPA (5 persons)		Thai Nguyen DONRE (11 persons)		Bac Kan DONRE (4 persons)	
		Average rating of capacity level	Response rate(%)	Average rating of capacity level	Response rate(%)	Average rating of capacity level	Response rate(%)
0. General Items related to the Study							
0-1	Do you know the objectives and contents of the Study?	2.8	100	2.5	100	3.8	100
0-2	Is the Study useful for your daily job in general?	2.6	100	3.0	91	4.3	100
0-3	Do you have interest in the Study?	3.4	100	2.9	100	3.8	100
0-4	Does your staff have time for co-working with the JICA Study Team (JST)?	3.6	100	2.5	91	3.5	100
0-5	Is it necessary for your staff to conduct co-working with JST in the Study?	3.6	100	3.1	91	3.8	100
0-6	Does your staff clearly know his/her job mandates in the office?	4.4	100	4.3	100	4.5	100
0-7	Do you have enough communication with your staff?	4.3	80	4.1	100	4.3	100
0-8	Does your office and section conduct enough job performance required by the mandate?	4.6	100	4.0	100	4.0	100
0-9	Does your department have enough capability (staff and equipment) required by the mandate?	4.6	100	3.7	100	2.5	100
0-10	Do you receive enough technical training and support from VEPA/MONRE?	4.4	100	3.3	100	3.3	100
0-11	Do you receive enough financial support from VEPA/MONRE?	3.8	100	3.4	100	3.0	100
0-12	Do you receive enough technical support from VEPA/MONRE?	4.0	100	2.5	100	3.5	100
0-13	Do you receive enough cooperative support from related organizations?	3.8	100	2.4	100	3.0	100
3. Items related to the Output-3 (Pollution Control Approach)							
3.1 Questions for Pollution Control Division in VEPA							
3-1-1	Can you explain the mechanism and significance of existing systems pertaining to regulatory approaches in water pollution control?	3.6	100	-	-	-	-
3-1-2	Can you guide DONRE to implement systems pertaining to regulatory approaches?	3.8	100	-	-	-	-
3-1-3	Can you explain the mechanism and significance of existing systems pertaining to economic approach in water pollution control?	3.4	100	-	-	-	-
3-1-4	Can you guide DONRE to implement systems pertaining to economic approaches?	3.2	100	-	-	-	-
3-1-5	Can you explain the mechanism and significance of expected	3.2	100	-	-	-	-

No	Question	PCD/VEPA (5 persons)		Thai Nguyen DONRE (11 persons)		Bac Kan DONRE (4 persons)	
		Average rating of capacity level	Response rate(%)	Average rating of capacity level	Response rate(%)	Average rating of capacity level	Response rate(%)
	systems pertaining to voluntary encouraging approaches in water pollution control?						
3-1-6	Can you guide DONRE to implement systems pertaining to voluntary encouraging approaches?	3.2	100	-	-	-	-
3-1-7	Can you explain the significance and necessity of systems pertaining to social infrastructure development approaches in water pollution control?	3.3	80	-	-	-	-
3-1-9	Can you monitor and check the results of various existing systems pertaining to pollution control approaches taken by DONRE?	3.2	100	-	-	-	-
3.2 Questions for Pollution Control Division of DONREs							
3-2-1	Can you explain the necessity and implementing procedures of existing systems pertaining to regulatory approaches in water pollution control?	-	-	3.6	91	4.0	100
3-2-2	Can you explain the necessity and implementing procedure of existing systems pertaining to economic approaches in water pollution control?	-	-	2.8	91	3.8	100
3-2-3	Can you explain the necessity and implementing procedure of expected systems pertaining to voluntary encouraging approaches in water pollution control?	-	-	2.7	91	3.3	100
3-2-4	Can you explain the necessity of systems pertaining to social infrastructure development approaches in water pollution control?	-	-	2.6	91	3.3	100

Note: Capacity levels are assessed by 5 ratings like; 5: capacity level more than 80%, 4: 80-60%, 3: 60-40%, 2: 40-20%, 1: less than 20%.
Source: JICA Study Team,

Table 5.5-3 Result of Questionnaire Survey of Output-3 Capacity Assessment before Project (For Supervisor Level)

No	Question	PCD/VEPA 1 person		Bac Kan DONRE 2 persons	
		Average rating of capacity level	Response rate(%)	Average rating of capacity level	Response rate(%)
0. General Items related to the Study					
0-1	Do you know the objectives and contents of the Study?	4.0	100	4.0	100
0-2	Is the Study useful for your daily job in general?	4.0	100	4.5	100
0-3	Do you have interest in the Study?	4.0	100	4.0	100
0-4	Does your staff have time for co-working with the JICA Study Team (JST)?	4.0	100	4.0	100
0-5	Is it necessary for your staff to conduct co-working with JST in the Study?	5.0	100	4.0	100
0-6	Does your staff clearly know his/her job mandates in the office?	5.0	100	4.0	100
0-7	Do you have enough communication with your staff?	5.0	100	4.0	100
0-8	Does your office and section conduct enough job performance required by the mandate?	5.0	100	4.0	100
0-9	Does your department have enough capability (staff and equipment) required by the mandate?	5.0	100	3.0	100
0-10	Do you receive enough technical training and support from VEPA/MONRE?	5.0	100	3.0	100
0-11	Do you receive enough financial support from VEPA/MONRE?	5.0	100	3.0	100
0-12	Do you receive enough technical support from VEPA/MONRE?	5.0	100	3.0	100
0-13	Do you receive enough cooperative support from related organizations?	4.0	100	3.0	100
3. Items related to the Output-3 (Pollution Control Approach)					
3.1 Questions for Pollution Control Division in VEPA					
3-1-2	Does your division have manuals for guiding and monitoring existing systems pertaining to regulatory approaches?	5.0	100	-	-
3-1-3	Do you think that your staff have enough ability guiding and monitoring existing systems pertaining to regulatory approaches?	5.0	100	-	-
3-1-4	Does your division have manuals for guiding existing systems pertaining to economic approaches?	5.0	100	-	-
3-1-5	Do you think that your staff have enough ability guiding and monitoring	5.0	100	-	-

	existing systems pertaining to economic approaches?				
3-1-6	Do you think that your staff have enough ability of explaining systems pertaining to voluntary encouraging approaches?	5.0	100	-	-
3-1-7	Do you think that your staff have enough ability of explaining systems pertaining social infrastructure approaches?	5.0	100	-	-
3.2 Questions for Pollution Control Division of DONREs					
3-2-2	Does your division manuals for implementing existing systems pertaining to regulatory approaches?	-	-	4.0	100
3-2-3	Do you think that your staff have enough ability of implementing existing systems pertaining to regulatory approaches?	-	-	3.5	100
3-2-4	Does your division manuals for implementing existing systems pertaining to economic approaches?	-	-	3.0	100
3-2-5	Do you think that your staff have enough ability of implementing existing systems pertaining to economic approaches?	-	-	3.0	100
3-2-6	Do you think that your staff have enough ability of explaining systems pertaining to voluntary encouraging approaches?	-	-	3.0	100
3-2-7	Do you think that your staff have enough ability of explaining systems pertaining social infrastructure approaches?	-	-	3.0	100

Note: Capacity levels are assessed by 5 ratings like: capacity level more than 80%, 4: 80-60%, 3: 60-40%, 2: 40-20%, 1: less than 20%.
Source: JICA Study Team

(3) Achievement in this Study

Main tasks of members of VEA in pollution control approaches are to establish the legal and institutional mechanism of pollution control systems and to guide their enforcement. Meanwhile, members of DONREs have tasks to enforce pollution control systems as a frontline agency. As identified in the study of Output-3, their main tasks are not properly fulfilled due to weak institutional capacity, except for a limited part of control systems like EIA, environmental inspection, wastewater fee collection, etc.

Various activities for capacity development have been taken through not only series of mini-workshops, workshops, co-working with the VST side for Output-3 in Hanoi City but also number of discussions in Thai Nguyen. Up to now, it has been observed that, in the sense of individual abilities of members both at central and local level have been gradually changing upward. As seen from the questionnaire survey of "after the project", the effect caused by the capacity development of this project can be observed in the differences between "before and after".

From the viewpoint of individual ability that most members have been strengthening some of necessary knowledge and skills, especially concerning pollution control systems now prevalent in Vietnam (like EIA, environmental inspection, wastewater fee system, etc.). However, it is assessed that their abilities are not enough to change current insufficient practices inhabiting in VEA. While their abilities are largely different depending on members, significant room for capacity building is seen to exist, on the whole.

(4) Further Challenge

Although the sign of upgrading in the individual ability of officers involved is observed, their abilities are limited to general knowledge on pollution control approaches. Most of them still lack specialized and specific knowledge and skills necessary for addressing actual issues. As such, it is assessed that the overall capacity of VEA staffs and DONRE staffs is not sufficient to address diverse issues inhabiting in the water environment management in Vietnam. It is concluded that continuous efforts are called for further capacity development of both VEA as the central government and DONREs as the frontline agency of water environment management, including the capacity building of organizational level and society-institutional level.

Major challenges which the environment management sector in Vietnam is facing for further capacity development in the coming stage are raised, as follows:

Further understanding of pollution control approaches and establishing secure mechanism:	To establish secure administrative system of water environment management in Vietnam, i) by examining current issues on various pollution control approaches like regulatory, economic, technical renovation, awareness raising and infrastructure development, including approaches/systems applied to foreign countries, and ii) by considering the necessity in introducing new pollution control approaches.
Specific knowledge and skills for respective pollution control systems:	To acquire secure abilities for effectively enforcing pollution control systems in the frontlines of the management, i) by examining the analysis result on existing pollution control systems for finding out inhabiting hindrances and solutions, and ii) by discussing the necessity of additional pollution control systems and successful conditions.
Understanding the necessity of good cooperative actions to promote pollution control approaches/systems and establishing secure cooperation mechanism:	To construct effective cooperation mechanism between other relevant agencies in the water environment management sector and also in other sectors , i) by clarifying respective roles of concerned agencies, and ii) by discussing specific methods for realizing good cooperation to address specific problems.

6. Development of Water Environment Management Plan in the Model Area of Cau River (Output-4)

6.1 Introduction

The Water Environment Management Plan (WEMP) in the model area was prepared aiming at water environment protection, strengthening overall administrative enforcement capacities, and supporting implementation of "the Master Plan on the Protection and Sustainable Development of the Landscape and Ecological Environment of Cau River Basin (CRB M/P).

(1) Legal Base

The fundamental basis of the environmental management in Vietnam is the Law of Environmental Protection (LEP) (No. 52/2005/QH11) promulgated on July 1, 2006. Under LEP, the Ministry of Natural Resources and Environment (MONRE) has responsibility for the state management of natural resources and environment.

Based on the Law on Water Resource, the National Water Resources Council was established in 2000. The Council was chaired by the Deputy Prime Minister, with Deputy Minister level participating members from MONRE, MARD, and Ministries representing fisheries, science and technology, planning and investment, finance, industry, construction, transport, health and national defense. The Council advised the Government on policy, strategy and approval of river basins plans; major projects on water sources development; disputes over water; and international aspect of water resources management and development.

During 2006, the Government requested MONRE to prepare plans for the integrated exploitation, use and protection of water resources in major river basins and for key economic zones. In response to this, MONRE prepared three (3) river basin plans - for the Dong Nai River basin, the Ba River basin and for the rivers within the Northern Economic Zone (broadly covering the Red River Delta). Design proposals for these plans have been approved by the Government and additional State funding has been assigned to MONRE to undertake this work.

The Government Decision No. 43/2007/TB-VPCP (2007) clarified the assignment to MONRE of the overall responsibilities for river basin management in Vietnam. Along this Decision's requirement that MONRE prepares a decree on river basin management by the mid of 2007, Decree No. 120/2008/ND-CP (river basin management) was promulgated in December 2008.

(2) Cau River Basin Master Plan (CRB M/P)

The most crucial bases of WEMP is the 'Master Plan on the Protection and Sustainable Development of the Landscape and Ecological Environment of Can River Basin' (CRB M/P) prepared in accordance with the Decision No. 173.2006/QD-TTg. The CRB M/P emphasizes the following four concepts in the conservation of the Cau river basin:

a) Conservation of the landscape and ecological environment by investing budgetary resource;
b) Conservation of landscape and ecological environment sustained by appropriate water quality and water supply by integrated administrative bodies;
c) Prevention of environmental degradation by controlling of pollution sources; and
d) Promotion of internal efforts in administrative bodies and pollution sources to clean the environment.

Based on these concepts, CRB M/P stipulates vigorous promotion of such several approaches as public awareness raising, strengthening of administrative management capacities, development of five-year and annual plan, investment for pollution control, and stringent measures on serious pollution sources. In this context, the Cau River Committee (CRC) was established based on Decision No. 171/2007 which should have overall responsibility in implementation and supervision of CRB M/P.

(3) Stakeholders of WEMP

The WEMP should be planned, designed, implemented, monitored, and managed by the administrative bodies concerned, such as CRC, Vietnam Environment Administration (VEA) under MONRE, the Provincial People's Committee (PPC) of Bac Kan and Thai Nguyen, the Department of Natural Resources and Environment (DONRE) and other related Departments in Bac Kan and Thai Nguyen, the District Divisions in charge.

Besides, WEMP should also involve concerned stakeholders to be discussed, shared, participated, collaborated, and contributed, such as state and private enterprises and related groups, local residents and associations, the Environmental Management Board of Industrial Parks and Zones (EMBIPZ) in order to promote and activate the proposed WEMP effectively and efficiently. Their positive involvement and participation is inevitable for the effective implementation of WEMP and for conservation of water environment in the Cau river basin.

6.2 Identification of Critical Areas in the Model Area

The critical areas which have the following characteristics, were should be identified from the following viewpoints, and were identified based on the information shown in Table 6.2-1. The identified nine (9) potential critical areas are shown in Figure 6.2-1. The identified potential critical areas should be scrutinized and prioritized in the course of preparation of WEMP.

a) Areas where pollution sources such as factories, mining areas, craft villages, and hospitals,

b) Areas with close relation between pollution source and water usage, and

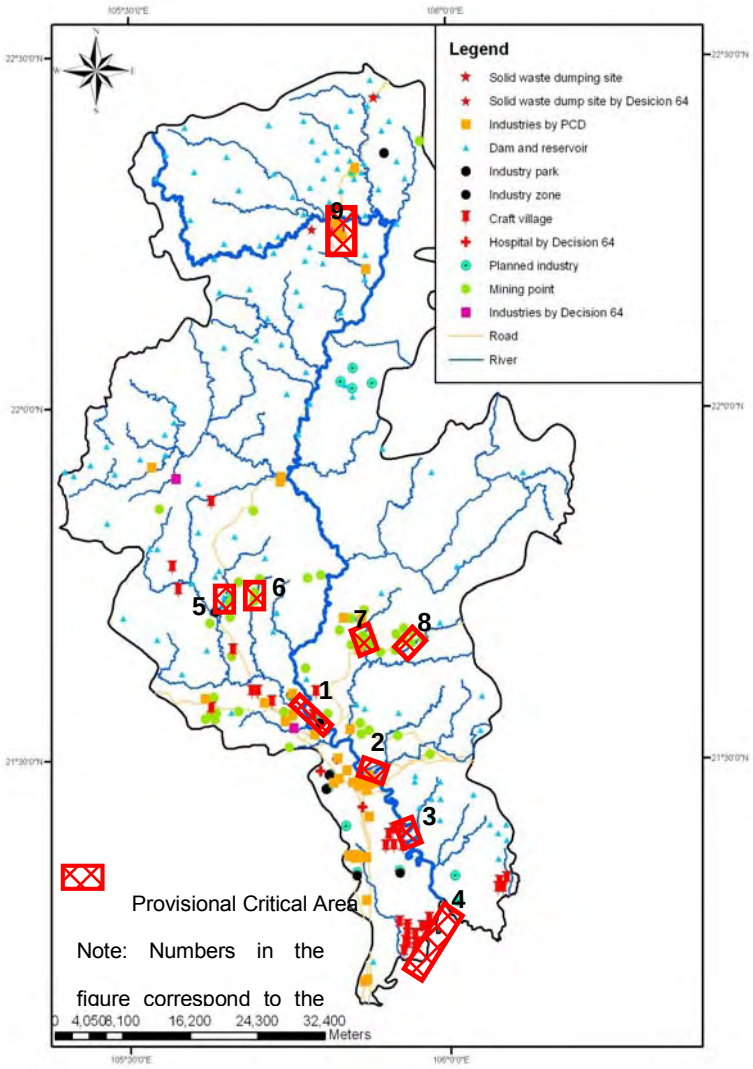
c) Areas where heavy pollution have been monitored in current monitoring program.

Table 6.2-1 Information Collected to Identify Provisional Critical Areas

No.	Category	Target
1	Industry	Industries targeted by Decision No. 64
2		Industries surveyed by PCD of VEA in 2008
3		Industries checked by DONRE in 2007.
4		Industrial zones
5		Industrial parks
6		Planned industrial zone and park
7	Mining	Inland mining area
8	Craft village	Craft village
9	Hospital	Hospitals targeted by Decision No 64
10	Solid Waste Dumping Site	Solid waste dumping sites targeted by Decision No 64

Source: JICA Study Team

No	Province	River	Type of Critical Area
1	Thai Nguyen	Cau river	Area with concentrated industries
2			Area with concentrated industries such as paper mill factory
3			Area with concentrated craft village
4			Area with concentrated craft village
5		Du river	Area with concentrated mining area
6		Tributary of Du river	Area with concentrated mining area
7		Dat river	Area with concentrated mining area
8		Bach Guong river	Area with concentrated mining area
9	Bac Kan	Cau river	Area with concentrated industries



Source: JICA Study Team

Figure 6.2-1 Identified Potential Critical Areas in the Model Area

6.3 Current Issues on Water Environment Management in the Model Area

Although both Bac Kan DONRE and Thai Nguyen DONRE are tackling water environment management in the model area, they face several difficulties in promotion of environment management. In Bac Kan DONRE, it has difficulties on water environment management mainly due to lack of human resources and capacity with more critical concerns. Since Bac Kan province aims at rapid socio-economic development until 2020, quick improvement of water environment management capacity in Bac Kan DONRE is an urgent issue. In Thai Nguyen province, the industrial sector, especially iron/steel and mining industry, plays an important role in economic development, and it is expected to develop rapidly until 2020. However, Thai Nguyen DONRE can not lead it to comply with environmental regulations very much.

Considering current situation on environmental management and pollution control activities, the following several points can be pointed out as common issues in Bac Kan and Thai Nguyen DONRE;

f) DONRE has not developed integrated pollution source inventory database. Each division has their own data but they do not share them. As a result, the data cannot be used for environmental management effectively.

g) Capacity of DONRE in conducting environmental inspection and managing environment protection fee from industry is not sufficient.

h) DONRE does not enforce administrative sanctions appropriately.

i) Current environment protection fee and preferential loan system can not afford enough incentives for enterprises.

j) In the District DONREs, lack of skills and human resources is the biggest obstacles in their water environment management. Improvement of cooperation and support from DONRE is an urgent issue as well.

In addition to above issues, cooperation between Bac Kan DONRE and Thai Nguyen DONRE should be developed in order to promote river basin management stipulated by Decree No.120/2008, their coordination is critical. Table 6.3-1 summarizes issues of water environment management in the model area.

Table 6.3-1 Issues of Water Environment Management in the Model Area

Item		Issues
Water Environment Management by DONRE	Environmental Impact Assessment (EIA)	- Bac Kan and Thai Nguyen DONREs do not have any guidelines for apprising application of EIA and EPP other than decrees and circulars. Some staff do not have sufficient technical skills to evaluate application documents. - District DONREs do not have sufficient technical skills in appraising EPC and EPP either. - Promotion of the EPP system is slow Bac Kan and Thai Nguyen DONREs, and district DONREs have not identified enterprises which have to obtain EPP approval. So, they cannot take effective actions to promote the EPP system. - The EPP regulation has not prevailed to enterprises well because it is a relatively new regulation, issued on September 2009.
	Self-Monitoring Report	- DONREs issue warnings to enterprises which do not submit a self-monitoring report. But it is not effective to improve compliance by enterprises. - Enterprises do not have sufficient skill to conduct self-monitoring. - Fines and penalty are not enforced appropriately. As a result, enterprises do not change their behaviors.
	Environmental Inspection and Check	- DONREs' environmental inspection is not effective because frequency of inspection is low, and DONREs need to inform target enterprises of their inspection plan in advance. - Bac Kan DONRE does not own its laboratory. So, it needs to hire a consultant for water quality monitoring in environmental inspection. - District DONREs do not have enough institutional capacity to conduct the environmental inspection. They do not have equipment for water quality monitoring either.
	Administrative Sanction	- Sanctions are not effective for enterprises to change their environmental management. In Thai Nguyen province, penalized enterprises receive warnings and all of them pay the levied fines. However, most of enterprises do not correct their management, and continue their violation. - To repeated violation cases, DONREs can take hard stance, operation suspension or facility closure. However, it is difficult for DONREs to issue such severe sanctions because its regal basis is not clear. The regulation does not clarify that operation suspension or facility closure should be applied to which violation activities. Besides, many legal steps which need to issue hard measures are also an obstacle in taking quick and effective measures.
	Industrial Wastewater Fee	- Bac Kan and Thai Nguyen DONREs have a difficulty in identifying enterprises which are obliged to pay the industrial wastewater fee, especially, those which have obtained EPC registers and EPP approval under control of district DONREs. District DONREs do not have sufficient capacity to promote EPC registers and EPP approval. To make matters worse, information exchange between provincial DONREs and district DONREs are scarcely conducted. - Skill of staff to assess self-reported fees by enterprises is insufficient. Many of them understand neither calculation of pollution load nor interpretation of monitoring data. They do not have any guidelines, other than Decree No.125/2003 and Circular No.106/2007. - Enterprises do not have sufficient skill and monitoring data for self-calculation of the fee. Besides, enterprises do not conduct monitoring regularly. Without monitoring data such as discharged wastewater volume and its concentration, calculation of amount of wastewater fee is difficult.
	Awareness Raising and Public Participation	- Environmental information provided by DONREs is limited to general information such as the State of Environment. There is no clear policy and strategy to disclose management information about environmental violations.
	Water Quality Monitoring	- Thai Nguyen DONRE, Bac Kan DONRE and CEM do not share their monitoring plan and monitoring data will share their plan - Bac Kan and Thai Nguyen DONREs do not monitor water discharge. - Thai Nguyen DONRE needs to improve laboratory activity such as QA/QC, preparation of SOP and data management. - Bac Kan DONRE needs to improve capacity of selection and supervision of consultant, and knowledge about monitoring activity (planning, sampling, data management, reporting).
Water Environment Management	Installation of Wastewater Treatment	- Some of enterprises do not install a wastewater treatment facility committed in their EIA, EPC or EPP approval. - Even though some of enterprises install a wastewater treatment facility, they do not operate it

Item		Issues
at Sources	Facility	appropriately. - Financial support from authority is weak so that enterprises cannot prepare enough capitals to install a wastewater treatment facility.
	Cleaner Production and Environmental Management System	- A handbook for introducing cleaner production is prepared. However, most of DONREs are not ready, no specific office and skilled staff, to promote cleaner production by using it. - Management by enterprises is premature to install cleaner production and adopt environmental management system.
Usage of Environmental Protection Fund		- Present charter capital amount of VEPF is too small to meet financial needs of enterprises. - Conditionality set by VEPF is strict. It is not attractive for enterprises.
Measures on Serious Pollution Sources Identified by Decision No.64/2003 and Circular No.07/2007		- Progress of measures taken by enterprises identified by Decision No.64/2003 and Circular No.07/2007 is slow. - Instruction and inspection by DONREs to the target facilities are not sufficient. Sanctions are not effective for enterprises to change their environmental management. - Financial support from authority is weak so that enterprises cannot prepare enough capitals to install a wastewater treatment facility.
Environmental Management of Industrial Park		- Due to lack of human resource and skills of the management board, it cannot fulfill most of its duties such as EIA and EPC appraisal, inspection and monitoring. - In most of the task of environmental management, the management board needs support from Thai Nguyen DONRE.
Sewerage Development		- Thai Nguyen city has started the project of sewerage development. However, neither Bac Kan nor Thai Nguyen province have master plans of sewerage development. - DONREs need to cooperate with DOCs to develop necessary actions for sewerage development plans.

Source: JICA Study Team

6.4 Water Quality Analysis and Prediction

6.4.1 Pollution Load Analysis

Pollution sources in the model area are broadly classified into two categories namely, point sources and non-point sources as shown in Table 6.4-1.

Table 6.4-1 Classification of Principal Pollution Sources in the Model Area

Category	Sector	Classification of Pollution Sources
Point Sources	Domestic	Domestic
	Facilities	Factory
		Mining
		Husbandry
		Hospital
		Craft Village
		SW Dumping
Non Point Sources	Livestock	Cattle
		Pig
	Urban Area	Urban Area
	Agricultural Area	Agricultural Area
	Forest Area	Forest Area

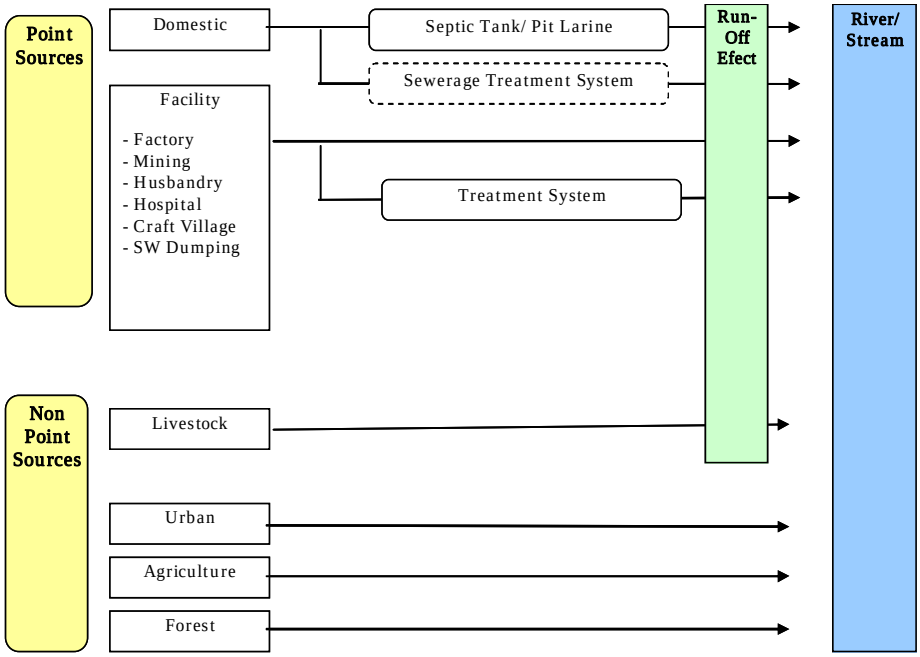
Source: JICA Study Team

(1) Procedure of Pollution Load Estimation

In this WEMP, "Pollution Load" means pollution load reaching to the river multiplying pollution load at sources by run-off ratio as shown in the following formula. The pollution load is estimated by collecting information on fundamental number and pollution load unit in accordance with classification of pollution load.

Pollution Load (PL) = Pollution Load at Source (PLS) x Runoff Ratio (α)

[Fundamental Number (N) x Pollution Load Unit (PLU)] x Runoff Ratio (α)



Source: JICA Study Team

Figure 6.4-1 Pollution Pathway from Sources to the River

(2) Setting Pollution Load Unit and Run-off Coefficient

Based on the currently available data and information such as provincial statistic data, results of pollution source inventory survey, land use map, and pollution load units, the base numbers and units for calculation of pollution load are selected for preparation of WEMP in the model area. Table 6.4-2 shows an example of the obtained fundamental number and set pollution load unit (BOD).

Table 6.4-2 Example of Pollution Load Unit (BOD)

Category	Sector	Classification of Pollution Sources	Fundamental Number	Pollution Load Unit	Source		Note
					Fundamental Number	Pollution Load Unit	
Point Sources	Domestic	Domestic	Population [p]	35 [g/p/day]	Statistic Data	TCVN51-2008	Discharge after Septic Tank
	Facilities	Factory Mining Husbandry Hospital Craft Village Solid Waste Dumping	- Effluent Water Quality [mg/L] and Quality [m^3/day] - Worker day [kg/worker] - Production area [kg/ha] - Number of animal [kg/number] - Number of bottles [kg/L] - Amount of wastewater [kg/m^3] - Worker shift [kg/worker shift] - Product [kg/ton] - Raw material [kg/ton]		Pollution Source Inventory Survey		CTC[1)]
Non Point Sources	Livestock	Cattle	Head [h]	520 [g/h/day]	Statistic Data	WHO[2)]	
		Pig	Head [h]	90 [g/h/day]	Statistic Data	WHO[2)]	
	Urban Area	Urban Area	Area [ha]	54 [kg/ha/ year]	Landsat Satellite Image	US-EPA[3)]	
	Agricultural Area	Agricultural Area	Area [ha]	8.7 [kg/ha/ year]		US-EPA[3)]	
	Forest Area	Forest Area	Area [ha]	2.5 [kg/ha/year]		US-EPA[3)]	

Source: 1) CTC: 2) WHO: 3) US-EPA

The Run-off coefficient which gives a ratio of pollution load reaching to the river is set based on the guidelines and manuals available in Vietnam, Japan, and other countries as shown in Table 6.4-3.

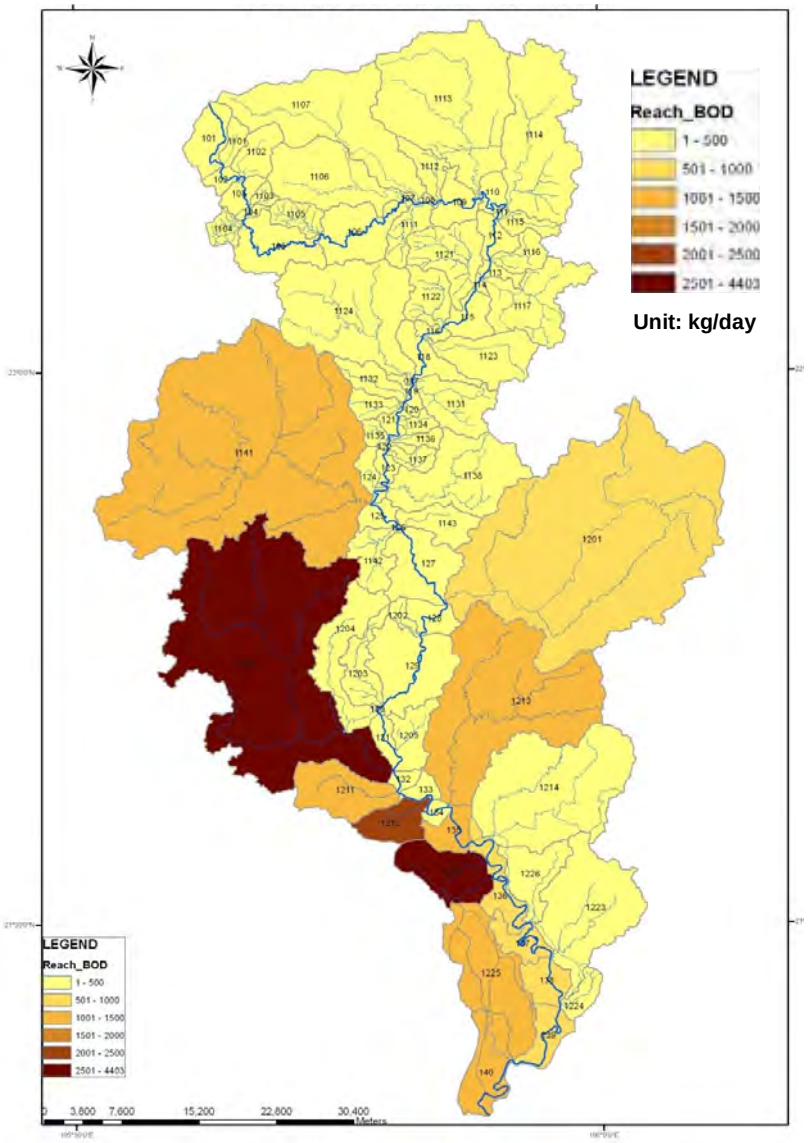
Table 6.4-3 Run-off Coefficient to be Applied

Category	Sector	Run-Off Coefficient (Depend on Ratio of Urban Area)			
		Less than 5%	5% - 10%	10~15%	More than 15%
Point Source	Domestic	0.1	0.4	0.7	0.9
	Facilities	1.0			
Non-Point Source	Livestock (Open Area)	0.01	0.04	0.07	0.09
	Agriculture	1.0 (These pollution load units are set as reached to river, i.e. including run-off coefficient)			
	Urban				
	Forest				

Source: JICA Study Team

(3) Estimation of Current Pollution Load

The current pollution load is estimated based on the above mentioned data, pollution load unit, coefficient, and procedures, and its result is shown in Figure 6.4-2 which shows current pollution load of each sub-basin (BOD). Among sub-basins, "Du River basin (1206)", "Mo Bach River Basin (1212)", and "Vo Ngua River Basin (1222)" are the basins discharging large amount of pollution load to the Cau river.



Source: JICA Study Team

Figure 6.4-2 Current Pollution Load of each Sub-Basin (BOD)

6.4.2 Water Quality Analysis and Prediction

(1) Methodology of Water Quality Estimation

To estimate water quality, the Streeter-Phelps formulation is adopted in WEMP. This is a simple model to express self-purification effect in river such as biological degradation effect, sedimentation and adsorption. Concentration of organic matter in river is decreased by self-purification effect as time of flow goes by. In case of adoption of the selected model to this Study, the following formula is established with consideration of pollution load from sub-basins through tributary and pollution load from along the Cau river directly. With respect to calculation of river discharge, these values are from the results of water balance study. The image of formulation of water quality prediction is shown in Figure 6.4-3.

$$C_x = \frac{L_x}{Q_x} = \frac{L_0 \cdot \exp^{(-k_D T_0)} + \sum_{i=1}^{i=n} l_i \cdot \exp^{(-k_D t_i)} + \sum_{i=1}^{i=n+1} L_i \cdot \exp^{(-k_D T_i)}}{Q_x}$$

C_x: Concentration at Evaluation Point [mg/L]

L_x: Pollution Load at Evaluation Point [g/s]

Q_x: River Discharge at Evaluation Point [m^3/s]

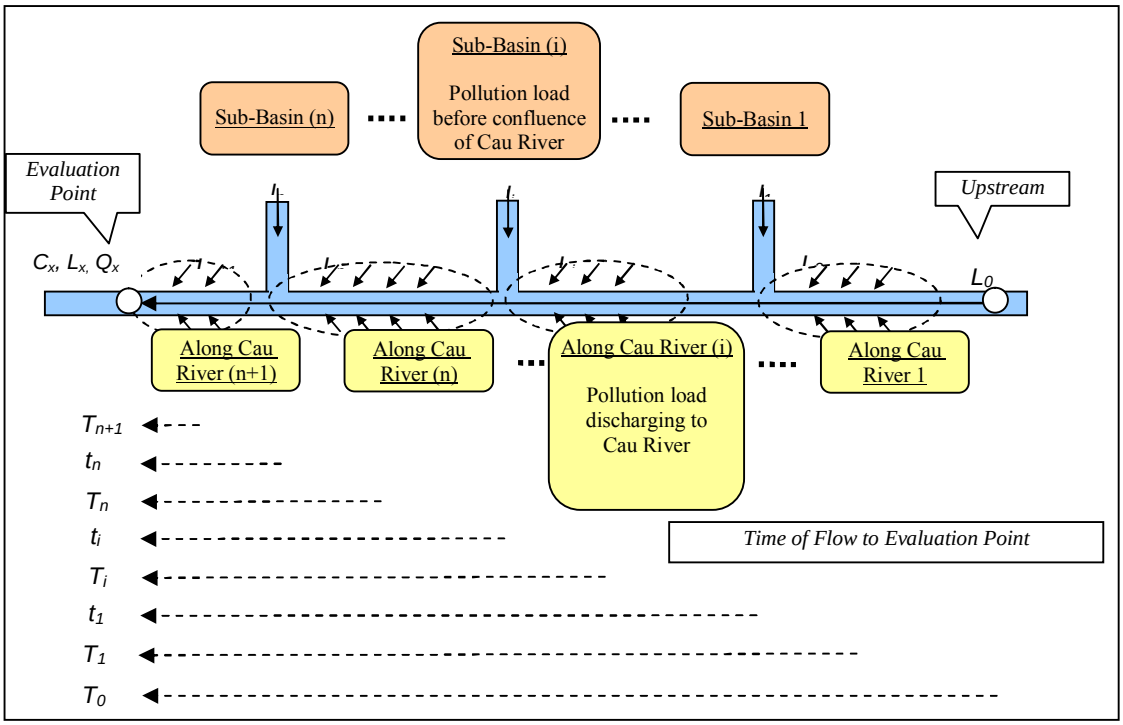
L_0: Pollution Load at Upstream including Background Pollution Load [g/s]

l_i: Pollution Load from Sub-basins through tributary [g/s]

L_i: Pollution Load from along Cau River directly [g/s]

t, T: Time of flow to downstream [day]

k_D: de-oxygenation coefficient [1/day]



Source: JICA Study Team

Figure 6.4-3 Image of the Formulation of Water Quality Prediction

(2) Setting Boundary Condition and Coefficient

Boundary conditions such as pollution load, river discharge, river flow, and river length and coefficient as self-purification effect are set to simulate current water quality. The coefficient of self-purification effect (de-oxygenation coefficient) is set by comparison of simulated water quality with monitoring data as parameter fitting based on the existing survey in Japan (Guideline of Study for Planning Development of Sewerage System in River Basin, Japan Sewerage Work Association, 2008) as shown in Table 6.4-4. Target month are set in February because this month of water quality tends to indicate worst in a year due to the least river discharge.

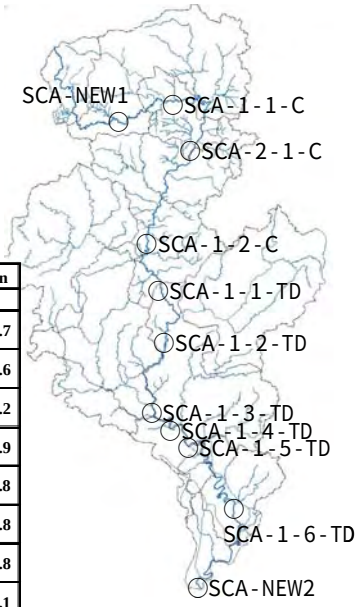
Table 6.4-4 Setting Self-Purification Effect ((De-oxygenation Coefficient)

Segment	De-oxygenation coefficient*1	River Flow*2
Upstream ~ SCA-2-1-C	0.12	0.40 m/s
SCA-2-1-C ~ SCA-1-1-TD	0.11	0.20 m/s
SCA-1-1-TD ~ SCA-1-5-TD	0.10	0.15 m/s
SCA-1-5-TD ~ Downstream	0.10	0.05 m/s

*1) Self Purification is set depend on the slope
*2) River flow was measured by JST in February 2009
Source: JICA Study Team

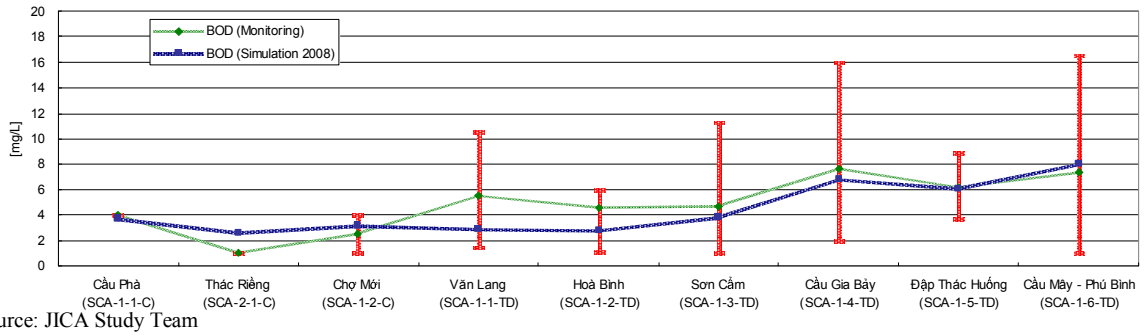
(3) Simulation of Current Water Quality

Based on the set boundary conditions and coefficient, current water quality (BOD) in the model area of the Cau River Basin was simulated as shown in Figure 6.4-4. As a whole, the trend of water quality (BOD) from upstream to downstream can be simulated by comparison the simulated water quality with monitoring data.



Station Name	Code	2006		2007		2008		2009		Monitoring			Simulation
		DONRE	CEM	DONRE	CEM	DONRE	CEM	DONRE	CEM	Ave	Max	Min	2008
Cầu Phà (SCA-1-1-C)	SCA-B-1-1	-	-	-	4.0	-	-	-	4.0	4.0	4.0	4.0	3.7
Thác Riềng (SCA-2-1-C)	SCA-B-1-2	-	-	-	-	-	-	-	1.0	1.0	1.0	1.0	2.6
Chợ Mới (SCA-1-2-C)	SCA-B-1-3	-	-	-	4.0	-	-	-	1.0	2.5	4.0	1.0	3.2
Văn Lang (SCA-1-1-TD)	SCA-T-1-1	8.5	-	4.5	4.0	10.6	4.0	1.5	-	5.5	10.6	1.5	2.9
Hoà Bình (SCA-1-2-TD)	SCA-T-1-2	5.5	-	5.1	4.0	5.7	6.0	1.1	-	4.6	6.0	1.1	2.8
Sơn Cẩm (SCA-1-3-TD)	SCA-T-1-3	5.5	-	11.3	4.0	4.0	2.0	1.0	-	4.6	11.3	1.0	3.8
Cầu Gia Bảy (SCA-1-4-TD)	SCA-T-1-4	7.0	-	12.5	4.0	16.0	2.0	4.7	-	7.7	16.0	2.0	6.8
Đập Thác Huống (SCA-1-5-TD)	SCA-T-1-5	6.5	-	5.4	-	8.9		3.7	-	6.1	8.9	3.7	6.1
Cầu Mây - Phú Bình (SCA-1-6-TD)	SCA-T-1-6	6.5	-	16.5	5.4	9.1	1.0	5.6	-	7.4	16.5	1.0	8.0

Note) "-" is not measured in January or February



Source: JICA Study Team

Figure 6.4-4 Result of Simulation of Current Water Quality (BOD)

6.4.3 Setting Socio-economic Development Scenario

(1) Consideration of Socio-economic Development Scenarios

Socio-economic scenarios of Bac Kan and Thai Nguyen provinces until 2020, the final target year of Water Environment Management Plan, are prepared. Table 6.4-5 shows considered items in the socio-economic scenarios. These items are critical one which affect pollution load and water quality. They are used in estimation of future pollution load, water balance and simulation of water quality in the model area until 2020.

Table 6.4-5 Items Considered in Socio-Economic Scenarios

Items	Unit	Used for
Population (urban and rural)	Person	Calculation of future pollution load from domestic wastewater
GRDP (industrial and agricultural sector)	VND	Calculation of water balance and future pollution load
Turnover (industrial and agricultural sector)	VND	Calculation of water balance and future pollution load
Number of livestock	Head	Calculation of future pollution load from livestock industry
Land use area (agriculture, urban and forest)	Ha	Calculation of future pollution load from non-point source

Source: JICA Study Team

(2) Basis of Socio-Economic Scenarios

Both Bac Kan and Thai Nguyen provinces have prepared the socio-economic development M/Ps which specify the prospects of population growth, development targets of turnover and GRDP, land use plans and so on. Therefore, based on the M/Ps of Bac Kan and Thai Nguyen, the socio-economic scenarios are developed. Future population, turnover, GRDP, etc. are estimated by multiplying the latest statistic by the growth rates mentioned in the M/Ps. If the M/Ps do not contain sufficient information, other sector development plans, such as the Revised M/P of Agricultural and Rural Development of Thai Nguyen Province until 2020, etc., are reviewed. In addition, relevant organizations are interviewed to obtain necessary information. Especially, with respect to economic items, i.e. turnover and GRDP, three development scenarios, high, base and low, are prepared

(3) Setting Socio-Economic Scenarios

Socio-economic scenarios such as population, turnover, livestock, and land use are set in the target years (2012, 2015, and 2020) based on the above development M/Ps and sector development plans. Table 6.4-6 shows trend of socio-economic development each target year and scenario in Bac Kan and Thai Nguyen provinces.

Table 6.4-6 Trend of Socio-Economic Development

Items		Case	Thai Nguyen				Bac Kan			
			2008	2012	2015	2020	2008	2012	2015	2020
Population [persons]		Base:	100%	104%	106%	111%	100%	105%	109%	114%
Industrial Turnover [million VND]		High:	100%	183%	274%	534%	100%	182%	303%	719%
		Base:	100%	174%	251%	463%	100%	163%	241%	471%
		Low:	100%	165%	230%	400%	100%	145%	191%	303%
Number of livestock [heads]	Cattle	Base:	100%	110%	122%	148%	100%	198%	233%	292%
	Pigs	Base:	100%	147%	170%	208%	100%	161%	189%	236%
Land use area [ha]	Urban	Base:	100%	157%	174%	204%	100%	165%	198%	255%
	Agriculture	Base:	100%	110%	108%	108%	100%	114%	122%	135%
	Forest	Base:	100%	104%	104%	104%	100%	113%	116%	120%

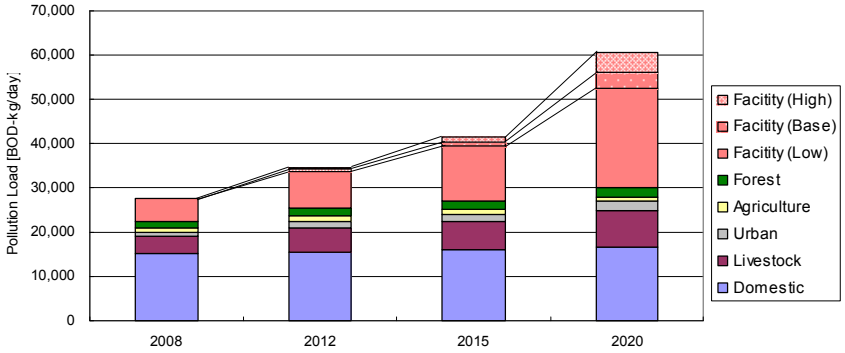
Source: JICA Study Team

6.4.4 Future River Condition without Measures

(1) Future Pollution Load

Future pollution load is estimated based on the set socio-economic scenario as shown in Section 6.4.3. Pollution load increases and decrease in accordance with population growth, increase of the industrial turnover and livestock, and variation of land use pattern. Figure 6.4-5 shows the yearly

trend of pollution load at the model area of the Cau River Basin. Pollution load in 2020 is estimated as twice of that in 2008.

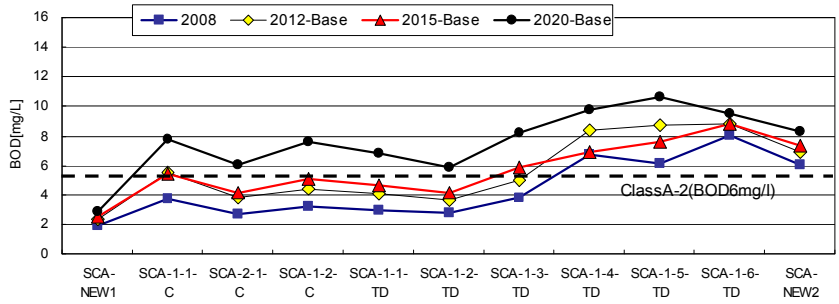


Source: JICA Study Team

Figure 6.4-5 Future Water Quality (BOD) of the three Scenarios in 2020

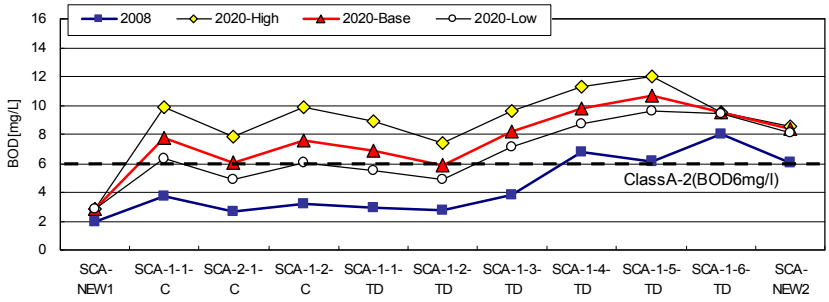
(2) Future Water Quality

Future water quality is simulated based on the results of pollution load estimation and water balance study of each target year and scenario. Figure 6.4-6 shows the future water quality (BOD) of the base scenario in 2012, 2015, and 2020 and Figure 6.4-7 shows the future water quality (BOD) of the three scenarios in 2020. Water quality from SCA-1-1-C (downstream area of Bac Kan Town) to the downstream area of the base scenario in 2020 is estimated beyond Class A-2 level (6 mg/L).



Source: JICA Study Team

Figure 6.4-6 Future Water Quality (BOD) of the Base Scenario in 2012, 2015, and 2020



Source: JICA study team

Figure 6.4-7 Future Water Quality (BOD) of the three Scenarios in 2020

6.5 Water Environment Management Plan of the Model Area

6.5.1 Vision, Goal, and Target Year

A Vision is a long-term development image of the Cau River basin. It shows 'how we wish to maintain the Cau River in future', and must be shared among all of stakeholders in the basin. The vision of the Cau River for the Water Environment Management Plan (WEMP) is set as follows:

'A healthy river water environment supporting ecosystem, people's livelihoods and socio-economic development in the Cau River Basin'

A goal is a positive impact created by implementation of WEMP, and it is set as follows:

'Achieve clean river water quality which meets Class A-2 of QCVN 08: 2008/BTNMT in the all model area in 2020'

The WEMP has a short target year of 2012, a middle target of 2015, and final target of 2020.

6.5.2 Classification of the Cau River and Target Water Quality

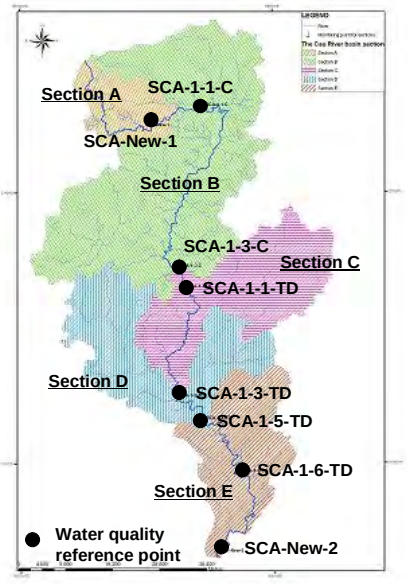
As shown in Table 6.5-1 and Figure 6.5-1, the Cau river in the model area is classified into five river sections referring to current and future water quality, pollution sources and water use. Water quality reference points are set up in each section.

Table 6.5-1 Characteristics of River Sections in the Model Area

Section	River Section	Area (km2)	Population (2008)	Length of Cau River (km)
A	Uppermost river until Bac Kan Town	231	16,000	51
B	From Bac Kan Town to provincial boundary	1,468	174,000	66
C	From provincial boundary to confluence of Du River	640	89,000	35
D	From confluence of Du River to Tac Hong Weir	642	262,000	25
E	From Tac Hong Weir to the end of model area	491	285,000	50
Total		3,472	826,000	227

Source: JICA Study Team

As Table 6.5-2 shows, each section has phased target water qualities until 2020. Achievement of the target water qualities will be identified by referring to water quality monitoring result at the water quality reference points.



Source: JICA Study Team

Figure 6.5-1 Classified River Sections and Water Quality Reference Points

Table 6.5-2 Classified River Sections and Their Target Water Quality*

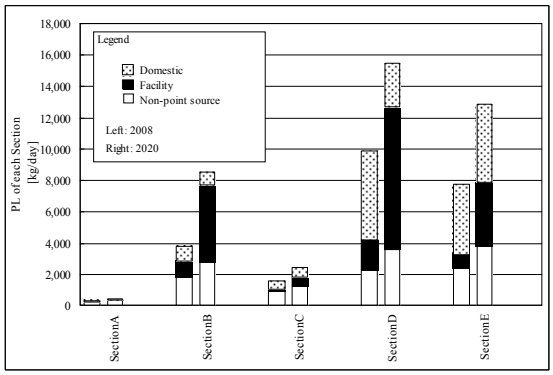
	Section	Water Quality of 2008	Target Water Quality			Water Quality Reference point
			2012	2015	2020	
A	Uppermost area until boundary of Bac Kan town	A-1 level**	A-1	A-1	A-1	SCA-New-1
B	From Bac Kan town to provincial boundary	A-1 level	A-2	A-2	A-2	SCA-1-1-C, SCA-1-3-C
C	From provincial boundary to before confluence point of Du River	A-2 level	A-2	A-2	A-2	SCA-1-1-TD
D	From confluence point of Du River to before Tac Hong Weir	B-1 level	B-1	B-1	A-2	SCA-1-3-TD, SCA-1-5-TD
E	From Tac Hong Weir to before confluence point of the Cong River	B-1 level	B-1	B-1	A-2	SCA-1-6-TD, SCA-New-2

* QCVN 08: 2008/BTNMT; ** Simulation result
Source: JICA Study Team

6.5.3 Target Pollution Sources and Critical Areas

(1) Pollution Load of Each River Section

Estimated pollution loads flowing into the Cau river system in 2008 and 2020 are shown in Figure 6.5-2. Comparing with 2008, the estimated results showed that pollution load from facilities increased significantly, especially in the section B, D, and E. Although pollution load of domestic wastewater will decrease by the on-going sewerage system development projects in Bac Kan town in the section B and Thai Nguyen city in the section D, it will be main pollution sources even in 2020.

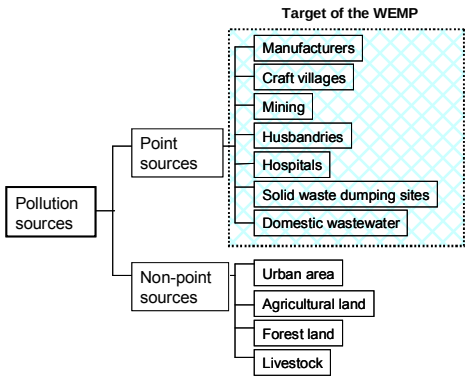


Source: JICA Study Team

Figure 6.5-2 Pollution Load of Each River Section

(2) Target Pollution Sources

Point sources are main targets of WEMP as shown in Figure 6.5-3, because their polluters can be identified clearly and effectiveness of water pollution control can be evaluated. On the other hand, though non-point sources are not main targets, WEMP contains some measures contributing to decrease pollution load from them.



Source: JICA Study Team

Figure 6.5-3 Target Pollution Sources of WEMP

(3) Target Pollutants

Target pollutants of WEMP are BOD, COD, SS, As, Cd, Pb, and Zn because they are major pollutants identified by monitoring results in the model area and target pollutants of environmental protection fee (Decree No.67/2003 and Joint Circular No.106/2007).

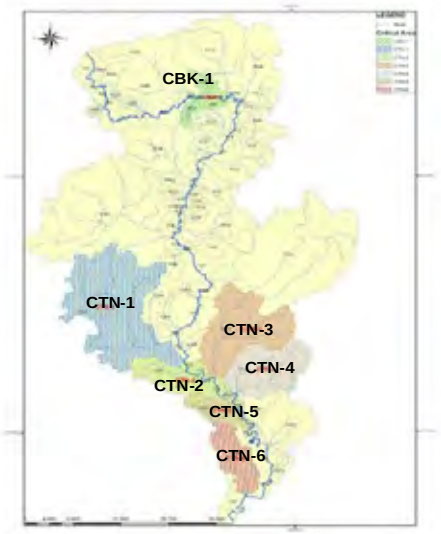
(4) Standard of Discharged Wastewater

The Class B of QCVN 24: 2009/BTNMT is used as the standard of discharged wastewater for industry in the model area. Besides, TCVN 7382: 2004 is applied to wastewater from a hospital, and QCVN 25: 2009/BTNMT is used for leachate from a solid waste landfill site.

(5) Critical Areas

The 7 priority critical areas are selected from sub-basins where point sources (domestic and facilities) are concentrated, and urban and industrial development are planned as shown in Figure 6.5-4. In the critical areas, around 77% of facilities identified by the pollution source inventory survey are located (See Table 6.5-3).

Total BOD load discharged by point sources in the critical areas accounts for around 70% of BOD load generated by point sources in the model area as shown in Table 6.5-4.



Source: JICA Study Team

Figure 6.5-4 Seven Critical Areas

Table 6.5-3 Number of Enterprises in the Critical Areas

		Total No. of enterprieses	No. of Highest enterprises	No. of Higher enterprises	No. of Other enterprises
Critical areas	CBK-1	14	3	3	8
	CTN-1	14	6	4	4
	CTN-2	28	9	7	12
	CTN-3	7	3	1	3
	CTN-4	2	2	0	0
	CTN-5	26	13	5	8
	CTN-6	20	5	3	12
Total in critical areas		111	41	23	47
Out of critical areas		34	15	10	9

Note: 'Highest', 'Higher' and 'Others' enterprises are defined by the pollution source inventory survey, i.e. Highest means large scale including No.64 facilities, Higher means medium scale, and Others mean smaller scale.
Source: JICA Study Team

Table 6.5-4 Pollution Load from the Critical Areas

Province	Section	Critical area	Discharged BOD from point sources in the critical areas (kg/d)
Bac Kan	A	-	0
	B	CBK-1	471
Thai Nguyen	C	-	-
	D	CTN-1	1,877
		CTN-2	4,892
		CTN-3	976
	E	CTN-4	84
		CTN-5	2,106
		CTN-6	563

Source: JICA Study Team

6.5.4 Consideration of Pollution Load Reduction Plan

(1) Estimated Pollution Load to be reduced up to 2020

Based on the pollution load analysis and future water quality prediction, the pollution load from the point sources should be reduced as shown in Table 6.5-5 to achieve the goal of WEMP in the model area in 2020.

Table 6.5-5 BOD Pollution Load to be Reduced in 2020

Unit: kg/day

Province	Section	BOD Pollution Load by Domestic Wastewater		BOD Pollution Load by Facility Wastewater	
		Total Amount of Discharged BOD Pollution Load	Amount to be Reduced	Total Amount of Discharged BOD Pollution Load	Amount to be Reduced
Bac Kan	A	60	0	0	0
	B	860	200	4,900	3,300
Thai Nguyen	C	600	0	550	140
	D	2,800	920	9,100	7,700
	E	5,000	1,300	4,100	2,900

Source: JICA Study Team

(2) Pollution Load Reduction Plan

In order to examine the required pollution loads to be reduced, several plans are considered as follows.

1) Plan-1: Implementation of Currently Planned/ On-going Sewerage Projects

It includes the planned Bac Kan town sewerage project assisted by the Finnish government (targeted around 10,000 persons) and Thai Nguyen city sewerage project assisted by the French government (targeted around 100,000 persons), but no other measures are taken for treatment of domestic and industrial wastewater.

The predicted BOD concentrations in 2020 shown in Table 6.5-6 will not meet the goal of WEMP in the most sections.

Table 6.5-6 Predicted BOD Concentration under Plan-1 in 2020

Province	Section	Critical area	Predicted BOD Concentration (mg/L)
Bac Kan	A	-	2.8
	B	CBK-1	7.6
Thai Nguyen	C	-	8.2
	D	CTN-1 CTN-2 CTN-3	10.7
	E	CTN-4 CTN-5 CTN-6	8.3

Note: Highlighted figures of the predicted BOD concentration mean that the figures are not satisfied with surface water quality standards QCVN 08:2008/BTNMT.

Source: JICA Study Team

2) Plan-2: Adoption of Measures on Enterprise in the Critical Areas and Density Populated Areas with Planned/ On-going Sewerage Project

In addition to the Plan-1, it includes the industrial wastewater treatment of enterprises located in the critical areas and the additional domestic wastewater treatment from the densely populated areas in Bac Kan town and Thai Nguyen city outside of the planned projects assisted by the Finnish and French government. The predicted BOD concentrations in 2020 shown in Table 6.5-7 will not also meet the goal of WEMP in the Section E at the downstream area of Thai Nguyen City.

Table 6.5-7 Predicted BOD Concentration under Plan-2 in 2020

Province	Section	Critical area	Predicted BOD Concentration (mg/L)
Bac Kan	A	-	2.8
	B	CBK-1	5.8
Thai Nguyen	C	-	5.2
	D	CTN-1, CTN-2, CTN-3	5.6
	E	CTN-4, CTN-5, CTN-6	6.2

Note: Highlighted figures of the predicted BOD concentration mean that the figures are not satisfied with surface water quality standards QCVN 08:2008/BTNMT.
Source: JICA Study Team

3) Plan-3: Introduction of Total Pollution Load Control Measure with Plan-2

In order to meet the Plan A-2 in the river section E (downstream area of the Tac Hong Weir), it will be required to reduce pollution load around 300 kg-BOD/ day by the domestic wastewater treatment in Thai Nguyen city or the industrial wastewater treatment targeting the enterprises located in the critical area of CTN-5. Comparing with the indicative cost of the domestic and industrial wastewater treatment, it is recommended to adopt the industrial wastewater treatment due to much cheaper investment cost. Moreover, it will be justified by the basic policy for formulating WEMP, namely the PPP policy.

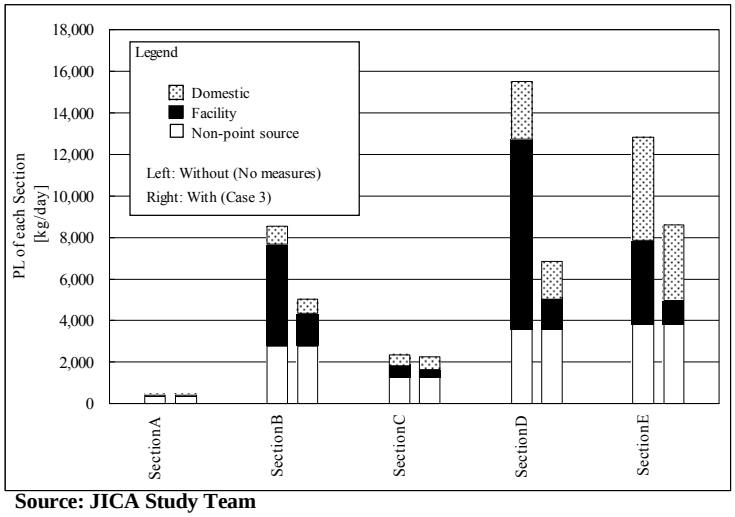
For adopting this method, a new approach namely, the total pollution load control, should be introduced in actual implementation of the Case-3, because it will require further efforts to the target enterprises for reducing their pollution load even though they may comply with the standard discharge wastewater quality (the Class B of QCVN 24: 2009/BTNMT). This means that the administrative enforcement bodies need to set up a new legal base by preparation of the provincial ordinances and to agree with the target enterprises for mutual cooperation.

The predicted BOD concentrations in 2020 shown in Table 6.5-8 will meet the goal of WEMP in the all sections in the model area. A comparison figure of pollution load flowing into the Cau river system between without (no measures) and with (Case-3) is shown in Figure 6.5-5.

Table 6.5-8 Predicted BOD Concentration with Plan-3 in 2020

Province	Section	Critical area	Predicted BOD Concentration (mg/L)
Bac Kan	A	-	2.8
	B	CBK-1	5.8
Thai Nguyen	C	-	5.2
	D	CTN-1, CTN-2, CTN-3	5.6
	E	CTN-4, CTN-5, CTN-6	5.8

Source: JICA Study Team



Source: JICA Study Team

Figure 6.5-5 Comparison Figure of Pollution Load Flowing into the Cau River System between Without (No measures) and With (Plan-3)

(3) Conclusion

Through the preliminary consideration of pollution load reduction plan mentioned above, the actual reduction should be set force by means of step by step implementation of measures described in the Plan-1 to 3 to achieve the goal and vision of WEMP in the model area, in conclusion.

6.5.5 Consideration of Measures and Actions

(1) Pollution Control Approach in Vietnam

The Vietnam environment management sector has made massive efforts to address environmental issues along with enacting the national environmental policies/strategies, renovating the Law on Environmental Protection (LEP) and related legislations, and reforming enforcement structures. However, the environmental pollution, especially river water, is still suffering from more acute influences and indwelling increasing potential environmental risk. This implies that all environment management agencies are in need of more rigorously integrated management capacity of water pollution control to deal with impending different environmental pressures.

Based on the overall problem analysis of existing approaches/systems in Vietnam, the Direction of reinforcement for water pollution control approaches consisting of 11 actions under 4 measures is proposed in the Study to be applied to the whole of Vietnam as follows:

Measure 1: Strengthening of enforcement capacity and supporting measures	■ Action 1.1: Information system of pollution source management ■ Action 1.2: Mechanism related with pollution control systems ■ Action 1.3: Capacity of local staffs in water environment management ■ Action 1.4: Capacity of local agencies in measurement and analysis
Measure 2: Strengthening of wastewater fee and integrated supporting system	■ Action 2.1: Wastewater fee system ■ Action 2.2: Lending capacity of VEPF ■ Action 2.3: Integrated supporting system to craft village industries
Measure 3: Promotion of self-supervising management	■ Action 3.1: Self-monitoring system ■ Action 3.2: Environmental supervisor system
Measure 4: Promotion of environmental awareness raising	■ Action 4.1: Public disclosure of environmental management information ■ Action 4.2: Dissemination activities

(2) Measures and Actions for WEMP in the Model Area

Considering the pollution control approaches applied in Vietnam and the current issues on water environment management in the model area shown in Table 2.4-13 in Section 2.4.4, the following 5 measures are proposed to achieve the goal of WEMP in the model area in accordance with the pollution load reduction plan described in Chapter 4.7.

a) Measure-1: To promote environmental management by enterprises

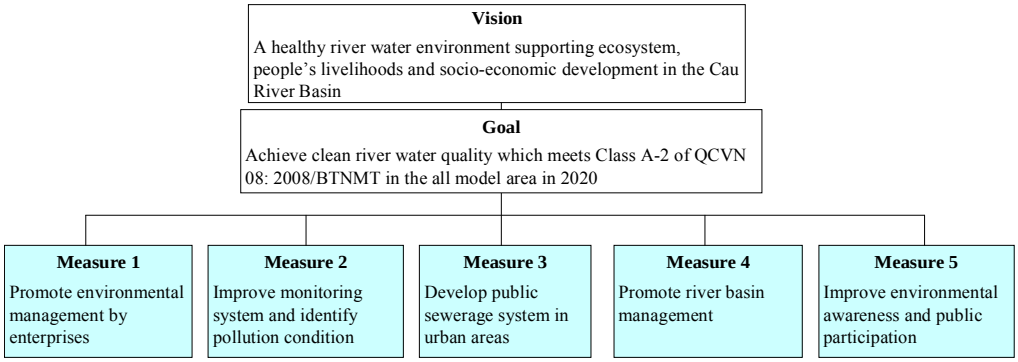
b) Measure-2: To improve monitoring system and to identify pollution condition

c) Measure-3: To develop public sewerage system in urban areas

d) Measure-4: To promote river basin management

e) Measure-5: To improve environmental awareness and public participation

Each measure consists of the Projects aiming at direct pollution load reduction to be implemented by the management bodies of the target pollution sources collaborating with the administrative enforcement bodies on water environment, and of the Operation Program supporting effective and efficient implementation of the Projects. Figure 6.5-6 shows structure of the vision, goal, and measures of WEMP.

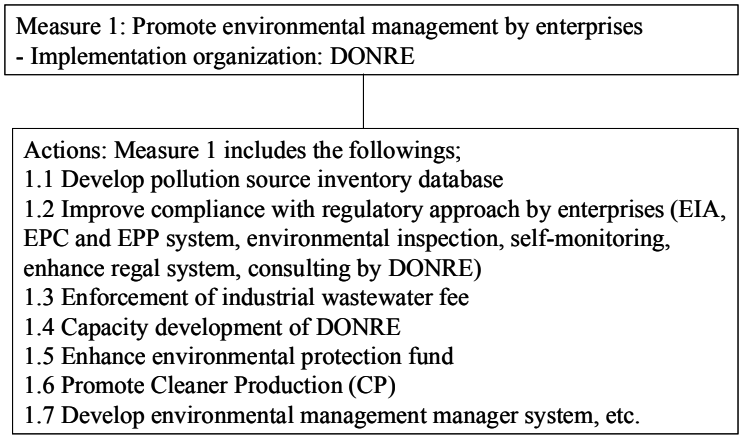


Source: JICA Study Team

Figure 6.5-6 Structure of the Vision, Goal and Measures of WEMP

1) Measure 1

Measure 1 aims at enhancing the mechanism of pollution control system to promote environmental management by enterprises. Currently, the regulatory approach with the type of command and control is not effective due to lack of capacity of DONREs and insufficient regal system. They need to be improved for appropriate enforcement of the regulatory approach. In addition, in order to lead spontaneous management by enterprises, promotion of cleaner production/environmental management system and development of pollution control manager system are necessary. Figure 6.5-7 summarizes Measure 1 and necessary actions to achieve it. Achievement of Measure 1 will be judged by indicators shown in Table 6.5-9.



Source: JICA Study Team

Figure 6.5-7 Summary of Measure 1 and Actions

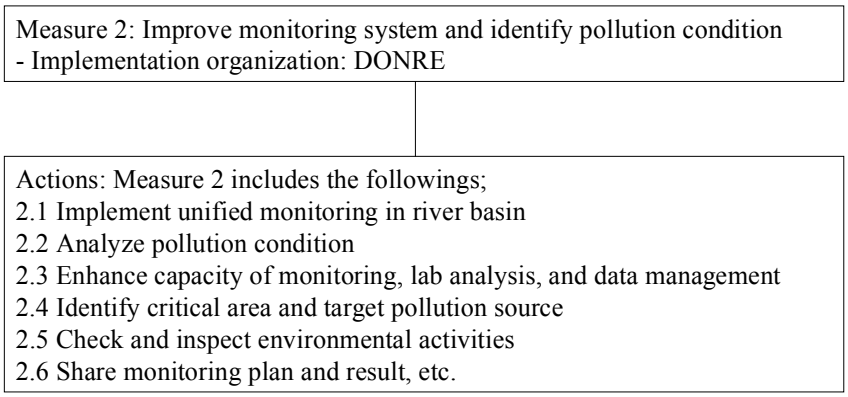
Table 6.5-9 Indicators of Measure 1

Period	Indicator
2012	Around 30% of enterprises in the model area will meet Class B of QCVN 24: 2009/BTNMT
2015	Around 45% of enterprises in the model area will meet Class B of QCVN 24: 2009/BTNMT
2020	Around 80% of enterprises in the model area will meet Class B of QCVN 24: 2009/BTNMT

Source: JICA Study Team

2) Measure 2

Monitoring data of the model area will be fundamental information to evaluate progress of the WEMP. Currently, Bac Kan DONRE and Thai Nguyen DONRE conduct monitoring activity, but there are several points which need to be improved. Firstly, on the view point of river basin management, sharing of their monitoring plans and results should be promoted. On the other hand, improvement of some technical skills, such as monitoring of discharge, management of consultant, etc., is necessary. Therefore, Measure 2 aims at improving monitoring system and laboratory activity by DONREs. Figure 6.5-8 summarizes Measure 2 and necessary actions to achieve it. Achievement of Measure 2 will be judged by indicators shown in Table 6.5-10.



Source: JICA Study Team

Figure 6.5-8 Summary of Measure 2 and Actions

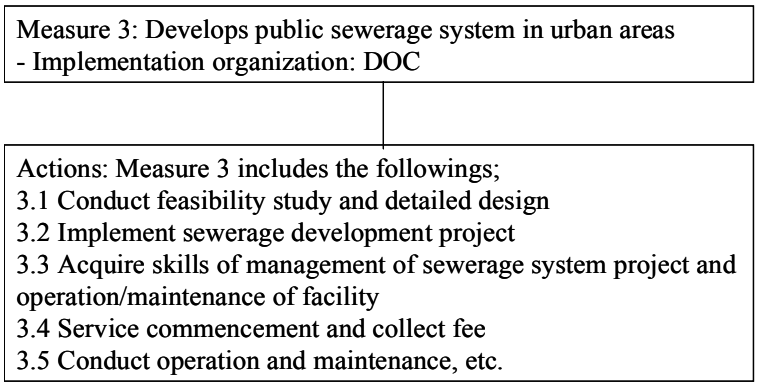
Table 6.5-10 Indicators of Measure 2

Period	Indicator
2012	Bac Kan DONRE will establish laboratory. Basin wide monitoring will be continued including data sharing and QA/QC.
2015	Basin wide monitoring will be continued including data sharing and QA/QC.
2020	ditto

Source: JICA Study Team

3) Measure 3

Currently, to control domestic wastewater is one of the urgent issues. Over half of BOD pollution load in the model area is originated from domestic wastewater. Until 2020, urban population in Bac Kan town and Thai Nguyen city will increase rapidly. Thus, Measure 3 aims to develop public sewerage system in urban area. Figure 6.5-9 summarizes Measure 3 and necessary actions to achieve it. Achievement of Measure 3 will be judged by indicators shown in Table 6.5-11.



Source: JICA Study Team

Figure 6.5-9 Summary of Measure 3 and Actions

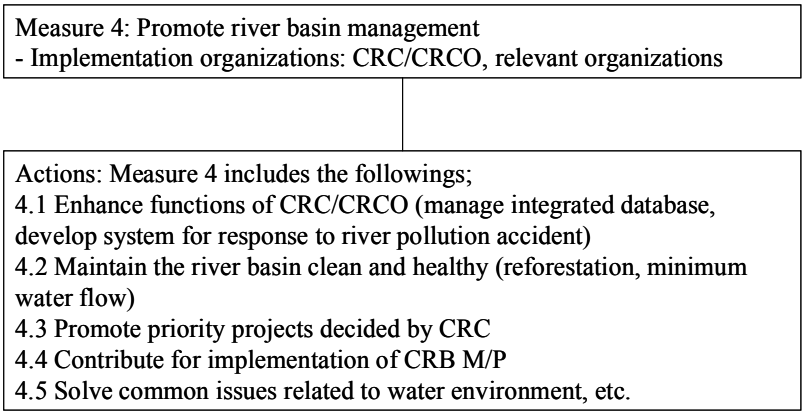
Table 6.5-11 Indicators of Measure 3

Period	Indicator
2012	-
2015	20% of urban population in Thai Nguyen province will access public sewerage system by WEMP and on-going sewerage development project.
2020	60% of urban population in Bac Kan town and 80% of Thai Nguyen city will access public sewerage system by WEMP and on-going sewerage development project.

Source: JICA Study Team

4) Measure 4

Though Decree No.120 was promulgated, the river basin management in the model area is still weak. The CRCO does not have sufficient capacity to coordinate relevant organizations in the model area. It is expected that the CRCO would have functions of controlling integrated database including pollution source inventory and monitoring data in the model area, and monitoring progress of the WEMP. So, Measure 4 aims at promoting river basin management under leadership by the CROC and positive involvement of relevant organization. Figure 6.5-10 summarizes Measure 4 and necessary actions to achieve it. Achievement of Measure 4 will be judged by indicators shown in Table 6.5-12.



Source: JICA Study Team

Figure 6.5-10 Summary of Measure 4 and Actions

Table 6.5-12 Indicators of Measure 4

Period	Indicator
2012	- Permanent member of the CRCO will be assigned - The CRCO will develop integrated database (inventory and monitoring data) - The CRC will be held regularly
2015	- The CRCO will update integrated database (inventory and monitoring data) regularly - The CRC will be held regularly
2020	ditto

Source: JICA Study Team

5) Measure 5

Currently, Bac Kan DONRE and Thai Nguyen DONRE conduct public awareness raising, but it is not comprehensive. Stakeholders such as enterprises, farmers and citizens do not access sufficient environmental information. Therefore, Measure 5 aims to disseminate environment-related information and environmental performance rating of enterprises to improve public awareness and participation. Figure 6.5-11 summarizes Measure 4 and necessary actions to achieve it. Achievement of Measure 4 will be judged by indicators shown in Table 6.5-13.

Measure 5: Improve environmental awareness and public participation
- Implementation organization: DONRE

Actions: Measure 5 includes the followings;
5.1 Promote environmental awareness esp. to owners/managers of enterprises
5.2 Implement environmental performance rating of enterprises
5.3 Disseminate environmental information to the public and farmers
5.4 Enhance public participation of the stakeholders
5.5 Disclose environmental information
5.6 Hold environmental symposium, seminar, and workshop, etc.

Source: JICA Study Team

Figure 6.5-11 Summary of Measure 5 and Actions

Table 6.5-13 Indicators of Measure 5

Period	Indicator
2012	Environmental awareness on owners and managers of enterprises will be conducted
2015	ditto
2020	Environmental performance rating of enterprises will be conducted

Source: JICA Study Team

6.5.6 Proposed Projects and Operation Programs

(1) Policy of Formulating Projects and Operation Programs

The WEMP requires a series of projects and operation programs to achieve its vision and goal. In this WEMP, the concepts of "Project" and "Operation Program" are defined as follows:

- Project: Concrete set of activities to achieve the vision and goal of WEMP, and

- Operation Program: Mechanism for effective and efficient implementation of the Projects.

For formulation of the projects and operation programs of WEMP, the following basic policies are adopted:

1) To apply Polluter Pays Principle (PPP),

2) To prioritize severe pollution sources as the first target,

3) To evolve from 'end-of-pipe (control of concentration)' to 'win-win (renovation of production process compatible with pollution load reduction)', and

4) To exclude the currently planned and/or on-going projects, but deal them with the given conditions of WEMP.

(2) Outline of the Proposed Projects

The Project should possess substantial impacts being driven to achieve the vision and goal of WEMP. Thus, its first priority target must be the industrial wastewater especially from severe pollution sources, and the domestic wastewater from dense populated areas. Through detailed analysis related to effectiveness and cost performance by the water quality simulation results, the following 7 Projects are proposed for WEMP in the model area.

- Project 1: Improvement of Water Quality from the Highest Priority Facilities in the Critical Areas, including those of Decision No. 64 and Circular No. 07,
- Project 2: Improvement of Water Quality from Higher Priority Facilities in the Critical Areas,
- Project 3: Improvement of Water Quality from other Facilities in the Critical Areas and Facilities Outside of Critical Areas,
- Project 4: Pollution Load Reduction by Introducing Total Pollution Load Control in the Model Area,
- Project 5: Construction of Small-scale Public Sewerage System in Central Bac Kan Town,
- Project 6: Construction of Public Sewerage System in North and Southeast Central Thai Nguyen City, and
- Project 7: Construction of Public Sewerage System in Southeast of Thai Nguyen City.

The Project 1, 2, and 3 are aiming at control of industrial pollution load from facilities by installation and operation of wastewater treatment plant. The Project 4 aims at introduction of a new concept of total pollution load control which regulates not by concentration, but by total amount of pollution load. The Project 5, 6, and 7 are aiming at control of domestic wastewater pollution load in and around Thai Nguyen city and at Bac Kan town.

The general outline of the proposed Projects is summarized in Table 6.5-14.

Table 6.5.-14 General Outline of Proposed Projects

Title	Purpose	Period	Implementation Body
Project1: Improvement of Water Quality from the Highest Priority Facilities in the Critical Areas, including those of Decision No. 64 and Circular No. 07	All Highest facilities in the critical areas will meet Class B of QCVN 24: 2009/BTNMT	2010-2012	Bac Kan and Thai Nguyen PPC
Project 2: Improvement of Water Quality from Higher Priority Facilities in the Critical Areas	All Higher facilities in the critical areas will meet Class B of QCVN 24: 2009/BTNMT	2013-2015	Bac Kan and Thai Nguyen PPC
Project 3: Improvement of Water Quality from other Facilities in the Critical Areas and Facilities Outside of Critical Areas	70% of Others facilities and those outside of the critical areas, including newly constructed facilities, will meet Class B of QCVN 24: 2009/BTNMT	2015-2020	Bac Kan and Thai Nguyen PPC
Project 4: Pollution Load Reduction by Introducing Total Pollution Load Control in the Model Area	Selected facilities in the critical area, CTN-5, will reduce 40% of total BOD load from the area.	2018-2020	Thai Nguyen PPC
Project 5: Construction of Small-scale Public Sewerage System in Central Bac Kan Town	Until 2020, 10,000 persons in the urban area of Bac Kan town will be served with small scale public sewerage system.	2015-2018	Bac Kan PPC and DOC
Project 6: Construction of Public Sewerage System in North and Southeast Central Thai Nguyen City	Until 2020, 30,000 persons in the urban area of central Thai Nguyen city will be served with public sewerage system.	2013-2015	Thai Nguyen PPC and DOC
Project 7: Construction of Public Sewerage System in Southeast of Thai Nguyen City	Until 2020, 35,000 persons in the urban area of southeast Thai Nguyen city will be served with public sewerage system.	2017-2019	Thai Nguyen PPC and DOC

Source: JICA Study Team

(3) Outline of the Proposed Operation Programs

The Operation Program is formulated aiming at effective and efficient implementation of the proposed Projects mentioned above and of the pollution control activities as a whole by focusing on the capacity development of concerned administrative bodies. Therefore, the Operation Program should have closer links with the proposed Projects and the actual pollution control activities taken in the model area. Taking the current administrative enforcement situations into account, the following 9 Operation Programs are proposed for WEMP in the model area.

- Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas,
- Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas,
- Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas,
- Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area,
- Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City,
- Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City,
- Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin,
- Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE, and
- Operation Program 9: Enhancement of River Basin Approach on Water Environment Management.

The Operation Program 1 to 4 are supporting effective implementation of the corresponding Project 1 to 4. The Operation Program 5 and 6 are aiming at enhancement of environmental management capacity of iron and steel enterprises that are major industrial pollution sources in the model area. The Operation Program 7 to 9 are aiming at enhancement of regional capacity on water environment management.

The general outline of the proposed Operation Programs is summarized in Table 6.5-15.

Table 6.5-15 Outline of Proposed Operation Program

Title	Purpose	Period	Implementation Body
Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas	(1)To promote effective implementation of the Project 1 (Improvement of water quality from the highest priority facilities in the critical areas, including those of Decision No. 64 and Circular No. 07) (2)To comply wastewater quality from all highest priority facilities in the critical areas with Class B of QCVN 24: 2009/BTNMT.	2010-2012	VEA, PPC, and DONRE
Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas	(1)To promote effective implementation of the Project 2 (Improvement of water quality from the higher priority facilities in the critical areas) (2)To comply wastewater quality from all higher priority facilities in the critical areas with Class B of QCVN 24: 2009/BTNMT (3)To follow up the output of the Operation Program 1 and to take supplemental activities, if any	2013-2015	VEA, PPC, and DONRE
Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas	(1)To promote effective implementation of the Project 3 (Improvement of water quality from other facilities in the critical areas and facilities outside of the critical areas) (2)To comply wastewater quality from 70% of facilities in the critical areas and facilities outside of the critical areas with Class B of QCVN 24: 2009/BTNMT	2015-2020	VEA, PPC, and DONRE

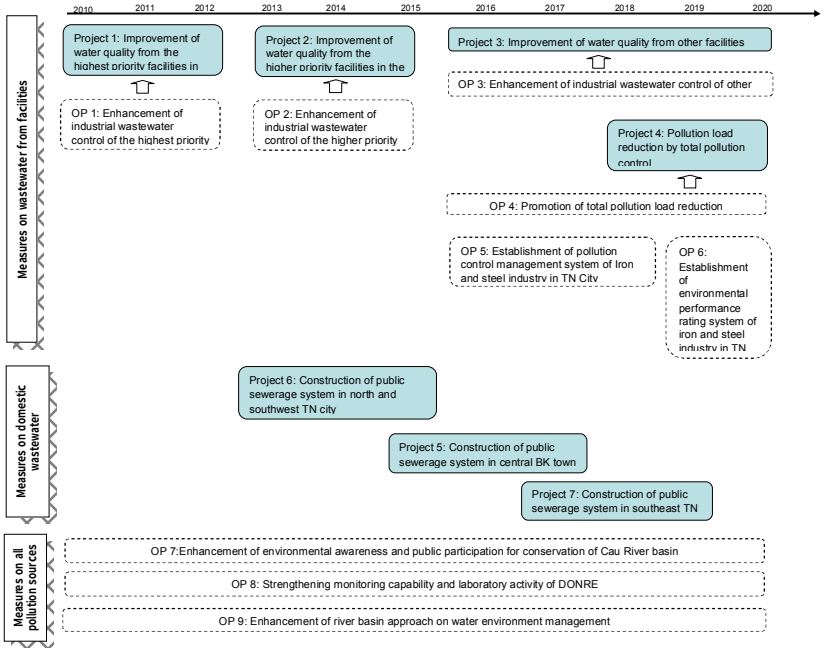
Title	Purpose	Period	Implementation Body
Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area	(1)To set up legal, institutional, technical, and financial mechanism for introduction of total pollution control in the model area (2)To promote effective implementation of the Project 4 (Pollution load reduction by introducing total pollution control in the model area)	2018-2020	VEA, PPC, and DONRE
Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City	(1)To establish pollution control management system of iron and steel industry of Thai Nguyen city (2)To establish specific environmental management section with pollution control manager and staff in iron and steel industry of Thai Nguyen city	2016-2018	VEA, PPC, and DONRE
Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City	(1)To establish environmental performance rating system of iron and steel industry of Thai Nguyen city (2)To monitor the activities of Operational Program 5 and to conduct supplemental activities for promotion	2013-2015	VEA, PPC, and DONRE
Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin	(1)To enhance environmental awareness and public participation of the local people, associations, and NGOs, (2)To promote point and non-point pollution source control and management (3)To present the results of Operation Program 6	2010-2020	VEA, PPC, and DONRE
Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE	(1)To strengthen monitoring and laboratory analysis capacity of DONRE including QA/QC (2)To share plans, activities, and results among concerned DONRE (3)To motivate staff in charge through exchanging experiences and publication of analysis paper	2010-2020	VEA, PPC, and DONRE
Operation Program 9: Enhancement of River Basin Approach on Water Environment Management	(1)To bridge WEMP in the model area to CRB M/P (2)To coordinate common issues between WEMP and CRB M/P (3)To promote priority projects designated by CRC and CRCO	2010-2020	VEA, PPC, and DONRE

Source: JICA Study Team

(4) Relation between Projects and Operation Programs of WEMP in the Model Area

The relation of the proposed Projects and Operation Programs is shown in Figure 6.5-12.

Measure	Proposed Project	Proposed Operation Program (OP)
1. Measure-1	-Project 1 to 4	- OP 1 to 6
2. Measure-2	-	- OP 5 to 8
3. Measure-3	-Project 5 to 7	-
4. Measure-4	-	- OP 2
5. Measure-5	-	- OP 5 to 7



Source: JICA Study Team

Figure 6.5-12 Relation between Projects and Operation Programs of WEMP

(5) WEMP Implementation Schedule

An implementation schedule of the Projects and Operation Programs proposed in WEMP is shown in Table 6.5-16.

Table 6.5-16 Implementation Schedule of WEMP

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Projects	Project 1: Improvement of water quality from the highest priority facilities in the critical areas, including those of Decision No. 64 and Circular No. 07	■	■	■								
	Project 2: Improvement of water quality from the higher priority facilities in the critical areas				■	■	■					
	Project 3: Improvement of water quality from other facilities in the critical areas and facilities outside of the critical areas							■	■	■	■	■
	Project 4: Pollution load reduction by introducing total pollution load control in the model area									■	■	■
	Project 5: Construction of small-scale public sewerage system in central Bac Kan town						■	■	▲			
	Project 6: Construction of public sewerage system in north and southwest central Thai Nguyen city				■	■	■	▲				
	Project 7: Construction of public sewerage system in southeast Thai Nguyen city								■	■	▲	
Operation Programs	Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas	■	■	■								
	Sub Operation Program 1-1: Development of Pollution Source Inventory (PSI) Database	■	■									
	Sub Operation Program 1-2: Enhancement of regulatory approach	■	■	■								
	Sub Operation Program 1-3: Enhancement of environment protection fee system and the Environmental Protection Fund	■	■	■								
	Sub Operation Program 1-4: Promotion of relocation of facilities to industrial parks and zones with installation of wastewater treatment		■	■								
	Sub Operation Program 1-5: Training and capacity development of human resources of the concerned implementation bodies	■	■	■								
	Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas				■	■	■					
	Sub Operation Program 2-1: Development of Pollution Source Inventory (PSI) Database				■							
	Sub Operation Program 2-2: Enhancement of regulatory approach				■	■	■					
	Sub Operation Program 2-3: Enhancement of environment protection fee system and the Environmental Protection Fund				■	■	■					
	Sub Operation Program 2-4: Promotion of relocation of facilities to industrial parks and zones with installation of wastewater treatment				■	■	■					
	Sub Operation Program 2-5: Training and capacity development of human resources of the concerned implementation bodies				■	■	■					
	Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical							■	■	■	■	■
	Sub Operation Program 3-1: Development of Pollution Source Inventory (PSI) Database							■	■			
	Sub Operation Program 3-2: Enhancement of regulatory approach							■	■	■	■	■
	Sub Operation Program 3-3: Enhancement of environment protection fee system and the Environmental Protection Fund							■	■	■	■	■
	Sub Operation Program 3-4: Promotion of relocation of facilities to industrial parks and zones with installation of wastewater treatment									■	■	■
	Sub Operation Program 3-5:Training and capacity development of human resources of the concerned implementation bodies							■	■	■	■	■
	Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area							■	■	■	■	■
	Sub Operation Program 4-1:Establishment of administrative system for introducing total pollution control							■	■			
	Sub Operation Program 4-2: Promotion of total pollution control									■	■	■
	Sub Operation Program 4-3: Training and capacity development of human resources of the concerned implementation bodies									■	■	■
	Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City							■	■	■		
	Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City										■	■
	Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin	■	■	■	■	■	■	■	■	■	■	■
	Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE	■	■	■	■	■	■	■	■	■	■	■
	Operation Program 9: Enhancement of River Basin Approach on Water Environment Management	■	■	■	■	■	■	■	■	■	■	■

■ : Implementation period
▲ :Service commencement

Source: JICA Study Team

(6) Cost and Financial Source

The WEMP covers 7 Projects and 9 Operation Programs and its indicative cost is summarized in Table 6.5-17. The total indicative cost was estimated approximately 155 million US$ by fixed price at 2008.

Table 6.5-17 (1) Indicative Cost of the Projects from 2010 to 2020 (fixed price at 2008)

Unit : 1,000 US$

Title of Project in WEMP	a) Initial Cost	b) O&M Cost		Total Cost a) + b)
		Annual Cost	Total Amount by 2020	
Project-1: Improvement of water quality from the highest priority facilities in the critical areas, including those of Decision No. 64 and Circular No. 07	44,235	1,327	10,616	54,851
Project-2: Improvement of water quality from the higher priority facilities in the critical areas	10,103	303	1,515	11,618
Project-3: Improvement of water quality from other facilities in the critical areas and facilities outside of the critical areas	22,763	320	640	23,403
Project-4: Pollution load reduction by introducing total pollution load control in the model area	5,600	200	200	5,800
Project 5: Construction of small-scale public sewerage system in central Bac Kan town	4,431	76	228	4,659
Project 6: Construction of public sewerage system in north and southwest central Thai Nguyen city	17,071	228	1,142	18,213
Project 7: Construction of public sewerage system in southeast Thai Nguyen city	20,924	266	266	21,190
Total Project Cost				139,734

Source: JICA Study Team

Table 6.5-17(2) Indicative Cost of the Operation Programs from 2010 to 2020 (fixed price at 2008)

Unit : 1,000 US$

Title of Operational Program in WEMP	Total Cost
Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas	3,040
Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas	2,480
Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas	4,480
Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area	1,828
Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City	1,196
Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City	456
Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin	440
Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE	740
Operation Program 9: Enhancement of River Basin Approach on Water Environment Management	468
Total Operation Program Cost	15,128

Source: JICA Study Team

6.5.7 Preliminary Balance Consideration on Indicative Cost and Financing

(1) Possible Financial Sources

1) 1% of Provincial Expenditure

Based on the Circular No.114/2006/TT-BTNMT, each province should allocate at least 1% of provincial expenditure for environmental protection. This budget is one of basic financial sources in Vietnam.

2) Environmental Protection Fee

Based on the Circular No. 04/2008/TT-BTNMT (former Decree No. 67/2003), the provincial government can collect environmental protection fee.

3) Subsidy from the State Government and Provincial Government

In Vietnam, some subsidies which cover several percentage of cost for specific projects and programs can be expected to be given by the state and provincial government for those actual implementation.

4) Own budget of the Target Enterprises

Based on the policy on "Polluter Pays Principle (PPP)", the cost for implementation of Projects should be covered by the target enterprises themselves.

5) Environmental Fund

There are several environmental fund in national and provincial level in Vietnam, such as VEPF. These kinds of environmental fund could be the possible financial source.

6) Others

Other financial sources can be expected such as the grant and/or loan from international donor agencies and international development bank though it has a lot of uncertainty on commitment and takes long time period for agreement.

(2) Preliminary Balance Consideration between Indicative Cost and Financing

Based on the indicative cost estimation results and the implementation schedule of the proposed Projects and the Operation Programs in WEMP, an annual balance sheet is prepared preliminary as shown in Table 6.5-18.

As for the cost of the Projects, its initial construction cost is allocated equally by the years of construction period, and its operation and maintenance (O/M) cost is allocated every year after commencement of the services. The cost of the Operation Programs is allocated equally by the years of duration period of each Operation Program.

In terms of the financing sources, these are estimated to assume the following conditions:

a) 1% of Provincial Expenditure:

The provincial expenditure is expected to increase based on the annual growth rate of GRDP and the amount of the 1% expenditure budget for environmental protection will increase with same manner. Since this budget should be used not only for WEMP but also other similar purposes, it is assumed only 40% of this budget will be available for WEMP.

b) Environmental Protection Fee:

The amount of environment protection fee is assumed that it will increase accompanying annual increase of turnover of enterprises which is linked to the annual growth rate of GRDP. The base amount is set a total amount of fee which is actually collected in 2008 in Bac Kan and Thai Nguyen provinces, though its collection coverage percentage is still low especially from enterprises. Therefore, it is expected that the prediction amount could be much more increase by improvement of its coverage ratio of the target enterprises.

c) Subsidy from the State and Provincial Government:

The percentage of subsidy from the state and provincial government differs from case by case in Vietnam. Because of financial vulnerability, rather high percentage of subsidy has been currently given to the target facilities of the Decision No. 64 by the state and provincial government, especially for hospitals, state/provincial owned enterprises, and so on. Therefore, the subsidy from the state and provincial government is assumed that 70% of the cost of the Project 1 to 3, and 20% of the Project 4 considering present situation. However, its balance should be carefully decided by the government to avoid exceedingly relying on the subsidy. Preparation of some soft loan system such as VEPF and preferential tax application should be considered for urging self-reliance of each facility based on the PPP polity. As for the sewerage system construction, its initial cost is usually covered by the government and its O/M cost covered by the tariff from users. Thus, the cost coverage of the Project 5 to 7 is

provisionally assumed 30% by subsidy and the rest by financial assistance from donors. Since the most activities of the Operation Programs are regarding to ordinal ones of the administrative bodies on environment management, its cost should be covered by the government. So, it is assumed that 50% of the Operation Program 1 to 9 will be covered by subsidy.

d) Own budget of the Target Enterprises:

Although the target enterprises should cover the cost for wastewater treatment plant installation based on the PPP policy, their affordability might not be enough to cover all cost. Therefore, it is assumed that the target enterprises will cover 10% of the cost of the Project 1 to 3, and 70% of the Project 4. Due to financial vulnerability of the target enterprises, the government should consider to provide them preferential loans.

e) Environmental Fund:

It is assumed that the financial source of environmental fund will cover the expected deficit of balance in the initial 3 years (2010-2012) which is around 2 million US$ in each year.

f) Others:

It is assumed that the financial source from the grant and/or loan of international donor agencies and international development bank such as WB and ADB will cover 60% of the cost of the Project 5 to 7.

Based on the assumptions mentioned above, a provisional balance sheet between cost and income related to WEMP is prepared as shown in Table 6.5-18. The key findings from this Table are as follow:

1) Under the assumptions mentioned above, the cost of WEMP and the expected financing will balance approximately in total.
2) The budget from the 1% of expenditure and the environmental protection fee will not be enough to cover the cost of WEMP. Therefore, the subsidies from the state and province will be inevitable for balancing.
3) The target enterprises should share 10% of the cost of the Project 1 to 3, and should owe 70% of the Project 4.
4) The financial assistance from the grant and/or loan of international donor agencies and international development bank should be expected for adequate balance.
5) It is recommended that the actual investment for WEMP should be coordinated with the budget planning for the priority projects decided by CRC to achieve CRB M/P.

This preliminary balance consideration should be discussed further with the Vietnamese side to seek for the applicable financing figure of WEMP.

Table 6.5-18 Provisional Balance Sheet of WEMP in the Model Area

Item		Unit	2008	WEMP Period											
				2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
A) Expenditure of PPC annual budget	A-1) Thai Nguyen province	billion VND	3,255	3,743	4,305	4,950	5,693	6,547	7,529	8,658	9,957	11,451	13,168	15,144	91,145
		1,000 US$	180,833	207,958	239,152	275,025	316,279	363,720	418,278	481,020	553,173	636,149	731,572	841,307	5,063,635
	A-2) Bac Kan province	billion VND	2,125	2,380	2,666	2,985	3,344	3,745	4,194	4,698	5,261	5,893	6,600	7,392	49,158
		1,000 US$	118,056	132,222	148,089	165,860	185,763	208,054	233,021	260,983	292,301	327,377	366,663	410,662	2,730,995
	Total of A)	billion VND	5,380	6,123	6,970	7,936	9,037	10,292	11,723	13,356	15,219	17,343	19,768	22,535	140,303
		1,000 US$	298,889	340,181	387,241	440,884	502,041	571,775	651,299	742,003	845,475	963,527	1,098,234	1,251,970	7,794,630
B) Cost of WEMP	Project-1: Improvement of water quality from the highest priority facilities in the critical areas, including those of Decision No. 64 and Circular No. 07	1,000 US$	-	14,745	14,745	14,745	1,327	1,327	1,327	1,327	1,327	1,327	1,327	1,327	54,851
	Project-2: Improvement of water quality from the higher priority facilities in the critical areas	1,000 US$	-	0	0	0	3,367	3,367	3,367	303	303	303	303	303	11,618
	Project-3: Improvement of water quality from other facilities in the critical areas and facilities outside of the	1,000 US$	-	0	0	0	0	0	0	3,553	3,553	3,553	6,373	6,373	23,403
	Project-4: Pollution load reduction by introducing total pollution load control in the model area	1,000 US$	-	0	0	0	0	0	0	0	0	1,867	1,867	2,067	5,800
	Project 5: Construction of small-scale public sewerage system in central Bac Kan town	1,000 US$	-	0	0	0	0	0	211	2,110	2,110	76	76	76	4,659
	Project 6: Construction of public sewerage system in north and southwest central Thai Nguyen city	1,000 US$	-	0	0	0	813	8,129	8,129	229	229	229	229	229	18,213
	Project 7: Construction of public sewerage system in southeast Thai Nguyen city	1,000 US$	-	0	0	0	0	0	0	0	996	9,964	9,964	267	21,190
	Operation Program 1: Enhancement of Industrial Wastewater Control of the Highest Priority Facilities in the Critical Areas	1,000 US$	-	877	1,081	1,081	0	0	0	0	0	0	0	0	3,040
	Operation Program 2: Enhancement of Industrial Wastewater Control of the Higher Priority Facilities in the Critical Areas	1,000 US$	-	0	0	0	947	767	767	0	0	0	0	0	2,480
	Operation Program 3: Enhancement of Industrial Wastewater Control of other Facilities in the Critical Areas and Facilities outside of the Critical Areas	1,000 US$	-	0	0	0	0	0	0	1,100	1,100	760	760	760	4,480
	Operation Program 4: Promotion of Total Pollution Load Reduction in the Model Area	1,000 US$	-	0	0	0	0	0	0	228	228	457	457	457	1,828
	Operation Program 5: Establishment of Pollution Control Management System of Iron and Steel Industry in Thai Nguyen City	1,000 US$	-	0	0	0	0	0	0	399	399	399	0	0	1,196
	Operation Program 6: Establishment of Environmental Performance Rating System of Iron and Steel Industry in Thai Nguyen City	1,000 US$	-	0	0	0	0	0	0	0	0	0	228	228	456
	Operation Program 7: Enhancement of Environmental Awareness and Public Participation for Conservation of Cau River Basin	1,000 US$	-	40	40	40	40	40	40	40	40	40	40	40	440
	Operation Program 8: Strengthening Monitoring Capability and Laboratory Activity of DONRE	1,000 US$	-	67	67	67	67	67	67	67	67	67	67	67	740
	Operation Program 9: Enhancement of River Basin Approach on Water Environment Management	1,000 US$	-	43	43	43	43	43	43	43	43	43	43	43	468
	Total of B)	1,000 US$	-	15,772	15,976	15,976	6,604	13,740	13,951	9,397	10,394	19,084	21,733	12,236	154,862
C) Financing	C-1) 40% of 1% Expenditure (0.4% of A)	billion VND	35	39	45	52	59	67	77	88	101	115	132	151	926
		1,000 US$	1,919	1,361	1,549	1,764	2,008	2,287	2,605	2,968	3,382	3,854	4,393	5,008	31,179
	C-2) Environmental protection fee from indusries	billion VND	0.36	0.41	0.46	0.52	0.59	0.67	0.76	0.85	0.97	1.09	1.23	1.39	9
		1,000 US$		23	26	29	33	37	42	47	54	61	68	77	497
	C-3) Subsidy from state and provincial government (70% of cost of Project 1to 3, 20% of cost of Project 4, 30% of cost of Project 5 to 7, 50% of cost of OP 1 to 9)	1,000 US$	-	10,835	10,937	10,937	3,742	5,846	5,910	4,882	5,181	7,579	9,186	6,317	81,351
	C-4) Own budget of enterprises (10% of cost of Project 1 to 3, 70% of cost of Project 4)	1,000 US$	-	1,474	1,474	1,474	469	469	469	518	518	1,825	2,107	2,247	13,047
	C-5) Foreign donor assistance (60% of cost of Project 5 to 7 excluding O/M cost)	1,000 US$	-	0	0	0	488	4,877	5,004	1,403	2,001	6,161	6,161	343	26,437
	C-6) Other finincial sources such as VEPF	1,000 US$	-	2,000	2,000	2,000	0	0	0	0	0	0	0	0	6,000
	Total of C)	1,000 US$	-	15,693	15,986	16,204	6,740	13,517	14,030	9,819	11,135	19,480	21,915	13,992	158,512
D) Balance between cost of WEMP and possible financing amount (finaicing C) - cost of WEMP B))		1,000 US$	-	**-79**	**10**	**228**	**136**	**-222**	**79**	**421**	**742**	**396**	**182**	**1,756**	**3,649**

Source: JICA Study Team

6.5.8 Institutional Structure

Since WEMP includes broad wide components for water environment management in the model area, its responsible, management, and implementation organization should be the following 3-stories structure.

a) Overall Management and Responsible Committee: the highest decision making committee consists of MONRE, CRC, Bac Kan PPC, and Thai Nguyen PPC. This Committee should have the following powers and responsibilities:

- To appraise and approve all trunk activities of WEMP prepared by the Project Management Unit (PMU),

- To coordinate among stakeholders and concerned organizations for efficient implementation and for effective participation related to WEMP,
- To bridge WEMP in the model area to CRC M/P,
- To check and review the progress and effect of WEMP, and instruct PMU for improvement,
- To coordinate among stakeholders and concerned organizations for efficient implementation and for effective participation,
- To report the Minister of MONRE related to progress, issues and solutions, and achievements of WEMP with accountability, and
- To open and publish major activities and monitoring results to the public, including lessons learnt related to WEMP.

b) Project Management Unit (PMU) for WEMP: the actual implementation and management body mostly consists of VEA, PPC and concerned Departments in Bac Kan and Thai Nguyen provinces. The PMU should have the following powers and responsibilities:

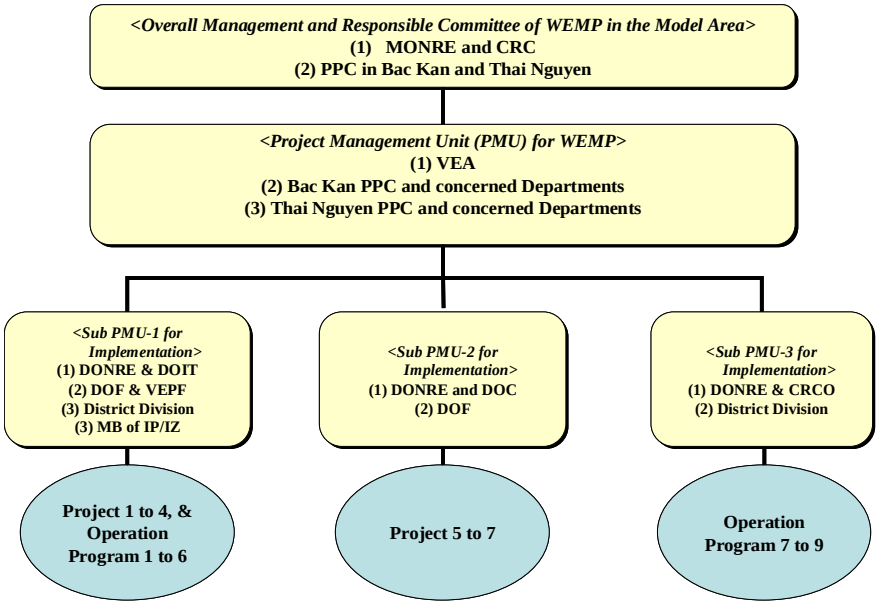
- To prepare overall technical and financial documents for the Overall Management and Responsible Committee, such as plans, implementation schedule, progress and completion report, monitoring and evaluation report, and so on,
- To conduct and manage all activities of the Projects and the Operation Programs in WEMP,
- To coordinate among stakeholders and concerned organizations for efficient implementation and for effective participation related to the Projects and the Operation Programs in WEMP,
- To check and review the progress and effect of the Projects and the Operation Programs, and instruct Sub-PMU for improvement,
- To report the Overall Management and Responsible Committee related to progress, issues/solutions, and achievements of WEMP with accountability, and
- To open and publish major activities and monitoring results to the public, including lessons learnt related to the Projects and the Operation Programs in WEMP.

c) Sub Project Management Unit (Sub PMU): the field implementation body mostly consists of organizations concerning to the actual implementation of the Projects and the Operation Programs in WEMP. Considering the components of the Projects and the Operation Programs, at least 3 Sub-PMU should be established, namely the Sub PMU-1 for conducting the Projects 1 to 4 and the Operation Program 1 to 6 concerning to industrial pollution control, the Sub PMU-2 for conducting the Projects 5 to 7 concerning to domestic pollution control, and the Sub PMU-3 for conducting the Operation Program 7 to 9 concerning to capacity development of pollution control.

The actual members of each Sub PMU should be subject to the components to be covered. The Sub PMU should have the following responsibilities:

- To prepare detailed plans and activities for implementation of the target Projects and Operation Programs in accordance with the instruction given by PMU,
- To implement all activities of the target Projects and the Operation Programs,
- To coordinate among stakeholders and concerned organizations for efficient implementation and for effective participation related to the target Projects and the Operation Programs, and
- To check and review the progress and effect of the target Projects and Operation Programs,
- To report PMU related to progress, issues and solutions, and achievements of the target Projects and the Operation Programs with accountability.

The Figure 6.5-13 summarizes the institutional structure for management and implementation of WEMP.



Source: JICA Study Team

Figure 6.5-13 Institutional Structure for Management and Implementation of WEMP

6.5.8 Monitoring of WEMP

(1) Project Monitoring

The management and implementation bodies of each Project and Operation Program, the Sub PMU, should hold a periodic meeting, every month in principle, to check actual progress of activities. The attendants discuss problems which occur during the implementation, share them among members, and develop countermeasures. Implementation bodies prepare a progress report and submit it to PMU every month, and the Overall Management and Responsible Committee every 3 months.

(2) Monitoring of Achievement of WEMP

Following the monitoring plans to be prepared by Bac Kan and Thai Nguyen DONRE in accordance with the Guideline for Designing Water Quality Monitoring System at River Basin Level, both DONRE continuously monitor water quality of the Cau river in the model area and prepare a monitoring report for submission to PMU and the Overall Management and Responsible Committee.

Based on the monitoring results and the progress reports, PMU and the Overall Management and Responsible Committee should review achievement and revise WEMP, if any. The PMU shares the monitoring and review results among the stakeholders concerning to WEMP in the model area.

6.6 Discussion with Vietnamese Side related to the Output-4

(1) Mini-Workshop

To obtain comments from the Vietnamese experts for preparation of WEMP in the model area, five (5) mini-Workshops were held in total as shown in Table 6.6-1. Comments and recommendations obtained are shown in Table 6.6-2.

Table 6.6-1 Mini-Workshop for Output-4

No.	Date	Venue	Attendants	Organization
1st	10 Feb.2009	VEA	11	VEA, CEM, VST, and JST
2nd	26 Aug.2009	VEA	21	VEA, CEM, VAST/IET, IWEET, VIWRR, Thai Nguyen Province, VST, and JST
3rd	03 Sep.2009	Thai Nguyen	29	Bac Kan Province, Thai Nguyen Province, VST, and JST
4th	22 Sep.2009	VEA	18	VEA, CEM, IWEET, Dep. of Finance in VEA, VST, and JST
5th	2 Oct.2009	Thai Nguyen	30	Bac Kan Province, Thai Nguyen Province, VST, and JST

Source: JICA Study Team

Table 6.6-2 Comments and Recommendations in Mini-WS for Output-4

Mini-workshop	Comments and Recommendations	Actions taken by VST/JST
1st mini-workshop	(1)To complement CRB M/P, WEMP should propose to set a desired status, a goal with measures and their clear quantitative targets to be achieved. (2)Proposed measures seemed to have some overlapping, and suggested to be re-arranged during preparation process of WEMP. (3)Actions proposed in WEMP should include clear actors, period, targets, tasks, methods, and justification for implementation, and intended to discuss for preparation of concrete proposals. (4)Discussion with Bac Kan and Thai Nguyen provinces is very important in the process of WEMP formulation to harmonize it with other plans prepared and implemented by them. (5)WEMP should be prepared based on the outcomes of Output-1, 2, and 3. (6)WEMP should have clear instruction for DONRE for easy understanding what to do, and carry out the proposed actions smoothly. (7)Not only benefit but also impact on socioeconomic condition caused by WEMP should be examined.	(1)A vision, goal, and target will be set and formulate plan to achieve them in WEMP. (2)VST and JST will prepare WEMP considering the comment. (3)ditto (4)WEMP will be prepared detailed discussions with concerned departments in Bac Kan and Thai Nguyen provinces. (5)VST and JST will prepare WEMP considering the comment. (6)Trial and error activity by DONRE to find a better way to achieve the objectives of the actions are also important to enhance environment management capacities of DONRE. (7)VST and JST will prepare WEMP considering the comment as much as possible.
2nd mini-workshop	(1)Scientific approach on pollution load is agreeable. Reason why the pollution load of heavy metals will not conducted as BOD. (2)Economic growth rates should be modified considering actual level of achievement in the provinces, and 10% of variation could be too large. (3)Condition, coefficient, and river flow regime applied for the model should be described clearly. (4)Current plans of PPC should be included in the socioeconomic scenario and water quality prediction.	(1)Proper pollution load unit of heavy metals is not available. It should be controlled at the discharge point of pollution sources. (2)Socioeconomic development scenarios will be set through further discussions with PPC. (3)These will be described with reasons why. (4)VST and JST will reflect current plans in PPC based on the information provided by the concerned departments. So, VST and JST will conduct these works in Thai Nguyen DONRE for close cooperation.
3rd mini-workshop	(1)WEMP should clarify the definition of "with/without" conditions, and the sources of applied pollution load unit. (2)To describe the carrying capacity in the model area. (3)Prioritization of critical areas should be clarified. (4)WEMP should consider the actual activities of PPC concerning to Decision No. 64, introduction of cleaner production, public awareness, and so on.	(1)"Without" means no implementation of WEMP. TCVN, WHO, and US-EPA are the main sources. These will be described in WEMP. (2)Provisional carrying capacity was estimated in the course of water quality prediction. (3)It is set considering the density of pollution sources and the total pollution load reaching to the Cau river. (4)Current activities will be involved as "business as usual conditions". VST and JST will request PPC to provide necessary information as much as possible.
4th mini-workshop	(1)To explain not only results of water quality prediction but also the process for better understanding, and to clarify the calculation of carrying capacity. (2)The water quality target of the section B in Bac Kan should be Class A-1 instead of A-2. (3)The proposed Projects and Programs could support the implementation of Cau River Basin M/P (CRB M/P), so WEMP should show a road map for actual implementation and actors. (4)Cooperation mechanism between the state and the provincial government including financing, and collaboration with the	(1)JST explained the process of prediction, and the conditions and limitations of the estimation of caring capacity estimation. (2)Current level is A-1. Although it is better to keep this level in future, it could be very hard to keep considering the future socioeconomic development conditions. Therefore, A-2 Class is applied for the target in this section. (3)WEMP should contribute the actual implementation of CRB M/P. Implementation structure and responsible organization will be clarified in WEMP. (4)Cooperation with concerned administrative bodies

Mini-workshop	Comments and Recommendations	Actions taken by VST/JST
	environmental police are important. (5)Projects which have similar objectives should be combined together. The Project No. 10 does not correspond to the priority in CRB M/P.	will be clarified in WEMP based on the current legal and institutional frame in Vietnam. (5)The Project in WEMP is proposed considering time and location factor, so it is not suitable to combine simply even though they have similar objectives. WEMP has different objectives and locations from these of CRB M/P. So it does not always correspond each other.
5th mini-workshop	(1)To explain the target water quality and the predicted future water quality. (2)The planned sewerage project is over wrapped the current plan in Thai Nguyen PPC. (3)WEMP should include newly established enterprises, and clarify the minimum river flow in the model area. . (4)To explain the method of indicative cost estimation and possible financial measures of WEMP. (5)WEMP is agreeable, but it is necessary to cope with non-point source as well. Features of the proposed Projects and Operation Programs should be described in detail.	(1)JST explained the target water quality was set to achieve vision and goal, and the predicted one was the results after taking the proposed activities in WEMP. (2)Based on discussion with DOC, JST proposed it avoiding duplication of the planned area, because the currently planned project by PPC would not enough to achieve the target set in WEMP. (3)WEMP includes the pollution load generated by the newly established factories based on the economic growth rate. The minimum flow in the downstream area of the Thac Huong weir could not be justified by WEMP. So, it will require another way to calculate and justify the minimum flow. (4)The estimation method is described in WEMP. There are several financial mechanism in Vietnam. So, some possible financial combination will be proposed in WEMP. Cooperation with concerned administrative bodies will be clarified in WEMP based on the current legal and institutional frame in Vietnam. (5)To control non-point source will be included in the Operation Programs because of its difficulty to clarify effect. VST and JST will describe the features as much detail as possible, but somewhat must be clarified in the nest F/S stage.

Source: JICA Study Team

(3) Workshop

The following workshop was held in Thai Nguyen city to discuss and disseminate WEMP in the model area.

Table 6.6-3 Workshop for WEMP

Date	Venue	Attendance	Organization
29 Oct. 2009	Thai Nguyen	76	VEA、IWEET, DONRE and concerned Departments in Bac Kan province, DONRE and concerned Departments in Thai Nguyen province, CEM、Representatives of enterprises and factories in Bac Kan and Thai Nguyen provinces, VST, JST, and mass media

Source: JICA Study Team

In the workshop, contents of WEMP in the model area were presented by VST and JST. Main discussion points of the workshop are as Table 6.6-4. Details of contents were compiled in the discussion record (D/R) attached in Annex-6 of this Draft Final Report (DF/R).

Table 6.6-4 Comments on Workshop for WEMP

Comments and Recommendations	Actions taken by VST/JST
(1)WEMP is well prepared by VST and JST and it will meet regional conditions.	(1)VST and JST will emphasize more for actual implementation of WEMP as a part of CRB M/P.
(2)The participants in this Workshop should proceed this WEMP to obtain a decision of authorities.	(2)ditto
(3)Indicative cost could be covered in general, but more specific efforts will be required. Currently, a way how to use the budget from 1% of total expenditure is ambiguous, so the clear instruction should be prepared by MONRE.	(3)VEA is now under consideration on this matter.
(4)There are no objections on WEMP. The participants request JICA for further support on promotion and implementation of WEMP in Cau river basin.	(4)VST and JST replied that the strong commitment of PPC and CRC is the most important for implementation of WEMP in the model area.

Source: JICA Study Team

6.7 Capacity Development Conditions of Output-4

Questionnaire survey for capacity assessment on Output-4 will be implemented in December 2009.

Table 6.7-1 Number of Answers for the Questionnaire

Organization	Number of answer	
	Director/Manager	Technical Staff
DWMEA/VEA		14
PCD/VEA	1	1
CEM/VEA	1	8
Thai Nguyen DONRE	1	6
Bac Kan DONRE	1	6

Source: JICA Study Team

(2) Result of Baseline Capacity Assessment

The results of this evaluation are summarized in Table 6.7-2, and the following are revealed by the preliminary analysis of the questionnaire. A questionnaire for the director/manager is under collection, so its results will be described in the Final Report.

1) Almost all officers in each organization recognized the Cau River Basin M/P. The interviewees answered that they understand objective of the Cau River Basin M/P and task of Cau River Committee well.

2) It is considered that knowledge on pollution load estimation should be enhanced.

3) Among various pollution control approaches, officers considered that they have knowledge on technical renovation approach and awareness raising approach more than regulatory approach and economic approach.

Table 6.7-2 Result of Questionnaire of Output-4 (Form-A)

No.	Item	DWMEA/VEA 14 persons		PCD/VEA 1 person		CEM/VEA 8 persons		Thai Ngyen DONRE 6 persons		Bac Kan DONRE 6 persons		Total 35 persons	
A. Questions about your understanding for planning a Water Environment Management Plan (WEMP)													
1.	Do you know the Cau River Basin M/P?	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%
		13	92.9	1	100.0	8	100.0	6	100.0	5	83.3	33	94.3
	Level of Understanding	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
	(1) Understanding of the objective of the Cau River Basin M/P	3.8	92.9	4.0	100.0	3.9	100.0	3.5	100.0	4.2	83.3	3.8	94.3
	(2) Understanding of the task of the Cau River Committee	3.6	100.0	5.0	100.0	3.9	100.0	3.5	100.0	4.2	83.3	3.8	94.3
2.	Do you know the water quality monitoring plan (WQMP) in the model area?	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%
		5	35.7	1	100.0	6	75.0	5	83.3	4	66.7	21	60.0
	Level of Understanding	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
	(1) Understanding of the objective of WQMP	4.4	50.0	5.0	100.0	4.2	75.0	3.5	66.7	3.6	83.3	4.0	65.7
	(2) Understanding of on polluted sections of the Cau River in the model area	4.4	50.0	4.0	100.0	3.8	75.0	3.5	66.7	3.6	83.3	3.9	65.7
3.	Do you know what is pollution source inventory?	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%
		11	78.6	1	100.0	7	87.5	6	100.0	4	66.7	29	82.9
	Level of Understanding	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
	(1) Information on pollution sources (point soruces) in the model area	3.1	85.7	4.0	100.0	3.4	87.5	2.7	100.0	4.0	66.7	3.2	85.7
	(2) Understanding of an estimation method of pollution load	2.7	85.7	4.0	100.0	3.6	87.5	3.5	100.0	2.7	50.0	3.1	82.9
4.	Do you know general pollution control approaches (regulatory, economic, technical renovation and awareness raising) used for water environment management?	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%	Yes (numbar)	%
		13	92.9	0	100.0	7	87.5	6	100.0	4	66.7	30	85.7
	Level of Understanding	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
	(1) Understanding on the advantage/weakness of regulatory approach in the model area	2.5	92.9	-	0.0	3.1	87.5	3.3	100.0	3.7	50.0	3.0	82.9
	(2) Understanding on the advantage/weakness of economic approach in the model area	2.5	92.9	-	0.0	3.3	87.5	3.5	100.0	3.5	66.7	3.0	85.7
	(3) Understanding on the advantage/weakness of technical renovation approach in the model area	3.3	92.9	-	0.0	3.3	87.5	3.5	100.0	3.5	66.7	3.4	85.7
	(4) Understanding on the advantage/weakness of awareness raising approach in the model area	3.8	92.9	-	0.0	3.3	87.5	3.5	100.0	3.3	83.3	3.5	85.7
5.	Do you know that the Study will prepare the water environment management plan (WEMP)?	Yes	%	Yes	%	Yes	%	Yes	%	Yes	%	Yes	%
		7	50.0	1	100.0	5	62.5	6	100.0	5	83.3	24	68.6
	Level of Understanding	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)	Avarage	Response rate(%)
	(1) Understanding of the objective of WEMP	3.4	50.0	4.0	100.0	3.6	75.0	3.2	100.0	2.8	83.3	3.3	74.3
	(2) Understanding of the components of the WEMP	3.1	50.0	4.0	100.0	3.3	75.0	3.2	100.0	3.0	66.7	3.2	74.3

Source: JICA Study Team

7. Development of Handbook for Formulation of Water Environment Management Plan (WEMP) (Output-5)

The Output-5 is planed to implement the following activities. A main outcome of Output-5 is the "Handbook for Formulation of Water Environment Management Plan (WEMP)".

1) Prepare "Handbook for Formulation of Water Environment Management Plan", and
2) Hold workshop to disseminate the handbook.

7.1 Purpose, Scope and Applicability of Handbook

7.1.1 Purpose

The purpose of this Handbook is to provide a common framework of WEMP and baseline procedures for developing WEMP on river basin approach by using experiences, data, and information obtained through the Study as examples. Because planning conditions such as natural conditions, administrative situations, and aimed targets are different from regions to regions, the results of the Study may not be used in whole situations. However, the basic way of thinking and procedures could be common. Therefore, it is expected that basic methodologies are commonly applicable in other regions as useful tools and prototypes. This Handbook describes baseline procedures for formulation of WEMP referring to the tools developed under the Study such as Guidelines and Reports related to Output-1, 2 and 3. In this context, the prepared "Water Environment Management Plan in the Model Area" is referred as examples.

7.1.2 Scope and Applicability of Handbook

(1) Scope of Handbook

The Handbook introduces general contents and procedures for formulating WEMP. Although WEMP needs to deal with various topics related to water environment management on water resources, this Handbook is specifically useful for the followings.

1) Inner and Inter-provincial River Basins Management

This Handbook introduces general contents which can be applied for inner and inter provincial river basins. For international river basins, the concepts themselves could be applied, but coordination with other countries should be carried out considering different criteria on water environment management at river basin level.

2) River Water Quality Management

This handbook mainly focuses on river water quality management such as pollution source control, water environment monitoring and management, development of coordination mechanism, public awareness enhancement, and preferable river flow regime.

(2) Applicability of Handbook

1) Consideration on Regional Characteristics of River Basins

This handbook is introduced baseline procedures for developing WEMP on river basin approach. It is necessary to specify the procedures especially for water quality simulation considering regional river basin characteristics such as effect of tidal current to river water quality.

2) Consideration on Revising of Legal Requirements and Standards

The Vietnamese environmental legal requirements and standards are being improved continuously. New technologies for water environment management are also being introduced actively. Users are requested to check the latest legal requirements and standards, and trends for water environment management. Based on accumulation of experiences and development of enforcement capacity, this Handbook should be updated and revised.

7.1.3 Expected Users and Involved Persons

(1) Expected User

Expected users of this Handbook are planners, supervisors, and advisors for formulating WEMP at river basin level. Organizations concerning each category in Vietnam are shown below:

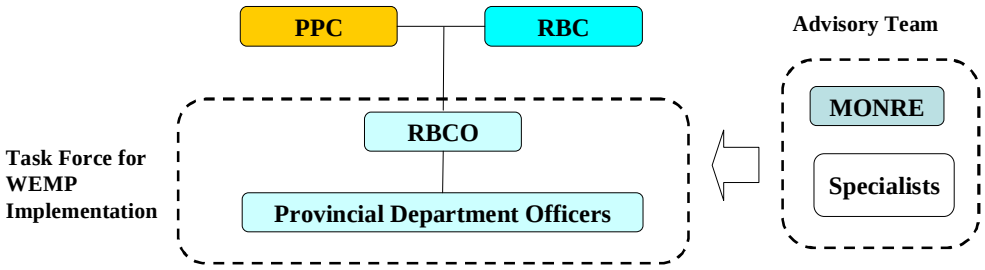
1) Provincial departments and River Basin Committee Office (RBCO) as formulation bodies of WEMP
2) PPC and River Basin Committee (RBC) as supervisors of WEMP, and
3) MONRE and Research Institutes as advisors of WEMP.

(2) Persons Involved in Development of WEMP

Since WEMP covers various fields on technologies and governmental administration, it is necessary for the officers of implement bodies to obtain supports from other organizations specialized for respective fields.

1) Example of Task Force for Formulation of WEMP

To formulate WEMP, it is recommended that the officers and specialists having various expertise should be worked together as a task force team. Figure 7.1-1 shows an example of task force for formulation of WEMP. The RBCO would be a core of the task force. Additionally, RBC or PPC should nominate and assign persons in charge for WEMP formulation from regional officers and concerned experts. MONRE will dispatch advisor to provide technical information and good practices on WEMP in other basins. An advisory team of specialist is requested to support the task force from technical viewpoints.



Source: JICA Study Team

Figure 7.1-1 Example of Task Force for Formulation of WEMP

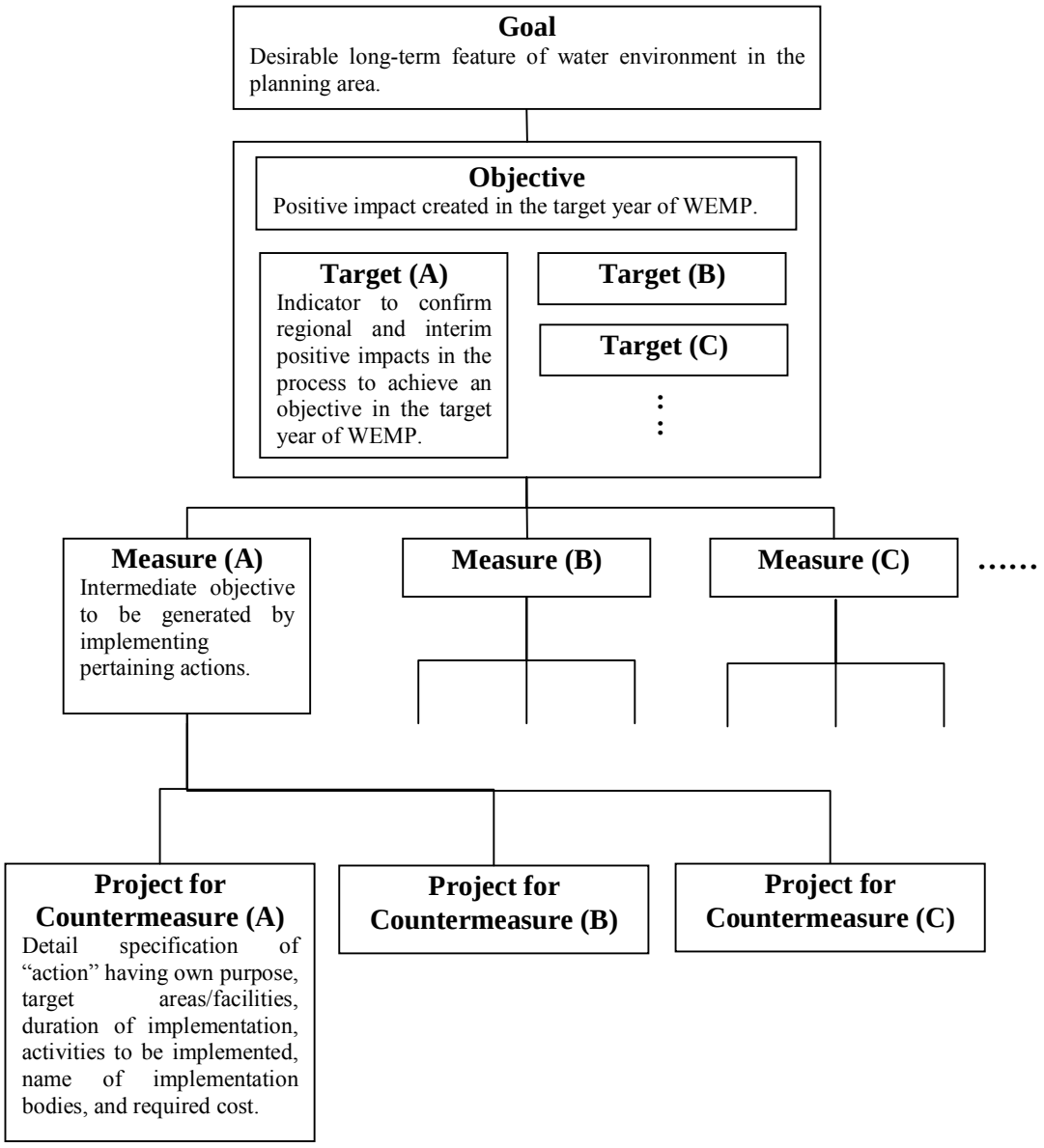
2) Assistance from Specialists

It will require specific and technical knowledge and experiences as a special input for formulation of WEMP. Conceivable input can be obtained by the experts described hereunder;

- Water quality monitoring and assessment;
- Water quality prediction by means of a simulation model;
- Legal matters for environment management;
- Sewerage planning,
- Wastewater treatment planning,
- Promotion of cleaner production and environment management system;
- Economic and financial planning;
- Public participation promotion; and
- Mass media communication.

7.2 Framework of WEMP

A framework of WEMP must express clear objectives to be achieved and activities necessary for achieving the objectives, so that the developed WEMP can be implemented and evaluated, appropriately. Consequently, WEMP is normally comprised of the following components as shown in Figure 7.2-1.



Source: JICA Study Team

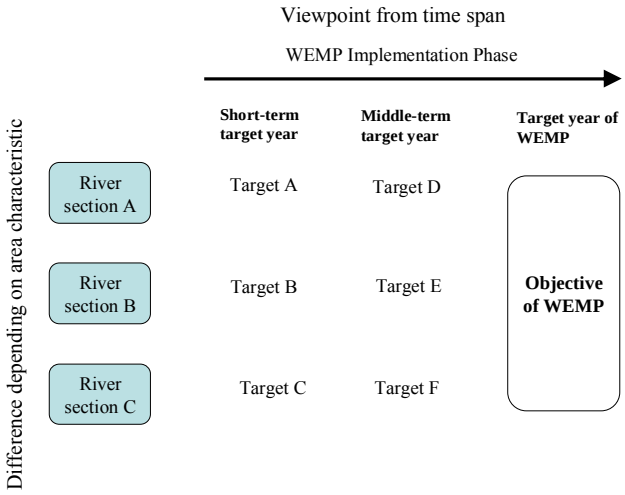
Figure 7.2-1 Framework of WEMP

(1) Goal and Objective

Because WEMP is implemented to improve regional water environment status, its goal and objective should show clear status of water environment to be achieved. The goal can be set as sentences describing water environment status to be achieved. On the other hand, the objective should show water environment status quantitatively such as surface water environmental standards to evaluate effectiveness of WEMP.

(2) Targets

Usually, it is difficulty to achieve the objective in whole target areas of WEMP in short-term, so phasing approach to improve water environment should be taken. To confirm effectiveness of such phasing approach at a part of the area before the final year of WEMP implementation, "targets" are set besides the goal and objective as shown in Figure 7.2-2.



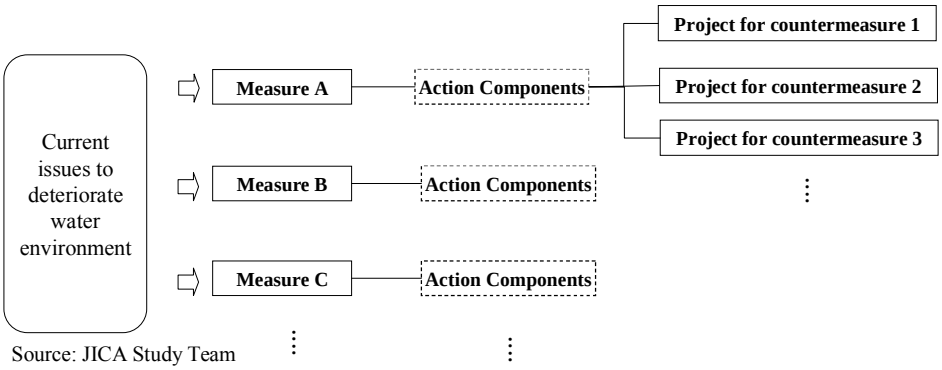
Source: JICA Study Team

Figure 7.2-2 Relation of Goal and Targets in WEMP

(3) Measures and Projects for Countermeasure

The WEMP is forwarded by implementation of a series of the planned projects for countermeasures. The projects for countermeasures are placed under measures to address identified issues to improve water quality and water environment management in the target area.

Figure 7.2-3 shows general structure of measures and projects for countermeasures. The "Action components" are tentatively placed under "measures" to prepare "project countermeasures".



Source: JICA Study Team

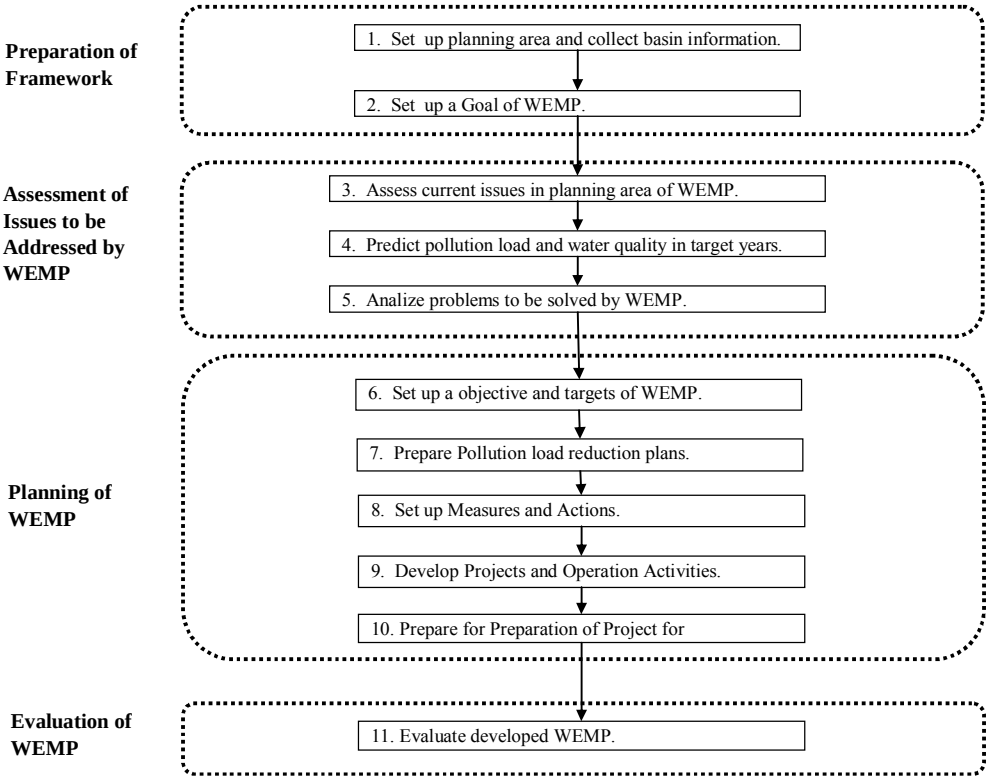
Figure 7.2-3 Structure of Measures and Projects for Countermeasures

7.3 Overall Planning Process

(1) Overview

The basic wide WEMP is to establish specific methodologies for solving problems of water environment management in a region. Therefore, the development of WEMP should start from clarification of present situation of water environment, and end to examination of its appropriateness. While, there are different ways being applied for the WEMP development depending on countries, regions, planners and so on.

The procedure introduced here is basically comprised of four (4) steps: Preparation of framework, Assessment of issues to be addressed, Planning of WEMP, and Evaluation of developed WEMP. The overall planning process is shown in Figure 7.3-1. Normally, the development work of WEMP is not "one way trip" but "way of trial and error", so it should be noted that the repeated examinations are always requested at all steps until finding rational solutions.



Source: JICA Study Team

Figure 7.3-1 Overall Planning Process of WEMP

(2) Preparation of Framework

This step clarifies the present situation of water environment in the planning area including natural and socio-economic characteristics, water quality conditions, and current management practices. In this step, the collected data and information are analyzed to know main topics of WEMP to be developed, and the "goal" of WEMP is set in view of a long-term perspective on the water environment in the planning area.

(3) Identification of Issues to be Addressed

The WEMP is a tool to respond certain problems by initiating a number of activities. Therefore, all problems concerned must be clarified including their causes. The issues should be identified by three (3) steps: Assessing current issues, Predicting pollution load and water quality in target years, and Analyzing problems to be solved.

In the process of identifying current issues, locations, and characteristics of pollution sources in the region are clarified with calculation of pollution load generation, and the river water qualities are evaluated with surface water quality standards considering regional water use conditions. In the aspect of environment management, current management practices are clarified in terms of administrative management practices, pollution mitigation measures at sources, activities of organizations concerned, and resources of management sectors. To clarify present situation on

water environment management, the information concerned should be collected taking into consideration on the pollution control approaches as shown below:

1) Regulatory approach aiming to promote the pollution mitigation measures at pollution sources by forcing pollution generators to comply with regulations and requirements by means of legal powers,
2) Economic approach aiming to promote the environment protection measure by economic or financial incentives and/or disincentives,
3) Technical renovation approach aiming to encourage the voluntary behaviors of pollution generators to introduce and apply the pollution mitigation measures through different ways,
4) Awareness raising approach aiming to promote the environmental protection measures by enhancing the environment awareness of pollution generators and general citizens, and
5) Infrastructure development approach aiming the development of sewerage systems attached by sewage treatment plant so as to reduce the pollution load derived from urban domestic wastewater to the environment.

In the next step, the pollution load generation is calculated along a socio-economic growth scenario, and river water quality in the target year is calculated by means of the simulation with a water quality model. Following the clarification of present situations, prospected pollution load generation, and river water qualities, the problem analysis takes place to identify the mechanism of problem structure in the region.

(4) Planning of WEMP

Planning of WEMP is a core step of development comprising: setting up objectives and targets, considering pollution load reduction plans, setting up measures and actions, developing projects for countermeasures, and preparing other necessary management accounts.

The “Objective” is defined as a specific desirable status to be achieved within a target year and the “Target” is an indicator for measuring the achievement status. Consideration of pollution load reduction plan examines a specific plan on how to achieve the “Goal” from the viewpoint of water quality. The “Measure” is direction and condition necessary for producing the “Objective” and for successful implementation of the “Project for countermeasure”. The “Measure” is raised as required states to solve problems coming from environment management and to attain pollution reduction plan. The “Project for countermeasure” is activity component to be implemented in WEMP.

Thus, the ”Objective”, “Measure”, and “Project for countermeasure” are mutually connected with logical relation. It is common that this planning step of WEMP is taken a way of “trial and error” to obtain rational results.

(5) Evaluation of Developed WEMP

As the final stage, the formulated WEMP is evaluated with certain criteria from comprehensive aspects to verify its appropriateness. Normally, the developed WEMP is evaluated by means of five criteria, assuming that various project objectives are achieved as scheduled. The significances of evaluation criteria are expressed as follows:

- Relevance : Is the project designed so as to be valid?
- Efficiency : Is the project designed efficiently?
- Effectiveness : Is the Objective of the project designed to be achieved within the project period, effectively?
- Impact: : Is it expected that the project produce any positive impacts?
- Sustainability : Is it expected that the benefits and effects of the project sustain, after the project completion?

The River Basin Committee (RBC) and/or PPC should organize and supervise implementation bodies for evaluation of the developed WEMP. An establishment of the third party could be another way for its feasibility evaluation from specialized technical and institutional viewpoints.

(6) Approval and Dissemination of WEMP

In order to apply formulated WEMP, it is necessary to prepare a dissemination plan for the concerned stakeholders. The RBC has responsibility to plan and implement these activities. The following ways can be adopted for dissemination of WEMP.

1) Approval by River Basin Committee (RBC) and PPC
2) Meeting with provincial and district departments
3) Workshop with regional stakeholders

7.4 Discussion with Vietnamese Side related to the Output-5

7.4.1 Mini-Workshop

To obtain comments from the Vietnamese experts for the Handbook for Formulating WEMP, two (2) mini-workshops were held as shown in Table 7.4-1. Comments and recommendations obtained are shown in Table 7.4-2.

Table 7.4-1 Mini-Workshop for Output-5

Date	Venue	Attendants	Organization
5 Nov. 2009	VEA	16	VEA, CEM, VST, local experts and JST
12 Nov. 2009	JST office	8	Local experts and JST

Source: JICA Study Team

Table 7.4-2 Comments and Recommendations in Mini-WS for Output-5

Comments and Recommendations	Actions taken by VST/JST
(1) Handbook should identify responsibilities of each organization for preparing WEMP.	(1) Description on a task force for preparing WEMP is added with proposals on responsibility of each organization.
(2) Handbook should clarify its scope and applicability.	(2) Description on scope and applicability of the handbook are added.
(3) Framework of WEMP should be explained more clearly.	(3) Description on structure of WEMP in the model area prepared under Output-4 is added as example to assist user's understanding on framework of WEMP.
(4)Regarding the items to be specified in the Project for Countermeasures, an indicator for evaluation and required resources for implementation should be added.	(4) Required resources for implementation are added as an item to be specified in Project for Countermeasure.
(5) The Handbook should introduce how to manage implementation of the Project for Countermeasures to evaluate the feasibility of WEMP formulated.	(5) A process to evaluate WEMP before implementation is added.

Source: JICA Study Team

7.4.2 Workshop

The following workshop was held to explain and disseminate the proposed Handbook.

Table 7.4-3 Workshop for the Handbook on Formulation of WEMP

Date	Venue	Attendance	Organization
20 Nov. 2008	Hanoi	41	VEA、MONRE, CEM/VEA, Institute of Environment Management Science/VEA, Thai Nguyen DONRE, Bac Ninh DONRE, Bac Giang DONRE, Hai Duong DONRE, universities, local consultant, international consultant, VST, JST, mass media

Source: JICA Study Team

The main discussion points during the workshop are presented in Table 7.4-4.

Table 7.4-4 Main Discussion Points in the Workshop

Comments and Recommendations	Actions taken by VST/JST
(1) The approaches introduced in the Handbook are logical, practical, and applicable for the model area of Cau river basin as well as other river basins.	(1) VST will try to apply the Handbook for water environment management at river basin level, and upgrade the handbook based on experiences obtained.
(2) It is necessary to clarify responsible and implementation bodies, criteria, and methods for evaluation. In this context, it is recommended to establish a third party who evaluates the developed WEMP for checking its feasibility.	(2) Concerned items were added to the Handbook.

(3) So far, there are many projects relating to the Decree 120/2008/ND-CP for river basin management by international donors and Vietnamese government, and there have been many outputs to be shared among stakeholders like the Handbook introduced in this Workshop. It is recommended to integrate such outputs by VEA to implement successful river basin management in Vietnam.	(3) Recommendations were described in Chapter 8 of this report.

Source: JICA Study Team

7.5 Capacity Development Conditions of Output-5

Through a series of co-working for preparing Handbook, the following capacity development was implemented in the discussion meetings, the mini-WS, the trainings, and daily-discussions between VST and JST.

(1) Responsible and implementation bodies to be established for formulating WEMP were examined, and proposals from the Vietnamese side were reflected to the Handbook.

(2) A general structure of WEMP was discussed, and comprehended by VEA, Bac Kan, and Thai Nguyen relevant officers.

(3) Processes for preparing WEMP were discussed, and proposals from the Vietnamese side were reflected to the Handbook.

(4) Items to be specified for projects in WEMP were discussed, and proposals from the Vietnamese side were reflected to the Handbook.

(5) Water environment management is a multi-sector work. Coordination mechanism to be established was discussed among the Vietnamese stakeholders.

(6) A lecture on measures for estimating pollution load and predicating river water quality was implemented for Thai Nguyen DONRE on 9th November 2009.

In Vitenam, preparing and implementing of WEMP at river basin level has been just started. Above capacity development activities are considered to contribute to enhance capacities of Vietnamese relevant officers for formulating WEMP.

8. Recommendations on Legal Framework and Coordination Mechanism for Water Environment Management Plan at River Basins (Output-6)

8.1 Legal Framework

Since the beginning of the 2000s, Vietnam has promulgated a large number of national policies and strategies on environmental management in line with the river basin water resource management. Along such policies and strategies, the Law on Environment Protection (LEP) has been amended in 2005 (Law No. 52), and the Vietnamese Government have been taking aggressive specific actions especially for the alleviation against serious pollution facilities, wastewater fee collection, water environment management with river basin approach.

In the course of the Study, the following weak constraints in the legal regulation system have been identified:

1) Construction of Effective Legal Mechanism for Environmental Management

Many policies and strategies for water environment management have not been fully activated since the actual enforcement was initiated without any effective legal mechanisms for implementation. This was due to insufficient allocated resources (human resources, finances, etc.), underdeveloped institutional capacities and lack of cooperation mechanisms among all levels in the environmental management sector in Vietnam.

2) Policy-Mix Approach for Pollution Control

The LEP is defining almost all pollution control approaches and pertaining systems for water pollution control. However, guidance necessary for actually enforcing pollution control approaches are deviated to only the regulatory approach (like EIA, environmental inspection, administrative sanction, etc.) and a part of economic approach (wastewater fee system). This is why diverse pollution control approaches have not been realized in Vietnam, at present. In this sense, VEA as the central government agency, is requested to lead the development of supplemental regulations and guidelines in order to guide and activate now sleeping approaches.

3) Activation of Pollution Control at All Levels

Decentralization in the administration of environment management is in progress along the prioritized policy of Vietnam. Along this trend, each District DONRE is placed at the authorization agency for many pollution sources which are registered by EPC. However, its institutional capacities are underdeveloped at present. Unlike pollution sources authorized by EIA, the sizes of pollution sources registered by EPC are relatively small, but they are discharging large pollution load due to the existence of large numbers of small-scale enterprises. To activate pollution control approaches/systems, special endeavors for effective guiding should be made, so that District DONRE can fulfill their mandates in environmental management such as authorization of EPC, environmental inspection, and administrative sanction.

The above constraints are regarded as the underlying persistent issues in water environment management sector at all levels, rather than just issues in the legal regulation system. Hence, it is advised that these issues be tackled from a long-term view in a strategic initiative, for reinforcing comprehensive abilities of the whole water environment management sector and in addressing increasing and diversifying environmental pressures.

(2) Regional Specific Issues of Legal Regulation System

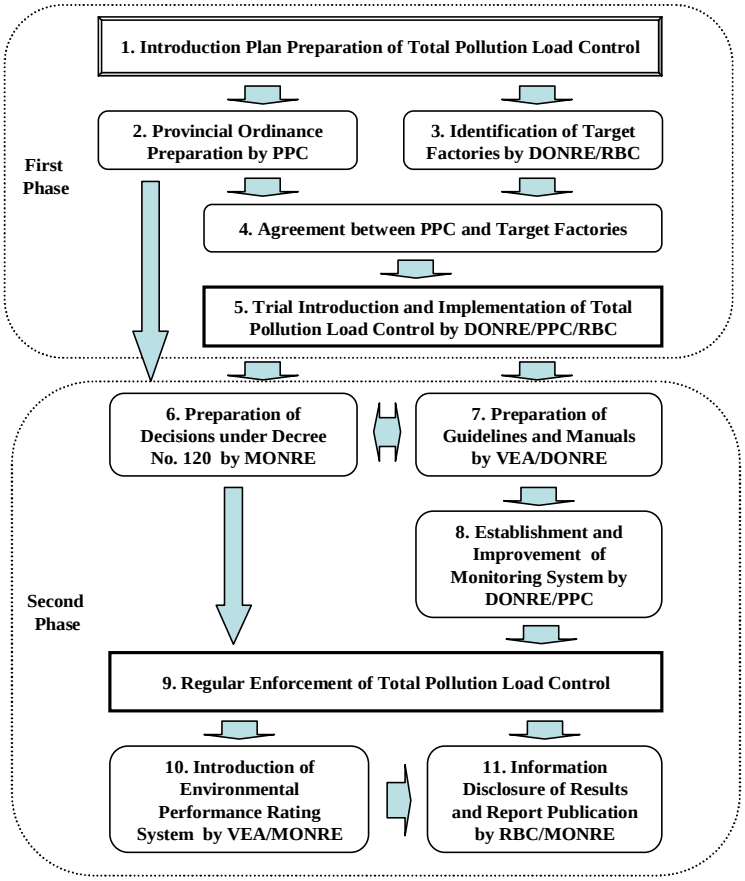
Considering current situation on environmental management and pollution control activities in the model area, several issues on i) the command and control activities such as inspection and sanction, ii) the economic incentive activities such as preferential tax and funding system are found to be

tackled and developed in order to promote water environment management in river basin stipulated by Decree No.120/2008. The detailed figures are summarized in Table 6.3-1.

(3) Introduction of Total Pollution Load Control Method

A total pollution load control is one of new tools for pollution control in river basins in Vietnam. At first, it will require a legal framework for introduction such as Decisions under the Decree No. 120. Moreover, it will also require more right system related to planning, design, monitoring, and implementation for actual enforcement by the local administrative authorities. Considering the current local situations on water environment management, the following step by step procedure is recommended for actual introduction of the total pollution load control method as shown in Figure 8.1-1:

1) Step-1: Preparation of Introduction Plan of Total Pollution Load Control Method,
2) Step-2: Preparation of Provincial Ordinance for Introduction of Total Pollution Load Control Method,
3) Step-3: Identification of Target Factories,
4) Step-4: Agreement between PPC and Target Factories for Trial Introduction,
5) Step-5: Implementation of Trial Introduction,
6) Step-6: Preparation of Decisions under Decree No. 120,
7) Step-7: Preparation of Guidelines and Manuals for Introduction of Total Pollution Load Control Method,
8) Step-8: Establishment and Improvement of Monitoring System,
9) Step-9: Regular Enforcement of Total Pollution Load Control Method,
10) Step-10: Introduction of Environmental Performance rating System, and
11) Step-11: Information Disclosure of Results and Report Publication.



Source: JICA Study Team

Figure 8.1-1 Proposed Introduction Procedure of Total Pollution Load Control

(4) Recommendations on Legal Framework

Through the Study, a number of impediments and insufficiencies in current pollution control have been clarified as mentioned above. Some items will require specific legal system solutions as shown in Table 8.1-1 to ensure the enforcement of WEMP. It is recommended that some needs of them may be timely responded by setting up "Ordinances" at the provincial level by PPCs, as an expeditious way and/or issues peculiar to a region.

Table 8.1-1 Specific Needs for Strengthening of the Legal Regulation System

No.	Pollution Control Approaches/Systems	Needs for Strengthening	Relevant Regulations
1	Environmental inspection and fines	- Enabling the environmental inspection on site without pre-notification on, to promote the environmental compliance. - Increasing the amount of fines against violations to promote the environmental compliance.	- Law on Inspection (June 24, 2004) - Decree No.41/2005/ND-CP and others -Circular No.07/2007/TT-BTNMT
2	Wastewater fee system	- Increasing the fee rate to render clear economic incentive to payers. - Setting up the payment of compensation for environmental damages against the violations beyond the effluent standard. - Setting up the penalties against no fee payers. - Setting up the minimum effluent discharge to be adopted for wastewater fee, to save the management resources of the environment management sector.	- Decree No.67/2003/ND-CP - Joint Circular No.125/2003/TTLT- BTC-BTHMT and others
3	Total load pollution load control	- Introducing the regulation of the total pollution load (calculated by multiplying wastewater flow and concentration) discharged from enterprises located in a special designated area. - Promotion of specific agreement between the local authorities and enterprises.	- Newly established regulation will be issued as none exists at present.
4	Environmental supervisor system	- Introducing the regulation of environmental supervisor system to be applied to enterprises for promoting specialized environment management by a certified supervisor. - Promotion of specific agreement between the local authorities and enterprises. - Introduction of regional specific regulations such as more stringent standards, increasing control substances, and cut-down criterion.	- Newly established regulation will be issued, as none exist at present.
5	Integrated supporting system to small-scale industries	- Launching integrated supporting (planning, constructing, soft-loan rendering, etc.) with establishment of a special agency under the auspices of MONRE, to promote the environmental protection measures in small-scale industries.	- Newly established regulation will be issued, as none exists at present.

Source: JICA Study Team

8.2 Coordination Mechanism

(1) River Basin Management Approach and General Structure

In Vietnam, Article 59 of the amended LEP stipulates clearly that the environmental protection of river water should be based on the river basin management approach with the cooperation among localities belonging to the river basins. Since the creation of MONRE (2002), there has been some confusion on the respective roles of MONRE and MARD regarding river basins. The Government Decision No. 43/2007/TB-VPCP (March 2007) clarified the assignment to MONRE of the overall responsibilities for river basin management in Vietnam. Along this decision's requirement, MONRE issued Decree No. 120/2008/ND-CP (river basin management) which was promulgated in December 2008.

The prime concern in river basin water management is how to encourage an economically efficient and equitable allocation of water resources in view of the conflicting demands from various sectors between upstream and downstream areas. Such sectors include agricultural, industrial and municipal water supply, power generation, flood control, navigation, and water quality, including wastewater disposal to the rivers.

Currently, the following decrees and decisions are determined related to the Cau River basin in general. These explicitly state the range of concerned organizations, coordination functions, and responsibilities. Under this legal framework, the concerned six PPCs have agreed to a shared commitment for the protection and sustainable exploitation of water in the Cau River basin.

-"A General Project on Protection and Sustainable Development for Ecological Environment and Landscape in sub River Basin" (Decision No. 174/2006/QD-TTg)

-"Establishing Cau River Basin Environmental Protection Committee" (Decision No.171/2007QD-TTg)

-"Promulgation of Organization and Operation Regulation of Cau River Committee Office" (Decision No.1770/2008/QD-BTNMT)

-"Decree on River Basin Management" (Decree No.120/2008/ND-CP)

(2) Specific Requirements on Coordination Mechanism on WEMP

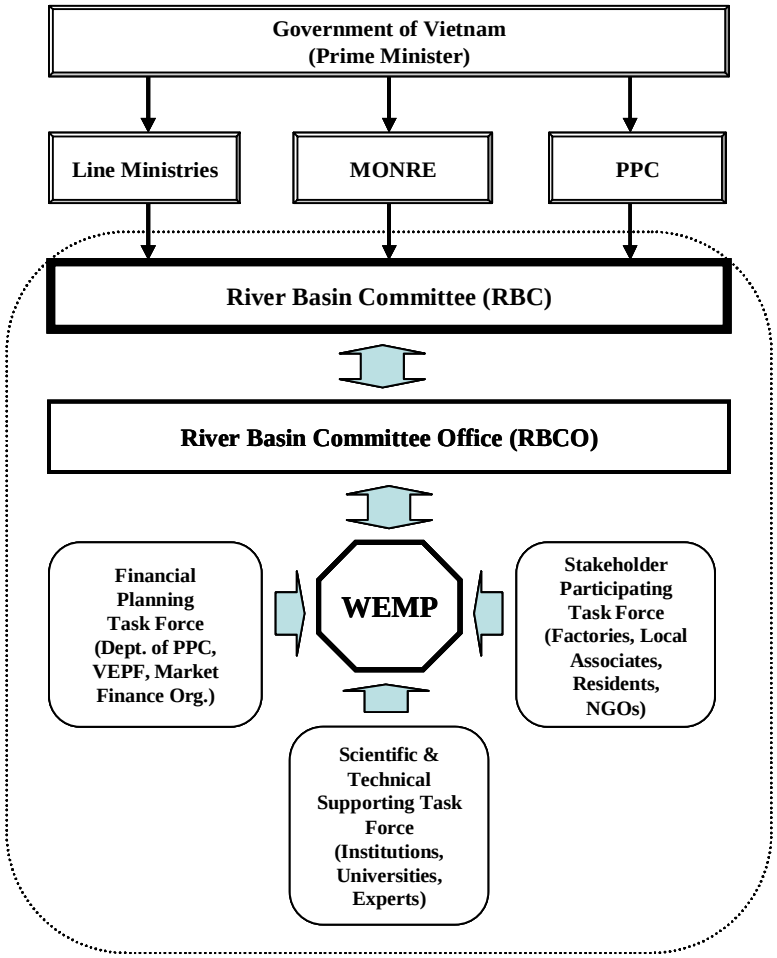
At present, the established CRC has dedicated great efforts to achieve the Cau River Basin M/P, with four CRC meetings held so far. Therefore, it is expected that the proposed WEMP in the model area will be built in the overall plans and activities of CRC for its successful implementation.

The current crucial issues in the CRC meetings that should be coordinated are a) prioritization of the projects and programs formulated in WEMP, b) financial aspect for implementation of WEMP, and c) participation of concerned stakeholders. It is recommended to establish special task forces to cope with these issues under RBC and RBCO, as shown in Table 8.2-1 and Figure 8.2-2.

Table 8.2-1 Recommendation on Establishment of Special Task Force

No.	Task Force	Focal Activities	Organizations
1	Financial Planning Task Force	- To propose draft plans and materials for coordination to be discussed in RBC meeting concerning to financial matters of WEMP - To assist and support RBCO's coordination activities related to financing and budgeting - To propose mechanism, system, and legal frame of WEMP	1)Leading: Representative of RBCO 2)Others: -Dept. of Finance in MONRE -Dept. of Finance in PPC and District -Environmental Fund such as VEPF & provincial fund -Market financial organizations such as commercial bank and development bank
2	Scientific and Technical Supporting Task Force	- To propose draft plans and projects to RBCO - To evaluate proposed plans and projects from technical viewpoint - To advise and support RBC and RBCO from scientific and technical viewpoint -To support technical appraisal of environmental fund application	1)Leading: Representative of RBCO 2)Others: -Concerned Dept. in PPC -Technical institutions -Universities -Scientific and technical experts
3	Stakeholder Participating Task Force	- To propose draft plans and activities - To promote and coordinate participatory approach of WEMP - To advise and support RBC and RBCO related to stakeholder participation -To support and propose related to data publication and information disclosure to RBC and RBCO -To plan and propose holding symposium, seminar, and workshop	1)Leading: Representative of RBCO 2)Others: -Concerned Dept. in PPC and District -Representative of local associations -Representative of enterprises -Universities -Local experts -NGOs

Source: JICA Study Team



Source: JICA Study Team

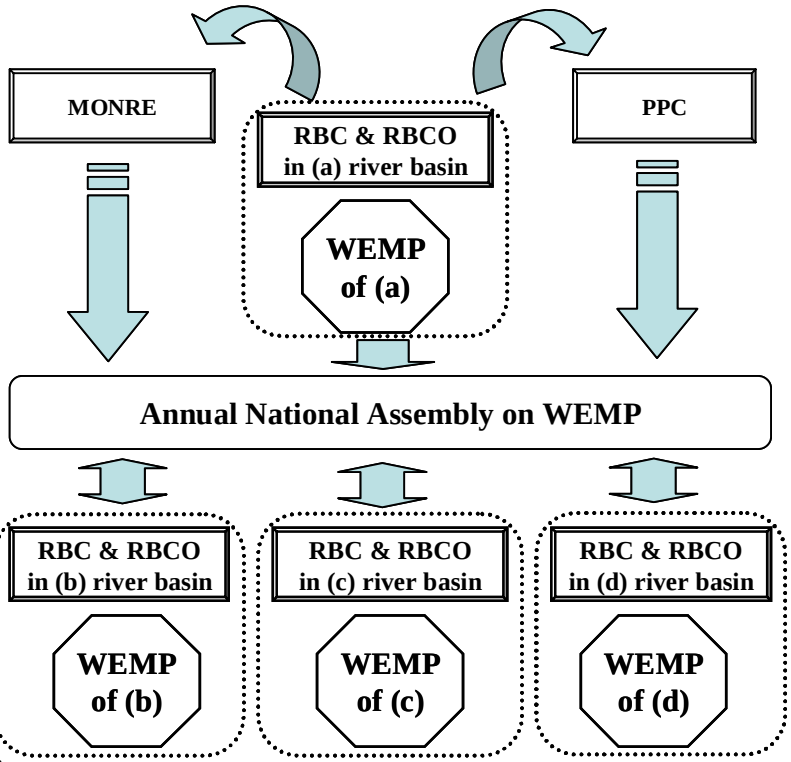
Figure 8.2-1 Recommended Structure of WEMP

8.3 Active Use and Dissemination of WEMP

The WEMP in the model area and the series of guidelines are developed mainly for the administrative organizations such as VEA in MONRE, DONRE in PPC, district DONRE, and the RBC. In particular, it is expected to be fully used by the RBCO because of its functional duties to RBC. Hence, these organizations should take an initiative not only for the effective and efficient use of the WEMP but also for its improvement and revision to meet its river basin specific conditions. It is then recommended that these experiences be accumulated and shared with the concerned organizations on other river basins holding a periodic national assembly in Vietnam. This schematic dissemination concept is depicted in Figure 8.3-1.

In the PCU meeting held on the 13th of November 2009, it was suggested that a trial application of the outputs of the Study should be conducted in the Nye-Day River basin in order to learn practical lessons and points to be improved in other river basins. These could also be recommended for application to subsequent project opportunities such as the National Water Environment Management Capacity Strengthening Project.

It should be noted that this WEMP consists of some parts of the overall River Basin Management concept in Vietnam. In fact, the "Decree on River Basin Management" (Decree No.120/2008/ND-CP) is promulgated pursuant to both LEP on 29/11/2005 and the Law of Water Resource on 20/05/1998 (LWR), and contain broad aspects on the river basin management. Thus, it is expected that WEMP should be formulated subject to said decree, and could form part of the overall river basin management plan in future.



Source: JICA Study Team

Figure 8.3-1 Concept of Transfer and Dissemination of WEMP

8.4 Dissemination of Outputs and Discussion for Future Application in the Final Seminar

VST and JST held a final seminar to disseminate the outputs of the Study to relevant stakeholders for applying the guidelines, handbooks, and manuals prepared, and implementation of the WEMP in the Model Area in Cau river Basin as shown in Table 8.4-1.

Table 8.4-1 Final Seminar of the Study

Date	Venue	Attendance	Organization
23 Dec 2009	Hanoi	82	VEA、MONRE, CEM/VEA, Institute of Environment Management Science/VEA, PCD/VEA, CECT/VEA, MOST, IET/VAST, Bac Kan DONRE, Thai Nguyen DONRE, Bac Ninh DONRE, Bac Giang DONRE, Hanoi DONRE, Ha Nam DONRE, Nam Dinh DONRE, universities, local consultant, international consultant, VST, JICA, JST, and mass media

Source: JICA Study Team

In the seminar, at the first, JST presented the key outputs and future direction for the output usage of the Study. Secondly, CEM/VEA presented application of the Monitoring Guideline and the PSI Guideline prepared under the Study. Then, Bac Kan DONRE presented the knowledge and skills obtained through the Study and the planned water environment management activities such as monitoring and environmental fund. Finaly, Thai Nguyen DONRE presented evaluation results of the outputs of the Study and plans for future application of them with several proposals.

Through the final seminar, the Vietnamese attendants presented to trial the outputs of the Study even after the Study is finished continuously, and to update the outputs based on the trial activities. These trial activities will be expected for Vietnamese relevant stakeholders to obtain experiences of river basin management and to contribute to actualize recommendation on legal framework and coordination mechanism for WEMP in river basins mentioned in this chapter.