

VIETNAM – NETHERLANDS PARTNERSHIP
ON WATER FOR FOOD AND ECOSYSTEMS

Main Case study #5

*National Level Review of Policies and Issues in Relation to Water–
Food-Ecosystems Interaction*

**FINAL REPORT
(DRAFT)**

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Ha Noi, November 2008

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ABBREVIATIONS

DOA	: Department of Administration
DOST	: Department of Science and Technology
DWR	: Department of Water Resources
DWRM	: Department of Water Resources Management
ENV	: Electricity of Viet Nam
ICD	: International Cooperation Department,
IPSARD	: Institute of Policy and Strategy for Agricultural and Rural Development
IUCN	: International Union for Conservation of Nature,
IWRM	: Integrated Water Resources Management
IWRP	: Institute of Water Resources Planning
LNV	: Netherlands Ministry of Agriculture, Nature and Food Quality
MARD	: Ministry of Agriculture and Rural Development
MOC	: Ministry of Construction
MOIT	: Ministry of Industry and Trade
MONRE	: Ministry of Natural Resources and Environment
MOT	: Ministry of Finance
SEI	: Stockholm Environment Institute
VESDI	: Vietnam Environment and Sustainable Development Institute
VIFEP	: Vietnam Institute of Fisheries Economy and Planning
VIWRR	: Viet Nam Institute of Water Resources Research
VNWP	: Vietnam Water Partnership
WARECODE	: Water Resources Conservation and Development
WFE	: Water for Food and Ecosystem
WG	: Working Group
WUR	: Wageningen University and Research Centre

I. INTRODUCTION

1. Background

This national level review is designed to support the development of the Viet Nam – Netherlands Water Partnership on Water for Food and Ecosystems. The partnership is between Viet Nam's Ministry of Agriculture and Rural Development (MARD) and the Netherlands Ministry of Agriculture, Nature and Food Quality (LNV). IUCN has been asked to coordinate the Partnership development process, including through undertaking studies that will identify strategies for the management of water resources that balance agricultural production with the maintenance of the integrity of critical ecosystems that depend on adequate water flows.

It will build on the overall strategy of the global Water for Food and Ecosystems Programme, which seeks to promote an ecosystems approach to agricultural production and a productive services approach to ecosystems management. This will in turn provide a basis for ensuring more effective synergies between agriculture and ecosystems, the two largest water users, within an Integrated Water Resources Management (IWRM) framework.

Water for food and ecosystems (WFE) forms a specific sub-set of the broader IWRM approach. IWRM is concerned with a holistic integrated approach to water resources management, with a specific focus on coordinating and integrating the water demands and impacts (in and outflows) of the different sectors and stakeholders in a congruent IWRM management plan at the river basin scale. Special focus herein is given to match water demand of the multiple sectors and stakeholders with available supply at the river basin through integrated and multi-stakeholder coordination and management plans.

The approach to the WFE Partnership will be to build a consensus on innovative approaches to balancing production and sustainability through developing the knowledge base and the involvement of key stakeholders in dialogue and discussion. Phase 1 of the development of the WFE Partnership is focused on enhancing the knowledge base on water-food-ecosystems interactions, including the identification of interventions that have the potential to enhance synergies between ecosystems maintenance and food production in the conditions of contemporary Viet Nam.

The Review complements case studies that were drawn from appropriate projects/programmes that have been or are being implemented throughout the country. The purpose of the case studies is to identify mechanisms through which main areas of water management, which are traditionally approached as single purpose management regimes, can be enhanced to become more integrated, multi-

stakeholder based management systems in which the original activity is maintained and improved and at the same time linked water-dependent activities are also taken into account in management decisions.

The specific aim of Phase 1 of the WFE is to identify and develop innovative practices in water use and management for the agriculture and environment sectors that can: a) alleviate the water demands and pressures in the river basin – especially for agriculture, while; b) securing an adequate level of (water) productivity. The focus is on how agricultural water use and productivity can become more environmental (and IWRM) friendly, while retaining required (economic) productivity; and co-exist and actively support ecological sustainability and/or rehabilitation.

The explicit aim of the WFE approach is to develop alternatives to the traditional zero-sum trade-offs between agriculture, water supply, industry and environment that are typical for many IWRM scenarios, by fostering innovative approaches and practices in which agriculture and environment can co-exist while maintaining agriculture and ecological productivity and value. The approach is to assess the potential for “scaling up” management options identified in the case studies for national replication through the analysis of the national-level water-food-ecosystems situation and the review of the existing policy, institutional and legislative framework for water, ecosystems management and food production.

2. Objectives

The Purpose of the National-Level Review is to define the scope and policy context for the development of the WFE approach in Viet Nam.

The Objectives of the National-Level Review are:

- To assess the policy, legal, regulatory and institutional environment within which a WFE approach would be implemented.
- To provide an overview of the national situation for water resources, food production and ecosystems management.
- To assist with the assessment of the potentials for the replication of management options identified through the WFE case studies nationwide.

3. Methodology

3.1 Approach

The review is conducted under the team-work approach, meaning it is coordinated by one institution which has developed close cooperative relationship

with other partner institutions and experts and relies on the inputs from the partners. The review is carried out in a participatory nature with the engagement of not only research institutions but also concerned policy and decision-making agencies throughout the review process.

3.2 Methodology

The following methods were used for conducting the review:

- Desk review of existing materials, policy and strategy documents
- In-depth individual interviews with a check-list of questions
- Analysis of findings from four case studies
- Focus-group and routable discussion and forum with a set policy agenda
- Policy dialogue with key stakeholders discussing initial findings

4. Organization of the Research

The Review is coordinated by NISTPASS and was conducted under the close guidance and supervision of the VNN-WFE working group and IUCN/SEI/WUR advisors.

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6. Electricity of Viet Nam (EVN)
7. Vietnam Institute of Fisheries Economy and Planning (VIFEP)
8. Institute of Water Resources Planning (IWRP)
9. Institute of Water Resources Research (IWRR)
10. Vietnam Water Partnership (VNWP)
11. Vietnam Environment and Sustainable Development Institute (VESDI)
12. Water Resources Conservation and Development (WARECODE)

5. Structure of the Report

The report consists of 4 chapters..

CHAPTER I: GENERAL STATUS OF NATIONAL WATER RESOURCES

Water, food and ecosystem are three important factors related to nature and society. In fact, people do not understand well or ignore this relation in the sector approaches. More over, natural and agricultural ecosystems are the biggest water users. The challenge for each country in over the world is how to balance between the demand for economic development and food security with sustainable ecosystem development. This challenge is more difficult in the third world countries which are now facing with poverty and food security issues and the economy is agricultural based and mainly depended on the consumption of natural resources. Therefore, the study on the relationship and interaction between water, food and ecosystem is the key for the success of the current international commitment.

Vietnam is the agricultural based country with more than 80% of population live on agriculture production. For agriculture development, Vietnamese farmers have recognized the very important role of water for food production revealed through their proverb “Water, Fertilizer, Labour and Variety are important in descending order respectively”. A numbers of irrigation canals had been constructed such as Nhu Nguyet, Dao and Moi canals etc, the dyke system also had been constructed under Ly dynasty for agriculture protection and human life.

Since 1960s, the Government of Vietnam has been constructed a lot of big irrigation systems for agriculture production, these irrigation have contributed to bring Vietnam from the rice importer to be the second largest rice exporter and ensure national food security.

Beside these positive effects, we could not say any word about the negative effects on environment, ecosystem such as water, air, ecosystem and wetland environment etc..

I. General Introduction of Water Sector in Vietnam

Vietnam has a gross area of 331,690 km² with population of around 84.1 million (2008), population density of 242 people/ km². Over 75% of Vietnamese population are living in rural areas. Ratio of agriculture in the national economy in 2003 was 22%. In recent years, economic growth of Vietnam is stable at rate of 7.5% per year. In which agriculture is constantly increased with rate of 4-4.5% per year. Vietnam is a big agricultural product exporting country (such as rice, coffee, rubber, pepper, cashew etc.). Agricultural development in last years not only made national income increase, food security, poverty reduction but also contributed to social stability, environmental protection

Vietnam has achieved remarkable economic growth and reductions in poverty over the last decade, from about 58.1% in 1993, to 23.2% in 2004, and an estimated 22.0% in 2005. Gross domestic product (GDP) per capita increased from \$288 in 1993 to \$622 in 2005, with a marginal increase in inequality. Strong economic growth has been accompanied by increasingly rapid urbanization and significant increases in wages and quality of life. However, this growth has included some less positive changes, such as high rural–urban migration, and is placing heavy pressures on the country’s dilapidated infrastructure and fragile natural resource base.

Vietnam is located in a tropical monsoon zone. Water resources potential is at moderate level. Annual runoff is about 844 billion cubic meters, of which 323 billion cubic meters are generated inside the country, and 521 billion cubic meters come from overseas countries. Groundwater source has dynamic potential of about 1500 m³/s. However, water distribution is uneven in both space and time. 75-80% of annual runoff is concentrated in 3-4 months of mid rainy season. While runoff of 3 months in mid dry season is 5-8%. Therefore, water shortage, drought and water logging often happen with increasing, complicated, serious trend in most of areas within the country.

Although Vietnam is a high rainfall country, averaging 1,940 millimeters per year, it is not rich in water. Increasing competition for reliable water resources may constrain economic growth and the creation of livelihood opportunities. Currently, average annual per capita surface water availability that generated within national borders is about 3,840 cubic meters (m³), based on water resources generated within national borders. Vietnam can be considered a water deficient nation and is predicted to face increasingly difficult challenges with water resources in the near future. Allowing for projected population growth and taking the expected impacts of climate change into consideration, average annual per capita surface water availability will be approximately 2,830 m³ by 2025. Cross-border river flows increase the projected water availability to about 7,660 m³ per capita, but this figure disguises substantial seasonal and spatial disparities. Droughts are frequent and prolonged, and nearly two thirds of the surface water inflows from neighboring countries are concentrated in the Mekong River delta.

Demands for water resources are growing rapidly, not just for extraction but also for increasing hydropower generation to satisfy the expanding economy and growing population. Groundwater is increasingly used both in rural areas and major urban centers, in some areas groundwater levels are falling dramatically in some areas, resulting in land subsidence and its turn to damage to infrastructure. Some groundwater sources have elevated levels of arsenic.

The crucial role of water in the nation's sustainable development, human health, and life has not always been fully appreciated; its value as a scarce natural resource and economic good has not always been recognized. As a result, the protection and management of water resources has not been given adequate attention. An earlier review of Vietnam's water resources in 1995–1996 helped identify problems and the range of options available to overcome them. The review formulated strategies to help guide the Government's investment programs.

The water sector still faces substantial challenges, including (i) increasing competition for heavily committed freshwater resources; (ii) increasing pollution of rivers by industrial, municipal, and agricultural sources; (iii) increasingly severe and frequent natural disasters affecting a rising number of population living in disaster-prone areas. These challenges highlight the urgency for the Government to complete sector reforms to separate the tasks of regulation, delivery of services, and policy leadership in the water sector. Groundwater is being extracted at unsustainable rates; few water service providers operate in a financially viable way; much of the existing water management infrastructure is in poor repair and needs to be replaced; and most suitable agricultural land is under irrigation with diminishing opportunities for increasing production. Furthermore, development of basic water services has not kept pace with economic growth, leaving around one third of the population without adequate water supplies and two thirds of the population without sanitation. Vietnam is on target to meet Millennium Development Goal (MDG) (halving the number of persons without access to safe water and sanitation in urban areas) but progress in rural areas remains behind target.

The Government has made substantial progress in water sector reforms since 1995. Specific reforms include (i) passage of the Law on Water Resources in 1998; (ii) establishment of the Ministry of Natural Resources and Environment (MONRE) in 2002; (iii) establishment of the National Water Resources Council (NWRC), chaired by the deputy prime minister, as the water sector apex body; and (iv) adoption of the sustainability concepts reflected in the (a) National Strategy for Environmental Protection; (b) Strategic Orientation for Sustainable Development (Agenda 21); (c) National Water Resources Strategy toward the year 2020 (NWRS); (d) Law on Water Resources; (e) Law on Environmental Protection; and (f) adoption of a rural water supply and sanitation strategy following the multi-funding agency review of the subsector in 2005. These actions present an important shift toward recognition of the importance of a sustainable and healthy natural resource base. Such recognition is a critical ingredient in the Government's efforts to achieve sustainable socioeconomic development.

In its NWRS, the Government defined the main objectives for the water sector in the next 15 years as the protection, efficient exploitation, and sustainable

development of water resources on the basis of integrated and unified water resources management. The Government intends to meet water demands for people's living and socioeconomic development, while ensuring national defense, national security, and environmental protection as the country's industrialisation and modernisation proceed. The Government is encouraging proactive prevention to control and mitigate the adverse impacts of water-related disasters, while developing multisector industries that utilize water resources. Vietnam places high priority on improved international cooperation and the harmonious sharing of water resources.

Vietnam faces a number of challenges in the field of water resources management. In the rural sector, many irrigation systems suffer from low efficiency, and their management by irrigation management companies is not cost-effective. Non-irrigation uses of water in rural production are widely neglected in development programs. Systematic challenges remain in the water supply, sanitation, and health field despite recent reforms. Natural disasters are a concern in many parts of Vietnam, with flash floods, landslides, and coastal erosion common in coastal areas. Water shortages occur frequently during the dry season, and saltwater intrusion is advancing into coastal plains and delta areas, limiting opportunities for extraction of water for agricultural, domestic, and industrial uses. The high regional, seasonal, and annual variability of water supply is likely to become more extreme because of climate change associated with global warming. Pollution of surface and groundwater is emerging as a problem in many river basins because of population growth and rapid industrialization.

The water sector in Vietnam is characterized by a fragmented policy and institutional framework, with a wide range of policies affecting the sector and a history of poor coordination among ministries such as the Ministry of Agriculture and Rural Development, Ministry of Natural Resources and Environment, Ministry of Construction, and Ministry of Health. There are particular concerns over responsibilities for river basin planning and IWRM. Links to wider national poverty reduction, economic development, and institutional reform policies and processes (including decentralization, comprehensive Poverty Reduction and Growth Strategy, socialization, and 5-year planning system) are also poorly developed, so the full developmental impacts of water management are often not realized.

At the same time, the Government provides substantial investment funds for irrigation, flood protection, and hydropower development. National poverty reduction programs, such as Program 135 and the Rural Water Supply and Sanitation Program, also include large investments in water services. There have been a number of reform initiatives, including establishing river basin organizations, introduction of participatory irrigation management, and development of province-level water strategies. However, to date, these have been limited in scale and impact and are yet

to be adopted nationwide. Sustaining economic growth in Vietnam will require continuing investment in the water sector.

II. National water resources status

1. Surface water source

In Vietnam, surface water sources include direct water sources inside the country and external sources flowing into Vietnam through large inter-state river systems, e.g. Red River, Ma River, Ca River, Mekong River...

Total river basin area is 1.167.000 km², of which the area of outside country's basin is 823.250 km² (Mekong River basin of 724.000 km², Red River of 300 km², Ma River of 10.800 km², Ca River of 9.470 km², rivers in Eastern South of 6.700 km², Bang Giang-Ky Cung River of 2.658 km²).

Total annual flow of Vietnamese river basin reaches app. 843 billion m³, however only 323 billion m³ originates from Vietnam and the remaining amount of 520 billion m³ (about 61%) externally comes in. Rainfall & flow on each basin is summarized in Table 1.1.

Table 1.1. Annual rainfall characteristics and flow on river basins

Or.	River basin	Basin area Flv(km ²)	Yearly rainfall X ₀ (mm)	Yearly flow W ₀ (10 ⁹ m ³)
1	Ky Cung	6.352	1.500	3,70
2	Bang Giang	4.000	1.746	3,62
3	Quay Son	370	1.550	0,36
4	Rivers in North-East region	3.744	2.560	5,21
5	Thai Binh River to Pha Lai	12.700	1.320	8,64
6	Red River Delta	13.000	1.690	11,3
7	Red River:- External	81.200	1.500	52,9
	- Internal, to Viet Tri	62.100	1.980	63,6
8	Ma River:- External	10.800	1.400	3,9
	- Internal	17.600	1.640	14,1
9	Muc River + Yen River	2.810	1.750	1,75
10	Ca River:- External	9.470	1.400	5,32
	- Internal, affluent included	20.527	2.000	20,20
11	Rivers in Quang Binh prov.	7.977	2.420	17,0
12	Rivers in Quang Tri prov.	4.369	2.600	7,11
13	Huong River and its affluent	3.298	3.050	8,60
14	Thu Bon River	10.350	2.780	21,0
15	Tam Ky, Tra Bong, Tra Khuc, Ve	8.935	2.580	19,3
16	Kone River and its affluent	7.204	1.700	7,23
17	Cai River in Khanh Hoa prov.	1.048	1.700	1,06
18	Cai River in Nha trang + affluent	2.942	2.100	4,31
19	Basin of Ba River	13.800	1.740	9,87
20	Rivers in Ninh Thuan & Binh Thuan prov.	9.567	1.200	4,43

Or.	River basin	Basin area Flv(km ²)	Yearly rainfall X ₀ (mm)	Yearly flow W ₀ (10 ⁹ m ³)
	Small rivers	3.033	1.200	1,40
21	Dong Nai River System : - External	6.700	2.160	4,00
	- Internal (<i>Vam Ca Dong, Tay</i>)	37.400	2.200	33,8
22	Mekong River System :- External	724.00 0	1.400	452,8
	- Internal	70.520	1.800	55,1
	Total			843
	- External			520
	- Internal			323

In Vietnam, there are over 2,000 rivers with length of over 10 km including 8 big rivers which have basin areas larger than 10,000 km² of each. The total runoff of surface water in the territory of Viet Nam is about 832.67 billion m³/year, in which water produced in Vietnam is 311.5 billion m³/year (accounting for 37.4%) and 521.2 billion m³/year is water from outside of Vietnam's border (occupied 62.6%). There is 60% of surface water under the Mekong River Delta and over 20% belongs to the Red River and Dong Nai River. Water is not distributed evenly, concentrated mainly in the rainy season. The total runoff in dry season is only 194.5 billion m³/year, accounting for 23.36% of average annual runoff.

Total active capacity of reservoirs in Vietnam is approximately 37.03 billion m³, of which around 29.9 billion m³ (get round 30 billion m³) belongs to hydroelectric reservoirs. There are 9 reservoirs with over 1 billion m³ of each active capacity, total of them is 24.4 billion m³. There are 90 reservoirs with containing capacity of over 1 million m³.

There are 6 water basins dependent or related to the runoff of other countries, such as Bang Giang - Ky Cung, Red River, Ma River, Ca River, Dong Nai River and the Mekong River Delta. Nearly 40% of the runoff of the Red River is from China; more than 10% of runoff of Dong Nai river is from Cambodia. Vietnam has not been able to control the use of water from outside. If the upstream water sources are thoroughly exploited in other countries, Vietnam will be affected significantly. Distribution of water resources by river basins is shown in Table 1.2

Table 1.2: Distribution of water resources by river basins⁽¹⁾

No.	River basin	Natural water (m ³ /person)	Water volume in dry season (including active capacity and water diversion for inter-basin) (m ³ /person)
1	Bang Giang - Ky Cung	6728	1725
2	Red River - Thai Binh River	4833	1858
3	Ma	4107	1418

4	Ca	6051	2691
5	Gianh	12417	3517
6	Thach Han	7031	2344
7	Huong	5885	2746
8	Vu Gia - Thu Bon	11412	4105
9	Tra Khuc	7307	2531
10	Kon	4616	1737
11	Ba	6968	2143
12	Dong Nai	2798	1093
13	Southeast River Group	3205	888
14	Se San	17496	9729
15	Sre Pok	6958	2183
16	Mekong River Delta	27719	6292

Surface water resources are not distributed evenly in the territory of Vietnam and fluctuated strongly over time, so a lack of fresh water are now occurring in many places, especially in the north mountainous area and coastal plain. This status will be more severe in the next century when water demand increases extremely. Activities of people living in water basins have been bad impacted on environment, ecology in general and water resources in particular. The uncontrolled exploitation, forest burning causing erosion and, degeneracy of land as well as water source exhaustion, floods, droughts are increasing trend and more serious. The improper exploitation and use of water resources also cause water loss and waste. At present, many people still consider water as "the heaven-sent" and use it spontaneously; they are lack of sense of saving and protecting water resources.

2. Ground-water source

Reserves of ground-water in river basins of Vietnam have been defined:

- Nation-wide, total reserve of natural moving flow is app. 195.666.650 m³/day, equivalent to 2.264 m³/s;
- Total ground-water reserve of (A+B) level is 986.500 m³/day;
- Exploitation reserve of C1 level is 2.400.000 m³/day, C2 level of 10.400.000 m³/day;

The dynamic reserve and groundwater flow module in each river basin is presented in Table 1.3

Table 1.3. Dynamic reserve and ground water flow module

River basin	Natural moving reserve (m³/day)	Groundwater module (l/s.km²)
Bang Giang-Ky Cung	3.296.160	2 ÷ 5
Quang Ninh coastal line	1.907.712	1,5 ÷ 7
Lo River	61.846.063	3 ÷ 7
Da River	16.597.267	3 ÷ 10
Thao River	6.428.160	3 ÷ 7
Cau River	1.823.472	

Thuong River	1.149.120	2 ÷ 5
Luc Nam River	99.100	2 ÷ 3
Northern delta	7.180.539	0,5 3 ÷ 10
Ma River	6.082.560	2 ÷ 5
Ca River	11.001.605	2 ÷ 5
Nghe – Tinh coastal line	2.409.005	2 ÷ 10
Binh – Tri – Thien coastal line	6.569.683	2 ÷ 10
Thu Bon River	103.500	6 ÷ 13
Quang Nam – Binh Dinh coastal line	2.797.200 4.173.000	3 ÷ 10 1 ÷ 5
Ba River	5.441.040	5 ÷ 6
Se San River	10.402.560	3 ÷ 5
Srepok River	2.422.472	1 ÷ 5
Thuan Hai coastal line		
La Nga River	3.062.448	7 ÷ 10
Dong Nai River	24.231.312	5 ÷ 10
Be River	3.097.440	5 ÷ 7
Sai Gon River	3.246.480	5 ÷ 10
Vam Co Dong River	2.651.616	3 ÷ 5
Vam Co Tay River	850.176	2 ÷ 5

The investigation, exploration of groundwater has not been conducted completely, only in less than 20% of country's area. According to results of survey of groundwater, total amount of dynamic groundwater reserves is about 112 million m³/day, usable reserves of groundwater rated level A is about 1,282 thousand m³/day, level B is about 1,251 thousand m³/day, level C₁ is about 2,784 thousand m³/day and level C₂ is about 18,534 thousand m³/day. It is estimated on 2000 m³/s, equivalent to 62.8 billion m³/year. According to preliminary assessment, the great potential groundwater areas are in the Red River Delta and Southern (see Table 1.4). The areas where the demands for groundwater use are big are coastal cities, the provinces of Southeast, Central Highlands and South Central Coast. These regions exploited groundwater primarily for uses of irrigation and domestic purpose, partly for industry. The rate of contribution of groundwater to surface water in three-month dry season is very significant, the highest rate in Central Highlands and Southeast is 0.95, Northwest and North Central Coast is 0.94, Northeast is 0.93 and the lowest rate in South Central Coast is 0.9⁽²⁾

Table 1.4: Distribution of groundwater reserves by regions on the whole of Viet Nam

No.	Region	Area (km ²)	Dynamic reserves (m ³ /day)	Potential usable reserves (m ³ /day)
1	Northwest	35,530	15,516,332	15,521,338

2	Northeast	66,434	27,952,643	27,995,374
3	Red River Delta	8,204	6,795,588	17,191,162
4	North Central Coast	51,095	18,160,909	15,830,784
5	South Central Coast	44,245	12,283,053	12,839,864
6	Central Highlands	54,701	18,009,389	18,009,388
7	Southeast	9,009	1,615,642	1,642,349
8	Mekong River Delta	35,780	11,905,586	23,843,731
	Entire of country	304,998	112,239,142	132,873,990

3. Water quality

Surface water quality

According to the Vietnamese standards (referred to as TCVN 5942, 1995), surface water quality is classified into two categories, Class A and Class B. Surface water of Class A quality is good enough to be used as a supply source for domestic use, after proper treatment. Class B water can be used for purposes other than domestic use. These surface water quality standards were developed by the Ministry of Science Technology and Environment. Domestic water standards have also been prepared by the Ministry of Health, including standards for drinking water issued in April 2002. In addition, each ministry has its own sector standards applicable for sector activities.

Studies since 1991 indicate that the surface water in Vietnam is generally of good quality. In rivers where surveys are conducted, almost every indicator meets the standard for Class A water for domestic supply, and all meet the standard for Class B, water for other purposes. Such indicators as BOD (biological oxygen demand), COD (chemical oxygen demand) and others are of A level by Vietnamese standard. However, in places where industrial and domestic wastes are discharged, many indicators exceed the acceptable level. For instance, in the section of the Red River from Viet Tri upstream the river receives heavily polluted effluent from intensive industrial activities. The COD is 2.37 times and BOD 3.83 times higher than acceptable levels. Water pollution mainly occurs in urban areas, industrial zones, traditional trade villages, and major residential areas. Major sources of pollutants are domestic and industrial wastes discharged to open canals that contain rain water, production and domestic waste water. All physical and biological indicators of water sources in the major cities of Hanoi, Ho Chi Minh City, Hai Phong, Da Nang, and Hue exceed the allowed levels.

Water in urban areas, industrial zones, and handicraft villages is even more seriously polluted by liquid and solid waste. In large cities, hundreds of industrial factories have contributed to water pollution due to their lack of waste water

treatment facilities. Water pollution due to industrial production is very serious. For example, in the garment and textile industry and paper production, wastewater contains an average pH of between 9 and 11; BOD, COD, suspended solid indicator exceeds the acceptable level by several times. In some chemical and mineral industries, cyanide in wastewater is 84 times higher than the standard, H₂S 4.2 times higher, and NH₃ 84 times higher, all of which creates serious pollution for the surface water in the area.

Industrial development without appropriate environmental protection measures is seriously polluting the surface water in many locations. For example, in the Cau River at Thai Nguyen City, the Thuong River at Bac Giang Bridge, the Cam and Tam Bac Rivers in Hai Phong City the water quality indicators exceed the standard by two to ten times for Class A water.

Water in central area rivers is of fairly good quality. Water upstream and in mid-reach is at a Class A level by TCVN 5942-1995 (Vietnamese Standard). These are major sources of water for domestic and industrial uses. They are the Vinh Phuoc River in Dong Ha, the Huong River in Hue, the Tuy Loan River in Da Nang, and the Tra Khuc River in Quang Ngai. However, their downstream reaches are polluted by waste from industrial factories and urban areas resulting in Class B water level standards.

In the south, BOD and COD indicators in the Dong Nai, Vam Co, and Saigon Rivers are from 10 to 15 times higher than Vietnam's standard for Class A water, and two to five times higher than that for Class B water. The water quality deterioration in southern rivers is shown by low pH, for example In the Saigon or Vam Co Dong Rivers, the pH levels are between three and five.

Groundwater quality: Basically, it meets the requirements of use, including domestic water supply. However, because the exploitation and use of groundwater is excessive permit and lack of planning, it causes contamination, salinization and drawdown of groundwater level, even difficult recovery, typically in big cities, large urban such as Hanoi, Ho Chi Minh City, Central Highlands and some areas in the Mekong River Delta.

PH degree of groundwater in the territory is within the limits of 4.5-8.5, mainly in the 6.5-7.5 range (3). The regions with pH < 6.5 are quite large from Quang Nam to the Southeast, there are mainly unconfined groundwater because content of carbonate in soil contains water and dust in the air as well as in low soil layer. In some exploited mining areas in Northern such as Phan Me, Na Duong coal mines, several ones in Quang Ninh and some other with strong acid activity distributing from Da Nang to the south, pH also decreases to 4, even lower in some places. This

phenomenon is mainly caused by the oxidation of some sulphide of metals in the soil of mines and dumping site.

Total dissolved salts or total mineral content of water is limited ≤ 1.0 g/L, so the low-concentration groundwater part should be only considered by this level. With $\text{TDS} \leq 1$ g/L, almost chemical components achieved the specified criteria. Particularly, the amount of chlorine often exceeds its criterion when the groundwater in the plains has $\text{TDS} > 0.8$ g/L. Most of the results of the analysis of element components of groundwater in different water mines showed that their contents (Cu, Pb, As, Hg, etc.) are smaller than the limit for permission to use water for domestic purpose.

4. Impact of climatic change to the water sources

Global and regional climate has been and are changing abnormally; storms, flood and drought happen at more frequent basis and severely which create huge change to the water source and serious impact to the socio-economic activities.

4.1. Annual flow

- *Red River*: Studies on variations of rainfall and temperature show that:

+ Case 1: If there is an increase in temperature of 4.5°C , rainfall of 10% in wet & dry season, then annual flow increases 6%, dry flow reduces 10% and flood peak increases 12%.

+ Case 2: If there is an increase in temperature of 4.5°C , 10% reduction of rainfall in wet season and increase of 10% in dry season, then annual flow reduces 13%, dry flow reduces 13% and flood flow increases 15%.

+ Case 3: If there is an increase in temperature of 4.5°C , 10% reduction of rainfall in wet & dry seasons, then annual flow reduces 19%, dry flow reduces 15% and flood flow increases 5%.

- *Mekong River*:

+ Case 1: If there is an increase in temperature of 3°C and rainfall of 20%, then annual flow reduces 4%, minimum flow reduces 2%, flood flow increases 15%.

+ Case 2: If there is an increase in temperature of 3°C and rainfall of 25%, then annual flow reduces 15%, dry flow reduces 16%, flood flow increases 19%.

+ Case 3: If there is an increase in temperature of 3°C and 10% reduction of rainfall, then annual flow reduces 15%, dry flow reduces 24%, flood flow reduces 7%.

Research results show that if rainfall reduces in rainy season, the annual flow reduces from 10-20%, dry flow reduces from 10-25%. Max flood flow will increase 10-15% in the Red River, 10-20% in Mekong River. If daily max rainfall increases 25%, current flood frequency is 1% and future figure will be 5%.

4.2. Sea-water level

Sea-water level in Vietnam is under the impact of climatic change, El-Nino, storms and tidal mode. In current observation documents, there can only make assessment on the change of sea-water level alongside Vietnam coastal line.

- Observation data at Hon Dau station (Hai Phong) during 1957-2000 period show that sea-water level has increased 3,4 mm/year.

- El-Nino also creases certain impact to the sea-water level: in many years with El-Nino, sea-water level is lower than average level of 2 ÷ 10cm (at Hon Dau), 3 ÷ 6cm (at Quy Nhon), 4 ÷ 10 cm (at Da Nang), 1 ÷ 3cm (at Vung Tau).

Increase of water level results in huge impact to the change of coastal water level: at the outlet of Red River, the increased water altitude may reach 2,5m, at Mekong River of 0,8m.

It is estimated that by the year 2010, water level may increase by 90 cm. If the dyke system is not reinforced & heightened, about 0,5 million ha of the Red River Delta and 1,5-2,0 million ha of Mekong River Delta will be submerged. The capacity of flood drainage will be reduced, there should have increase of drainage through motive power with 2-2,5 times. Drainage pumping capacity for Red River Delta will be 1.000-1.500 MW and concurrently more summer-autumn crops should be switched.

The area of mangrove forest in the Red River and Mekong Delta will be reduced and 25-30 million m³ of timber will be lost.

In summary, the changes of climatic factors will lead to the change of water sources. Current water sources range around 843.10⁹ m³, and estimated data in the year 2025 will be 807.10⁹ m³, 765.10⁹ m³ in 2070 and 722.10⁹ m³ in 2100.

Total existing quantity of water in dry season is app. 102.10⁹ m³, estimated data in 2025 is 89.10⁹ m³, 76.10⁹ m³ in 2070 and 72.10⁹ m³ in 2100.

5. Actions for Climate Change Adaptation

Climate change is expected to alter the current runoff and rainfall regimes. MONRE has estimated increased mean annual temperature for Vietnam from climate model simulations under a range of emissions scenarios. The Intergovernmental Panel on Climate Change report produced in 2007 provides the following predictions for Vietnam, for the period 2080–2099, assuming a “medium” emission scenario, based on the results of 21 Global Circulation Models (GCMs):

(i) An average annual rainfall increase of about 5%, with the increase being higher in the north than in the south. Note that there was considerable variation between GCMs, with some predicting much larger increases, and some predicting decreased rainfall in parts of the country and in the Mekong headwaters;

(ii) An air temperature rise of 2 degrees C. Again there was a marked variation, with some GCMs predicting increases of up to 4°C; and

(iii) Most models also show that, on average, an increase in rainfall will more than counterbalance the higher evaporation caused by temperature increases, with the result that an average increase in runoff is predicted, of the order of 50 mm/annum (approx 5% increase).

Most of the increase in average annual rainfall predicted by GCM models is expected to occur in the already wet months of the year, with only a minor increase over the dry season. The result would be that the seasonal variation in river flows would increase, with a greater variation in runoff at the seasonal scale. The frequency of dry season water shortages may also increase, because of higher dry season evaporation rates. The higher temperatures will increase plant water requirements, increasing the dry season crop water demands. The other change expected is higher intensity of rainfall which will exaggerate the current issues in Vietnam regarding natural disasters in general, and some new risk issues in particular such as dam safety.

Recent UNDP and World Bank reports indicate that Vietnam is one of five countries world-wide most vulnerable to sea-level rise as a result of climate change. In a scenario of world temperature increases and a 1 m rise in sea level, assessments have determined that Vietnam would lose 5% of its land, 11% of the population will be seriously affected, agricultural production would decrease by 7%, and the GDP would decrease by 10%. Sea level rises in some areas would have very major consequences. A 1m rise would flood more than 11,000 km² of the Cuu Long Basin, representing some 38% of the land in the basin (Figure 28). Bến Tre and Long An would lose nearly half of their land area. Sea level rise has further consequences such as coastal erosion, higher flood levels.

In down-river areas, increased salinity in river mouths and groundwater in near-shore areas, higher failure risk for river and sea dikes, extensive drainage

problems and extended crop inundation, and higher salinity intrusion affecting fresh water intakes.

In December 2007, the Government issued Decision No 60/2007/NQ-CP to assign MONRE to collaborate with other Ministries and Sectors to develop a National Target Program (NTP) on Climate Change Adaptation, to search for international assistance for the Program, and to submit it to the Prime Minister in the Second Quarter of 2008. The NTP program has six objectives:

- (i) Identify Climate Change (CC) features of Vietnam due to global CC;
- (ii) Assess CC impacts on national, provincial, sectoral development plans and programs;
- (iii) Identify the needs for adaptation to potential impacts of CC;
- (iv) Develop effective adaptation measures to be integrated into national, sectoral and provincial social economic development plans and strategy;
- (v) Identify a portfolio of priority activities/projects to be implemented for the most sensitive and vulnerable sectors and provinces;
- (vi) Identify a policy of Vietnam on international and regional cooperation and negotiation on CC mitigation and adaptation.

MONRE has indicated that a draft proposal on how to minimise the effects of global warming would be submitted to the Government at the up-coming fourth session of the 12th National Assembly. Under the proposal, climate-change adaptation and mitigation projects would be piloted in provinces most at risk of sea-level rise – Nam Dinh, Thua Thien Hue, Quang Nam, Ba Ria – Vung Tau and Ben Tre over the next two years. From 2011–2015, the plan will be adopted nationwide.

MONRE has also been the lead agency for the government efforts in related areas including United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol adoption by Vietnam, and the Clean Development Mechanism (CDM). The National Steering Committee for implementing UNFCCC was set up in 2007 based on the CDM committee, with the involvement of many agencies. The direction of this initiative is to formulate the legal framework, raise public awareness and strengthen institutions and technology infrastructure, to promote activities and research, enhance international cooperation, and organise activities between sectors aimed at environmental protection and socio-economic development.

MARD also has a major role to play in the NTP. In July 2007, MARD issued a report called “Global climate change – Issues for the agriculture and rural development sector”. In November 2007, MARD established a Steering Committee for an Action Plan on Adaptations to Climate Change in the agriculture and rural development sector.

6. Investment on water sector

Investment in water resources development is always paid attention by the State. However, integrated effective investment in water resources has not been consistent and sufficient. Annually, water use plans of the various sectors such as irrigation, water supply for urban rural areas, industries, hydropower etc. were balanced in the national financial plan but it did not compare with the water balance in river basins or inter-river basins. Investment in databases, monitoring, management etc. has not met the requirements.

The Vietnamese government is keenly interested in environmental infrastructure investment, but there are often few mechanisms to mobilise capital resources for investment. The government has been seeking to develop solutions to diversify investment for the environment, for example, through the established Vietnam Environmental Protection Fund (VEPF) in 2002 for the purpose of helping localities and enterprises to invest in environmental infrastructure. However, the investment is often not well organised, and the investment rate is still lower than in other countries in Asia.

The relationship between the international partners and the Government is in a transition phase as both seek to implement the Hanoi Core Statement. Despite some past efforts in this area (ISG and ISGE), investment by international partners remains uncoordinated. There are significant overlaps in projects, synergies are not exploited, projects tend to be fairly short term and piecemeal, and project outputs are not readily available. As a result, there tends to be duplication of efforts in some areas, while there remain gaps in other areas, and opportunities to build on previous work are missed. The sustainability of projects is also questionable. In many cases, once project funding ceases, so does all associated national effort, as the outputs and outcomes are rarely integrated into ongoing national activities.

Regarding to the cooperation with the international donor community to seek the assistance for development, the water sector of Vietnam has received a big amount of financial support from worldwide financial institutions (Loan and granted aids) such as Asian Development Bank (ADB), World Bank (WB), Japanese Bank for International Cooperation (JIBIC), AFD of France and KfW of Germany and also from international development organizations and countries (granted aids) such as DANIDA of Denmark, SIDA of Sweden, JICA from Japan, CIDA from Canada, the Government of Netherlands etc.

In the decade of 90's of last century and water sector is given high priority in the agenda of almost of international donors to help reconstruction of infrastructures of the sector, especially the irrigation works that was constructed during the years of 60's and seriously degraded or damaged during the war time in the North or newly

construct the irrigations systems for expanding the irrigated paddy production areas for the country food self-sufficiency.

By providing the water sector with USD billions of loan investment projects, the technical assistant (TA) are also offered by the donors for the purposes of strengthening and improvement of project management and implementation capacity of relevant government agencies and institutions at the central and provincial levels. The TAs and the programmes and projects funded by the international agencies and the countries to the water sector have played an essential role in process of building capacity for human resources in water sector of Vietnam.

From 2001 to 2007, total budget for irrigation, drainage and flood control administrated by MARD is 15,200 billion VND (around 1.1 bil. USD), of which the State budget is 8,800 bil. VND and Government Bond is 6,400 bil. VND. Concerning with water supply and sanitation, from 2001 to 2007, total budget is 9,747 bil. VND, of which State budget is 1,932 bil. VND (20%), provincial budget and people's contribution is 5,127 bil. VND (53%), international supports: 1,465 bil. VND (15%), credit: 1,223 bil. VND (12%). Annual budgets for irrigation, drainage, flood control and water supply are listed in the below table 1.5:

Table 1.5. Investment budget under management by MARD (2002-2007)

Unit: Billion VND

No.	Description	2002	2005	2007
1.	Irrigation, Drainage and Flood Control			
	Total budget	1022	2491	4310
	Annual budget	1022	1303	1948
	In-country	713	841	894
	Overseas	309	462	1054
	Government bond		1188	2362
2.	Water Supply			
	Total budget	948	1700	2268
	Central budget	215	300	439
	Provincial budget	648	782	712
	Others	0	0	217
	International supports	85	295	374
	Credit	0	323	526

The budget allocation is different from zone to zone. The Red river and Cuu Long river delta have high percentage of budget allocation as presented in the below table 1.6:

Table 1.6: Budget allocation percentages of various zones in Vietnam

No.	Zone name	Investment Allocation of the Zones		
		1986-1990	1991-1995	1996-2000
1	North Mountainous Zone	10.18	9.48	11.05
2	Red River Delta	23.07	16.98	31.08
3	North Central Zone	16.32	16.98	17.46
4	South Central Coastal Zone	17.30	21.34	8.46
5	Central Highland	3.80	9.92	2.67
6	South East Zone	9.69	8.42	9.00
7	Cuu Long River Delta	19.63	16.98	20.09

Under the The five-year Socio-Economic Development Plans (SEDP) to 2010, the GoV clearly expects the pace of economic reform to be maintained into the future. Under the sector Plans, the priorities for the period 2010-2020 show the following:

(i) **Navigation:** state funds are proposed for infrastructure, and enterprise's funds for means of transport. Projects are concentrated in the Red and Cuu Long deltas.

(ii) **Hydropower:** financing source is not an issue for hydropower development. The private sector is involved strongly in development projects and many are international. Vietnam is also funding some projects in Laos and Cambodia.

(iii) **Irrigation:** major investments are proposed for construction and maintenance of irrigations schemes, lakes and reservoir; however, the financial source appears very limited. Similarly, projects for flood protection and disaster mitigation (which constitute 8% of the total prioritised program from 2010 to 2020) do not appear to be well funded.

(iv) **Water supply and sanitation:** 86% of projected funds to 2010 are for urban water supply and sanitation, whereas only 14% of funds are for rural water supply and sanitation (75% of the population is in rural areas). By 2020 the funding ratio will be 67% and 30%. The sub-sector is also overburdened with loans.

In terms of the benefitting Government organisations, the striking conclusion is the lack of support for MONRE. This new Ministry with state responsibilities to implement IWRM, attracts less than 1% of the total direct support from the donor. Current international investments reflect a strong development focus with an emphasis on works and measures. This level of support under these projects may be quite appropriate. However, it is of concern that many areas of water sector management have very minor or zero investments. The lack of investment in IWRM area is apparent, in areas such as legal reform, policy and strategy development, data and information, river basin planning, tools such as licensing and pricing, protection of environmental assets, water quality management and mobilisation of communities

to get involved. These tools are essential if the water sector in Vietnam is to be indeed to operate on a sustainable basis. As well the coordination linkages between the international development partners and MONRE has stalled – ISGE is not operating as effectively as it could.

As in many countries, water and water services are currently well underpriced in Vietnam. As well the pricing policy is neither efficient nor equitable. In a backward step by the Government, irrigation fees have been removed. Where water supply is apparently plentiful, the current pricing policy results in inefficient use by those who have had access to cheap water, for instance in agriculture, and in households and industries. It has also led to a dearth of financial resources where the water sector has not been self-financing, but has lived from subsidies. Therefore, more investment in the water sector, be it from public or private sources, must go hand in hand with the recognition that water and discharge pricing is an essential instrument to enhance the sustainability of the resource, expand services, including operation and maintenance of water utilities and irrigation systems, and maintain water resources management functions, etc. Most improvements in the water related sectors will not occur if governments do not consider developing socially acceptable pricing and tariff policies. Moving forward on this issue must also recognise that in a number of situations, full cost recovery may not be achievable at all due to social considerations or because of previous inefficient decisions on capital infrastructure. There may be clear justification to provide water to some sections of the community at less than full cost, and this is perfectly legitimate and a function of water supply in most countries. However, such costs should be clearly agreed and disclosed as a transparent subsidy.

All international development partners were asked by the Project to complete a simple survey that identifies the focus of their current and future investments. The total value of all the projects is equivalent to about USD 1,740 million, of which 54% were for projects solely funded by individual donors. The support provided by the donors also covers a considerable time span. However, the vast majority of projects start from about 2006/07 and run to 2013. Around 62% of the international support consists entirely of loans. There are also many projects that were a combination of TA and loans (the loans component could be at around the 80% level). Direct budget support comprised 9% of the investments. MARD is nominated as the sole benefitting Ministry for 27% of investments, although many of these also specify benefitting provinces. If the specific purpose JBIC urban loans are excluded, then the MARD support is 47% of the remaining investment. MARD is also a partial beneficiary of another 9% of investments. MONRE is nominated as the sole benefitting Ministry for 0.3% of investments and is the partial beneficiary of another 4%. EVN receives 7% of investments (one loan project from the ADB) and MOC

6%. MOF/MPI is nominated as the benefitting Ministry for 4% of investments. The PPC of a City or provinces is nominated as the benefitting body for 10% of investments. 54 provinces were nominated as benefitting from the international investments. These projects are clearly related to either rural poverty and social improvement, or to urban improvements in larger cities.

Projects for the development of legislation and policy received 0.05% of the investments, projects for improving conditions of poor people received 15%, projects for the development and use of water resources received 73%, projects for environmental improvement received 8% and capacity development and community involvement received 4%. Within the projects for the development and use of water resources, there is zero investment in data and information, 0.08% in river basin plans, 64% in water development works and measures, 24% in urban works and measures, 12% in flood protection and zero in IWRM tools. 15% of all investments deal with social and living conditions for people, all of which covers rural infrastructure for the poor (NTP II). All of the investments for environmental improvement are for works to improve the environment (mostly urban). For institutional capacity development, nearly 90% of the investments are for GiV capacity development, with 11% for strengthening the involvement of water users.

7. Main existing Programmes and Projects related to water resources sector

International fund projects/programme

Overview of ODA project for Vietnam period 1993-2007

The Consultative Group Meeting for Vietnam conducted in Paris in November 1993 marked the complete resumption of the development cooperation relationship between Vietnam and international consultative group.

Over the past years, ODA mobilization is undertaken under the Party and the State's foreign diplomatic policy, that's "Vietnam is willing to be a solid partner in the international community, striking for peace, independence and development".

Up to present, 14 official Consultative Group Meetings for Vietnam (CG Meeting) were successfully held. This is an important annual forum where Government of Vietnam (GoV) and the international donor community in Vietnam can discuss the country's development process and ODA coordination supporting the progress. In addition, mid-term CG meetings were held annually in provinces, facilitating donors to understand provincial prioritized development needs and meet their aid beneficiaries. ODA mobilization has also been carried out through foreign diplomatic activities of senior leaders of the Party, the State, the National Assembly,

and the Government as well as ministries, sectors, provinces, political and social associations, and Vietnam's diplomatic representative agencies in other countries.

Some 51 donors including 28 bilateral and 23 multilateral are implementing regular ODA program in Vietnam, namely:

- Bilateral donors: Ireland, Britain, Austria, Poland, Belgium, Canada, Kuwait, Denmark, Germany, Netherlands, South Korea, Hungary, Italy, Luxembourg, the United States of America, Norway, Japan, New Zealand, Australia, Finland, France, the Czech Republic, Spain, Thailand, Sweden, Switzerland, China and Singapore.

- Multilateral donors:

- + International Financing Institutions and Funds : the World Bank Group (WB), the International Monetary Fund (IMF), the Asian Development Bank (ADB), the Nordic Investment Bank (NIB), the Nordic Development Fund (NDF), the OPEC Fund for International Development (OFID or OPEC formerly), and the Kuwait Fund.

- + International and inter-governmental organizations : the European Commission (EC), the United Nations High Commissioner for Refugees (UNHCR), the United Nations Fund for Population Activities (UNFPA), the United Nations Industrial Development Organization (UNIDO), the United Nations Development Programme (UNDP), the Joint United Nations Programme on HIV/AIDS (UNAIDS), the [United Nations Office on Drugs and Crime](#) (UNODC), the United Nations Capital Development Fund (UNCDF), the Global Environment Facility (GEF), the United Nations Children's Fund (UNICEF), the International Fund for Agricultural Development (IFAD), the United Nations Education, Science and Culture Organization (UNESCO), the International Labour Organization (ILO), the United Nations Food and Agriculture Organization (FAO), and the World Health Organization (WHO).

ODA commitment has been made with annual increasing level. In the period 1993 - 2007, total ODA commitment valued at some USD 42,438 million, much from many large donors such as Japan, WB, ADB UN agencies, France, Germany and so on. This implies the strong support from the international donor community to the Vietnam's doi moi process, socio-economic development and poverty reduction cause.

In 1993 - 2007, total ODA conclusion reached some USD 32,109 million, accounting for 75.66% of total ODA commitment; total ODA disbursement is USD 19,865 million or 61.86% of total ODA conclusion.

Table 1.7. ODA commitment, conclusion and disbursement in 1993-2007

Unit : million USD

Year	Commitment	Conclusion	Disbursement
1993	1,861	817	413
1994	1,959	2,598	725
1995	2,311	1,444	737
1993-1995	6,131	4,859	1,875
1996	2,431	1,602	900
1997	2,377	1,686	1
1998	2,192	2,444	1,242
1999	2,146	1,503	1,35
2000	2,4	1,768	1,65
1996-2000	11,546	9,003	6,142
2001	2,399	2,418	1,5
2002	2,462	1,805	1,528
2003	2,839	1,757	1,422
2004	3,441	2,568	1,65
2005	3,748	2,515	1,787
2001-2005	14,889	11,063	7,887
2006	4,457	2,824	1,785
2007	5,426	3,795	2,176
Total	42,438	32,109	19,865

In the period 1993 - 2007, ODA fund has made a significant contribution to development investment, accounting for some 11% of total social investment and some 17% of investment from the State budget.

a) ODA implementation structure by sector in the period 1993 – 2007 is described in Table 1.8.

Table 1.8. ODA implementation structure by sector in 1993 – 2007

Unit: million USD

Sector	Concluded ODA Agreement in 1993 - 2007	
	Total	Percentage
1. Agriculture and rural development in combination with poverty reduction	5,130.73	15.9
2. Energy and industry	7,376.28	22.97
3. Transportation, post and telecommunication, water supply and drainage, and urban development, of which:	11,286.64	35.15
- <i>Transportation, post and telecommunication</i>	8,222.99	25.61
- <i>Water supply and drainage, urban development</i>	3,063.65	9.54
4. Health, education and training, environment, science and technology, and others	8,315.6	25.9
Total	32,109.25	100

In the *Agriculture and Rural Development* sector, ODA has been considerably used for upgrading irrigation system, rural power network, schools, health stations, rural transport, domestic water supply, small-scale rural credits, and integrated rural development in combination with poverty reduction.

The *Power Energy* sector has been using ODA to increase the power source capacity, develop and extend power distribution network including in rural areas. Some ODA-financed *industrial* production plants have created jobs in some provinces.

In the *Transportation, Post and Telecommunication* sector, ODA has been used for improving the technical infrastructure and service quality. The transport systems of road, railways, internal waterways, sea ports and airlines as well as post and telecommunication infrastructure have been developed remarkably.

ODA has contributed to development of the *Education and Training* sector including the infrastructure improvement for schooling in all levels (primary, secondary and higher education as well as university, college and vocational training); reform of textbooks and curricular for universal education; improvement of teachers' ability level; facilitation of teachers and students' overseas study overseas; sector policies and management capacity building.

In the *Health* sector, ODA has been used in infrastructure development for medical test and treatment, family planning, HIV/AIDS and communicable disease prevention, health worker training, sector policies and management capacity building.

ODA also has been invested in *environmental* protection and improvement such as afforestation, water resource administration, water supply and drainage, wastewater and waste treatment in many towns, cities, industrial zones and residential areas.

b) ODA implementation structure by region in the period 1993 – 2007 is showed in Table 1.9.

Table 1.9. ODA implementation structure by region in 1993 – 2007

Unit: million USD

Region	Concluded ODA Agreement in 1993 - 2007	
	Total	Percentage
1. Red River Delta	3,500.83	13.69%
2. Northern mountainous region	2,063.78	8.07%
3. Northern central region & Central coastal region	3,278.19	12.82%
4. Central Highlands	1,132.39	4.43%
5. Southeast region	3,995.60	15.62%
6. Mekong River Delta	2,394.67	9.36%
7. Inter-regions	9,211.33	36.01%
Total	25,576.79	100%

Average ODA value per capital is USD 33.98 in the northern mountainous area, USD 18.42 in the Red River Delta, USD 52.46 in the northern central and central coastal area, USD 21.86 in the Central Highlands, USD 25.4 in the Southeast area and USD 11.19 in the Mekong River Delta.

c) ODA has been used for institutional development, human resource capacity building, advanced scientific and technological transfer, and modern management experience sharing. ODA-funded projects have supported Vietnamese agencies in both finance and knowledge to prepare some important laws such as Business Law, Land Law, Trade Law, Investment Law, Procurement Law, Competition Law, Anti-Corruption Law, Environmental Protection Law, Water Resources Law and many other related documents. A large amount of people have been financially supported

by ODA to study in domestic and overseas, contributing to improving human resources at all levels.

d) ODA has contributed to the socio-economic development and poverty reduction process in many provinces including small-scale infrastructure improvement (water supply, transportation, schools, health stations, power distribution network, and rural telephone system), and agricultural, forest, irrigation and aquacultural development, especially in the poor, remote and ethnic areas.

Water projects related to food and ecosystem

In term of water for food and ecosystem, there are a lot of international support projects to assist the Government of Vietnam to ensure National food security and sustainable environment.

In agriculture sector, funded projects and programme are focusing on the function and mandate of the MARD on water for agriculture, forestry, fishery, livestock, natural conservation zone, rural water supply and sanitation..etc.

For Irrigation project: There are a number of projects such as Red River Basin Water Sector Project (ADB-3), Vietnam Water Resources Assistance Project (VIRAP), Central Water Resources Assistance Project (ADB-4), these projects will support the Government of Vietnam to improve agricultural performance and incomes of poorer communities through sustainable improvements in irrigation, drainage, flood protection and watershed management within an IWRM framework, and promote stakeholder participation in IWRM at provincial and local levels with emphasis on women's participation.

For fishery project: There are a number of projects support for fishery, particularly the Fishery Sector Programme Support II supported by Danida, the beneficiaries of the projects are the poor and fisherymen through sustainable development of the fishery sub sector. The project consists of 4 components which are STOFI, SCARFI, SUDA and POSMA....

Rural water supply and sanitation projects and programme: There are two funding approaches for rural water supply and sanitation, project and programme supports. The Project support are projects such as the Red River Delta water supply and sanitation project supported by WB, Central Highland rural water supply and sanitation projects supported by JICA, Cuu Long Delta rural water supply and sanitation projects supported by AusAID etc. These projects will provide fund for construction of rural water supply (piped scheme and household tank) and sanitation (household latrine, biogas) for people in the project areas. The programme support is the support from three donor, Danida, AusAID, RNE, in which the fund is

contributed under the budget support methods where the fund will transfer directly to the Ministry of Finance and it will be considered as the Government fund, the programmes is more targeted to the poor and ethnic minority groups.

In environmental and ecosystem sector: MARD is the State Management for Natural Conservation areas such as Ba Vi, Tam Dao, Cuc Phuong, Bach Ma, Cat Tien and YokDon, and this task is assigned to the Department of Forest Protection Department. However, the main duty of this task is to protect wild life and in danger animals and forest protection. However, the environmental and ecosystem is combined in some water resources and environmental protection projects carried out by both Ministries, MARD and MoNRE.

Projects and programm supported by the Government

In recent years, the Government has paid close attention to investment in water resources, specially for rehabilitate and upgrade existing irrigation and hydraulic works in order to ensure agriculture production and povertry reduction. The investment amount is increasing year by year. In 2000, the investment in water resources development increased by 2.5 times in comparison with that of 1996.

Over the 1996 – 2000 period water sector investment increased from VND 15.2 billion to VND 24.294 billion, and encreased to 25.511 billion VND over the period from 2000-2005. However, this level of investment is still not able to meet the demand. The private capital invested in water resources is very small. Cost sharing between Government and water users is mainly applied for small-scale works such as lining canals and farm-ditches. Capital provided by MARD is often invested in the head works and main channels, the localities invest in the lower-level channels. However, because of the shortage of investment capital in many localities, works may not be fully completed and the effectiveness of the investment may be low. In parrallel with the investment for irrigation and water resources, the environment protection is also received a lot of attention from the Government.

Conclusion

Projects and programs related to water resources have been implemented focusing mainly on specific sectoral issues and there have not been many projects addressing the integrated water resources management. In addition, most of projects have been supported technically and financially by foreign countries. These projects have been mostly led and coordinated by foreign experts and Vietnamese experts have participated mainly as assistant resources. In the near future, capacity of Vietnamese experts and staffs on water resources needs to be enhanced in the way that they can assume and implement most projects on water resources and foreign experts will play as consultants.

CHAPTER II: WATER FOR FOOD AND ECOSYSTEM IN VIETNAM

I. Status of agriculture infrastructure and ecosystem in Vietnam

1. National Hydraulic works status

Vietnam has 75 big irrigation and drainage systems including 1967 reservoirs (over 0.2 million m³ each) with total capacity is of 24.8 billion cubic m³ in which 10 biggest reservoirs with total capacity is of 19 billion m³ are mainly for power generation and the rest are mainly for irrigation in the area of 50,000 ha, more than 5000 irrigation and drainage sluices, more than 10,000 big and medium pumping stations with total capacity is of 24,8 million m³ per hour, 5,700 km of river dykes and 2,000 km of sea dykes.

Up to now, the hydraulic work systems have effectively contributed for the agriculture development, especially for food production as well as natural disaster mitigation such as flood control, drought and inundation prevention. Total capacity of the systems is increasing timely and now the system could ensure directly irrigation for the area of 3.45 million ha, provide water sources for 1.13 million ha, drainage for the area of 1.4 million ha, saline intrusion prevention for the area of 0.87 million ha and sulfate soil reclamation for the area of 1.6 million ha. The irrigated area of paddy, vegetable and short-time industrial crop are increasing.

In 2003 the hydraulic work system had irrigation for 7.61 million ha of paddy (2.8 million ha of Winter paddy, 2.25 million ha of Summer and 2.51 million ha of wet-rainy paddy), more than 1 million ha of cash crop and industrial crop, drainage for 1.71 million ha of cultivated area, supply more than 5 billion m³ water for domestic and industrial use, provide water sources for fishery and tourist development. The services provided by the system have significant contribution for reduce poverty in remote and mountainous areas, crop pattern, environment and transportation.

A series of big hydraulic work systems has been upgraded, repaired and maintained to improve the integrated exploitation, specially the system that located in the projects supported by WB and ADB such as WB 1,2,3,4 and ADB 3 and 4.

As lot of main and onfarm canals has been concreted through the canal consolidation program supported by the central government budget. The small and medium system are upgraded, repaired and maintained by the provincial budget together with farmer contribution.

The government has approved the dam safety program. The objectives of the program are to ensure the safety of the dam, restore and strengthen capacity of reservoir to ensure water for production.

2. Ecosystem status

2.1. Aquatic Biodiversity

Vietnam's freshwater and marine biodiversity is relatively high but threatened by domestic and industrial water pollution, dam and road construction, dredging, destructive

fisheries techniques, aquaculture and over-fishing.

2.2. Inland ecosystem

Fig 1.1 Fish Species Distribution in Vietnam The freshwaters of Vietnam are tropically rich in flora and fauna biodiversity including species of fish, shrimp, crab, snail, mussels, amphibians, insects and plants. In different fresh water systems, there are about totally 20 species of freshwater weeds; 1402 species of algae; 782 of invertebrates; 544 of fish species and 52 species of crabs. In which, many species are in danger of extinction or becoming rare. Listed in the Red Book 2002 (forthcoming) are 6 wetland waterfowl birds, 24 reptiles, 14 amphibian, 37 fish, 19 mollusk and 1 insect freshwater species.

2.3. Coastal and marine ecosystem

The very diverse ecosystems distribute along the coastline . Among these the most important are wetlands, coral reefs, and sea grass. Within the project scope, coral reefs, and sea grass are not to be considered.

a. Wetlands

Vietnam is rich in freshwater and marine wetlands. These are mainly distributed in the Red River and the Mekong River Deltas and along the 3,260 km coastline. The Directory

of Asian Wetlands lists over 25 wetland sites in Vietnam that meet the criteria of wetlands of International Importance.. Despite this the only designated such site under the Ramsar Convention is the Xuan Thuy National Park, a 12,000 ha mangrove on the mouth of the Red River in Nam Dinh Province. However, there are plans for additional Ramsar sites, including the Tram Chim National Park in Dong Thap Province in the Mekong River Delta. Can Gio mangrove forest as Vietnam's first protected area was designated as Man and Biosphere Reserve by UNESCO (2000).

b. Mangroves

Over the last 50 years of development, Vietnam has lost more than 80% of Fig 1.2 Mangrove change in Vietnam mangrove forest. The surge in shrimp farming emerges as one of the leading causes of mangrove forest destruction. Other causes for mangrove losses include conversion to agricultural and construction lands, war destruction, fuel wood collection.

Over the last three decades from 1960 to 1995, Quang Ninh and Hai Phong has seen the disappearance of close to 40,000 hectares of mangrove forest. Only 15,700 hectares remain in the two provinces.

Estimated data compiled from various sources for 1999 and 2001 indicates some increase in mangrove areas Table 1.1 Major coastal and marine ecosystem

c. Biodiversity regions

According to Vietnam Environment Monitor 2005 Biodiversity, there are ten of Terrestrial biodiversity Regions and nine of Coastal and Marine Biodiversity Regions. Those are as followed:

2.4 Terrestrial biodiversity Regions

1. Northeast. The region has many ecosystems ranging from limestone mountains to low hills and a narrow coastal plain. It includes many picturesque sites of important heritage value: the Ha Long Bay area, Cat Ba Island, and the Ba Ba Lake area. The fauna and flora of the region are very rich, with a number of rare endemic species such as musk deer (*Moschus caobanghensis*) and snub-nose monkey (*Trachypithecus avunculus*). Forest cover was once around 50 percent but has been seriously depleted due to shifting agriculture and illegal logging.

2. Hoang Lien Son Range. Vietnam's most important mountain range with the country's highest peak, Phansipan. This region has diverse biological resources, particularly medicinal plants of value.

3. Red River Delta. One of the two largest river deltas in Vietnam. The region possesses a typical wetland ecosystem, including Xuan Thuy, the first Ramsar site of Vietnam.

4. Northwest. Although not extensive, the forests of this region represent well-defined ecosystems at different altitudes. Biodiversity per unit area may be low, but there are about 38 rare animal species and several important plant species such as ginseng and *Fokienia hodginsii*.

5. North Central (Bac Trung Bo). A typical feature of the region is the long but narrow band between the Truong Son Range and the sea. Rich forest still covers a long strip of the Truong Son Range, near the Lao border. The varied relief explains the rich biodiversity of the region with a number of endemic and endangered species, such as the blue pheasant with white tail (*Lophura hatinhensis*) and the Hatinh monkey (*Trachypithecus francoisi hatinhensis*). Over the past five years, two new mammal species, saola (*Pseudoryx nghetinhensis*) and the large muntjac (*Megamuntiacus vuquangensis*), have been discovered in this region.

6. Central (Trung Trung Bo). The region has transitional features between the limestone mountains of the North and "earth" mountains of the South. This creates an area with unusual biodiversity characteristics including endemic species and the Truong Son muntjac, a newly discovered mammal species.

7. South Central (Nam Trung Bo). This region has coastal characteristics, and is not of high biodiversity value.

8. Tay Nguyen Plateau. This region lies at the Indochinese junction between Vietnam, Lao, and Cambodia. The region has great biodiversity wealth, including many large mammals such as elephants, tigers, panthers, wild buffalo, and kouprey. The region is also home to rare plant species; for example, ginseng, Ngoc Linh, and the Dipterocarpaceae.

9. Nam Bo Plain. It is a transitional region between the high plateau of Tay Nguyen and the plain of Nam Bo. There are many rare tree species in this region. However, its biological resources have been depleted due to the development of hydroelectric dams and of rubber and cacao plantations.

10. Mekong Delta. This is the largest river delta in the country. The region possesses a diversity of mangrove and paper bark wetland ecosystems that provide habitat for the eastern sarus crane (*Grus antigone*).

2.5. Coastal and Marine Biodiversity Regions

Less is known about marine systems, so only basic information is provided on distinguishing characteristics.

1. Mong Cai to Do Son: The dominant dynamic is tidal; the seashore is estuarine and the sediment is mud.

2. Do Son to Lach Truong River Mouth. Riverine flows; the seashore is a deltaic river mouth and the sediment is sand-mud.

3. Lach Truong River Mouth to Mui Ron Cape. Riverine flows and wave action; the seashore is sandy plain and the sediment is sand.

4. Mui Ron Cape to Hai Van Cape. Seashore currents and waves; the seashore consists of sand dunes and behind these formations are lagoons.

5. Hai Van Cape to Dai Lanh Cape. The land-sea interaction is relatively balanced. The seashore consists of capes, small deltas, small lagoons, and bays. The land area is affected by subtropical climatic influences.

6. Dai Lanh Cape to Vung Tau Cape. The land-sea interaction is relatively balanced. The seashore consists of capes, small deltas, small lagoons, and bays.

7. Vung Tau Cape to Ca Mau Cape. River flows. The seashore is a delta with mangrove forests. The sediment is sand and mud.

8. From Ca Mau Cape to Ha Tien (West Nam Bo). Southwesterly waves. The seashore is a delta with mangrove forests and the sediment is sand and mud.

9. Parasells and Spratlys Archipelago. Almost all islands are coralline.

2.6 Nature Reserves

Up to December 2005, 126 approved special-use forests (SUFs) approved by the Government and Provincial People Committee, comprising 59 nature reserves included nature reserves and species/habitat protected area) and 39 landscape-protected areas, with a total area of 2,541,675 ha. Not all of the sites are under conservation management on the ground.

Nevertheless, the number of SUFs with established management boards is increasing and has more than doubled over the last decade, from 50 in 1995 to 106 in 2004. (Source: Birdlife International, 2005. Sourcebook of existing and proposed protected areas in Vietnam)

2.7. National environmental assets related water resources

Environmental assets included national parts, nature reserves, species/habitat protected areas, Landscape protected area /Cultural & historical sites...Nature reserves and wetlands make significant environmental benefit and economic contribution to water resources Management, such as: Watershed of nature reserves make significant contribution to provision of flows during dry seasons, climate and moisture regulation by evapotranspiration; prevention of soil erosion by reduction of velocity of precipitation, increased percolation, and maintenance of soil moisture; protection& improvement of water quality for downstream processes including domestic consumption Wetland and flood plains as Tram Chim National Part provides sources of commercial species, wastewater treatment and eutrophication removal Estuaries as Xuan Thuy Nature Reserve and Ramsar Site make coastal protection against typhoons, storms and tidal surges; flushing, and sediment replacement

Otherwise, water supply and quality make important contribution to nature reserve & wetland.s protection and development, especially to those in estuaries and flood plain. Table ... describers important nature reserves, national parts, wetlands that depend on water quality and supply.

Conclusions

There are 8 main agro-ecological zones in Vietnam. The distribution of water resources, the topography of land and soil are the main factors which decide ecological zones in the country, such as: fresh water ecological zones, brackish water ecological zones, salt water ecological zones, alum water ecological zones. The research on ecological zones is very important and necessary affecting the management of these zones in the way promoting most effective food production as well as sustainable ecosystems integrity .

II. Status of water utilization for food production and ecosystem

1. Water for agriculture production

Water use for agriculture is quintessential Viet Nam. At the national level, water has been an essential component to the rural social and economic development that has lifted millions out of poverty and propelled the country well on its way to achieving middle income status. The *doi moi* reforms in the mid-eighties transformed agriculture, setting the seeds for rapid economic and industrial development. From 1989 to 1991, Viet Nam transformed from a net rice importer to one of the world's

largest rice exporters. Growth in agriculture allowed Viet Nam a means to earn badly needed foreign exchange. Rising farm incomes provided the initial financial resources to start the domestic economy growing. Today, irrigated agriculture provides the bulk of Viet Nam's employment and is by far the largest user of water. Increased specialisation within the agriculture sector is continuing to help to stimulate labour demand and is leading to increased production, drastically improving food and economic security. Viet Nam's agriculture sector has grown and diversified achieving major exporter status for crops such as coffee and pepper.

Water is used for agricultural production the most in Mekong River Delta with 29 billion m³, next to the Red River Delta is 17 billion m³, accounting for 82% - 83% of the total quantity of water used. The rivers that have lower rates of water for agricultural use are in Gianh, Thach Han, Dong Nai river basins and rates of water for agricultural use of the rivers in Southeast are only 57.5% - 79.0% with quantity of 0.01 - 4.8 billion m³.

Agriculture is the largest user of water in Viet Nam and this is likely to remain the case. While the agricultural sector will decline in its contribution to national GDP, it is projected to continue to grow at a modest rate and provide a significant source of employment. Water resources have been extensively developed to support the growth of agriculture. As at 2006, there were about 100 large and medium scale hydraulic works systems in Viet Nam. The total investment in these systems is estimated to be VND 125 trillion. Breaking this down, there are well over 8,000 irrigation systems involving close to 750 medium- and large-scale reservoirs, over 1,000 weirs, almost 5,000 irrigation and drainage gates of medium and large scale, and nearly 2,000 large pumping stations¹.

Irrigation withdrawals exceed 63,000 million m³ per year, being over 80% of the total estimated water use in Viet Nam. The total irrigated area was 8.34 million ha in 2007 out of a cultivated area of 9.7 million hectares. Paddy field rice was the dominant crop, accounting for 82% of the total irrigated area in that year – 42% spring paddy, 30 % summer paddy and 27% winter paddy. Of this irrigated area, 44% of the spring paddy was grown in IMCs, 38% of the summer paddy and 53 % of the winter paddy. The remaining area was in local districts. Non-perennial crops accounted for 95% of the remaining 11%; and the rest were areas of irrigated perennial industrial and fruit trees.

The relatively strong growth in irrigated rice area that has occurred over the past 14 years has resulted largely from a process of intensification. There has been little investment in new irrigation capacity or in rehabilitation of facilities. Growth has taken place largely within the bounds of the existing irrigation facilities through

expansion of the areas producing spring and autumn crops occurring predominately in the Mekong delta region.’ Biltonen et al found that the designed irrigation service areas total about 3 million hectares. However, on average, only 68 percent of this total area represents actual irrigation-service areas.

2. Water for Fishery and aquaculture

The fisheries sector in Viet Nam has been growing considerably, strongly promoted by the government for hunger and poverty reduction. The sector provides about half of the supply of animal protein to the human diet. Total earnings make it the third most important export-oriented sector. More than three million people are directly employed and nearly 10% of the population derive its main income from fisheries.

Most river basins are developing aquaculture, however, Tra Khuc river basins (shrimp raising) and river group in the Southeast are typical with all kinds of fishes in fresh, salty and brackish water. Water used for aquaculture is only charged for making sanitation of fish pond, maintaining salty degree and not for all the needs of the brackish regions. The regions have the high rates of aquacultural water use are the Mekong River Delta, Red River - Thai Binh basin, the Southeast, Dong Nai and Ma river basins with the total volume of water used: 5.8 billion m³, 0.7 billion m³, 0.63 billion m³, 0.4 billion m³ corresponding rate of 67%, 8.3%, 7.2%, 4.7% and 4.6% respectively.

Inshore fisheries are now over-exploited and there is great pressure on these resources. Inland fisheries provide an important source of aquatic products for nutrition and seasonal income. Aquaculture has grown significantly in recent years, averaging over 12% annual growth since 1990, contributing more than 40% of total fishery production with a value in 2003 of 15,400 billion VND. In terms of aquaculture production, the freshwater subsector remains dominant at approximately 65-70%. Brackish water aquaculture – mainly shrimp - contributes more than 40%.

The household remains dominant for both capture fishing and aquaculture, and in 2001 these represented the main business of 4.3% of households and the primary employment of 5.1% of the national labor force. Levels were highest in South Central Coast and the Mekong Delta. Most fishers and those involved in aquaculture are small-scale producers – 77% of households conducting aquaculture have under 0.1 ha of pond area and another 7% between 0.1 ha to 0.2 ha. More recently some cooperatives have been established. The biggest source of fishing and aquaculture income is generated within the Mekong Delta, where between 60% and 70% of households are involved in some form of aquaculture, involving employment for over 600,000 workers. Shrimp aquaculture accounts for more than half of this.

The value of production of aquaculture in river basins varies considerably – from 15,300 VND/m³ of water used in the Kone basin and 12,400 VND/m³ in the

Gianh, to a low of 3,800 VND/m³ of water used in the Cuu Long. In terms of returns per areas of aquaculture, the Tra Khuc has the highest value at 198 million VND/ha and the Cuu Long (93 million VND/ ha).

By the end of 2005, there were 439 enterprises for aquatic product processing, more than double the 2000 number, and there were 320 enterprises for frozen food products. In 2005, the total export turn-over was US\$2.65 billion. A feature of this growth has been the increase in the number of large modern and privately owned facilities. Of some registered processing plants, about 80% are in the south, 12% in the central region, and 8% in the north.

The emergence of food safety requirements as barriers to accessing international markets has significantly shaped the industry structure. The United States and the European Union rules are increasingly strict and producers have to quickly adapt.

The targets for fisheries and aquaculture show that significantly greater export income (50% increase) is expected to be generated from only a small increase in total fisheries exploitation, in line with the focus on efficiency and effectiveness of the sector. The area under aquaculture is expected to almost double over the five years to 2010, which is expected to generate about a 50% increase in production.

The Fisheries Law (2003) (FL) covers the use and preservation of fishery resources, as well as businesses operating in the sector. An integrated planning approach to aquaculture is required, with local planning consistent with aquaculture planning nationwide.

Environmental protection is to be strictly regulated. In a bid to protect and develop the fisheries resources, the government has introduced a financial fund for the enhancement of the resources including a 'Fund for Rehabilitation of Fisheries Resources'.

Management of all fisheries activities lies with MARD, which is responsible for defining total allowable catch and fishing capacity; protection measures relating to the marine environment and aquatic living resources; zoning, monitoring and research; and managing fishing permits. It has 11 Departments and a system of institutes, and stateowned enterprises specialising in both fishing and aquaculture. Staff numbers are about 222 (excluding institutes) with an current annual operating budget in 2005 of almost 9 billion VND.

The Department of Science and Technology is responsible for national scale aquatic products factories, and the National Department of Aquatic Resources and Exploitation and Protection for managing the natural environment (marine and inland natural conservation areas).

The National Fisheries Quality Assurance and Veterinary Directorate was established in response to the EU/US health standards and is the national authority for

fisheries food safety assurance and quality control. An environmental monitoring and disease early warning system for the fisheries sector is operating.

In coastal provinces, local fisheries administration authorities are the Provincial Fisheries Departments. In inland provinces, the fisheries administration units are included in the Provincial DARDs.

The number of State Fishery Enterprises (SFEs) in the sector has decreased steadily. In 2002, there were 41, three as large state-owned general corporations, managed centrally by MARD; and the rest managed by PPCs. There are three public sector aquaculture enterprises. Most coastal provinces own one or more state enterprises in the fisheries sector. SFEs are characterised as having low efficiency and are often unprofitable.

Establishing systems that meet international food hygiene standards is capital intensive and has been limited to the State Owned Enterprises (SOEs).

While there are many water related threats arising from activities within the fisheries sub-sector, it is aquaculture and the fisheries processing industries that contribute to significant water source degradation through water use and pollution. Major fisheries and aquaculture issues are as follows:

(i) Water quality and pollution from fisheries processing: Wastewater from aquatic processing factories is one of the greatest environmental problems in food processing.

(ii) Water quality and pollution from aquaculture can be severe - the levels of BOD, coliform, total N, total P and H₂S in some areas near aquaculture zones are higher than the national standard from between two to twenty times. However, the most common production in Viet Nam is family sized and sparse.

(iii) Water quality can threaten aquaculture. Poor water quality in source water, or a sudden change of water quality, can cause major loss of aquaculture animals.

(iv) Loss of mangrove forests. Aquaculture development has decreased the mangrove forest area, which is a precious ecosystem for various sea and aquatic species, as well as playing a vital role in estuary processes. In 1943, Viet Nam had the second largest mangrove forest in the world, behind the Amazon River. By 2001 only 150,000 ha of mangrove forest remained.

(v) Performance of the State Fisheries Enterprises is a major issue for the sector – they are inefficient operators providing relatively small return for their investment. As well, they have very poor environmental performance, particularly for wastewater management. Equitisation has been slow and most equitised enterprises are small.

(vi) Institutional issues are also significant. There is somewhat of a conflict in terms of the natural resources issues as both fish exploitation and conservation are

both functions of one organisation. A further issue is the relationship with MONRE which is the independent regulator for environmental protection and natural resource use.

(vii) Information, research and capacity building: The subjects of environment management and conservation of fisheries resources is not well understood. Vocational training is a major limitation, a factor contributing to the lack of skilled local level workers and poor quality of services to the aquaculture sector.

3. Water for Industry

Viet Nam is experiencing a fundamental structural shift away from agricultural, forestry, and fisheries towards industry. In 1986, industrial activities accounted for 26% of national GDP. This increased to over 41% in 2006, and is expected to reach 45% by 2010.

Industrial activities are being increasingly concentrated in two major regions. In the Red – Thai Binh and the SREC (Ba Ria - Vung Tau) and Dong Nai basins in 2006, there were 23,500 industrial enterprises in the main industrial cities (HCM, Hanoi, Dong Nai, Ba Ria – Vung Tau, Binh Duong, Hai Phong, Vinh Phuc, Khanh Hoa) accounting for almost 80% of national industrial GDP (1994 prices), but only 13.8% of the total number of enterprises. The Cuu Long provides a further 9% of output and the remaining basins provide about 7% between them. The Central river basins provide a very small contribution to industrial GDP - Sre Pok was only 0.13%, Sesan is 0.12% and Thach Han only 0.12%. The Sre Pok, Sesan and Thach Han have no real opportunities to increase. Industrial developments have grown rapidly over recent years in all river basins. Most basins are experiencing a yearly growth rate of between 15% and 21%. The exceptions are the Cuu Long with a growth rate of just over 9% and the Sre Pok at just over 6%.

Table 2.1. List of main manufacturing activities and GDP contribution
(current prices)

Manufacturing		Number of enterprises	GDP (billion d) 2004	GDP (billion d) 2005	% of enterprises
Manufacturing: 92% of total		21,196	657,114.7	824,718.3	100%
1	<i>Manufacture of food products and beverages</i>	4,484	156,096.5	204,027.8	25%
2	Manufacture of textiles, wearing apparel	2,476	62,277.1	79,070.4	10%
3	Manufacture chemicals, chemical products	901	43,855.3	55,301.9	7%
4	Manufacture of non-metallic mineral products	1,633	46,203.2	54,216.5	7%
5	Metal products except machinery equipment	324	35,039.3	46,013.2	6%
6	Repairing of other transport equipment	475	38,596.6	44,313.9	5%
7	Tanning leather; leather products, bags	2,075	33,480.1	42,423.7	5%
8	Manufacture of furniture	1,488	30,356.7	40,519.9	5%
9	Manufacture of rubber and plastic products	1,164	32,426.9	38,952.0	5%
10	Manufacture of basic metal	2,126	31,010.4	37,303.1	5%
11	Electrical machinery and apparatus	371	24,154.8	33,208.7	4%
12	Assembling and repairing motor vehicles	311	26,911.2	28,501.8	3%
13	Radio communication equipment & apparatus	1,073	17,652.5	20,385.8	2%
14	Manufacture of wood and wood products	1,478	14,786.8	19,539.3	2%
15	Manufacture of paper and paper products	817	15,201.6	18,574.1	2%
Other					8%

Water use in industry is not measured or recorded, except perhaps by the industrial plant itself for its own production records. Due to this lack of information, water use for industrial activities is calculated based on the norms of the water required for producing each unit of industrial output. The norm of water supply for industrial activity is about 40-45 m³/ha/day up to 70m³/ha/day (JICA, 2002) and depends on the type of industry involved. Where there is insufficient information for this, assessment have been made based on the land for industry and the average of water use for each area of industrial sector, varied for each river basin. Based on these assessments, the total water use for industry is estimated at around 3,770 million m³ a year, with nearly half of that use in the Red – Thai Binh basin. 25% of industrial water use occurs in the Dong Nai, 7% in the SERC and 10% in the Cuu Long.

By 2015, industrial water use will be more than double the 2006 volume. The greatest increase is projected to occur in basins where there is already a significant industrial base – the Red R, the Dong Nai, SERC, Cuu Long, and Thu Bon & Vu Ga. Significant growth in water use is also projected for the Ba R basin and for “other” rivers or groundwater.

It is estimated that the use underground water for industry is still popular in Vietnam - 57% of enterprises in HCMC use groundwater. According to HCM

DoNRE², each day the city used 2.5 million m³/day of underground water when the safe level of exploitation is only 800,000 m³/day.

Table 2.2. Water use for industry per river basin (Million m³)

	Current	2015
Bang Giang – Ky Cung	17	30
Red - Thai Binh	1849	3810
Ca	77	150
Ca	15	40
Gianh	12	30
Thach Han	12	30
Huong	19	40
Thu Bon & Vu Gia	114	280
Tra Khuc	6	10
Kone	4	100
Ba	12	300
Dong Nai	924	1960
SERC	270	370
Se San	14	30
Sre Pok	15	40
Cuu Long	377	660
Other	30	600
TOTAL	3,767	8,480

4. Water for domestic use

The rivers that have the high rates of water for domestic use in turn are Red River, Dong Nai River, the Mekong River Delta, rivers in the Southeast and Ca River with the rates of 36.65%, 22%, 17.7%, 5% and 4.2% and total volume of 0.85 billion m³, 0.52 billion m³, 0.4 billion m³, 0.12 billion m³ and 0.1 billion m³ respectively. These rates are also similar to high-density residential area as Ho Chi Minh, Hanoi, Nha Trang and Vinh City.

Urban water supply: Many urban areas are exploiting and using groundwater sources for domestic and industrial uses. Cities and towns exploiting their unique groundwater source are: Ha Noi, Bac Ninh, Vinh Phuc, Ha Dong, Son Tay, Hung Yen, Tuyen Quang, Quang Ngai, Quy Nhon, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau. All of other urban areas use simultaneously surface water associated with groundwater. According to the statistical data, at present, quantity of groundwater exploited to serve urban areas accounts for approximately 30 - 31% of total quantity of water supply for urban areas (about 1.1 million m³/day). Most of urban areas using groundwater sources have exploiting capacities from small level at 5,000 – 15,000 m³/day to average level at 20,000 – 40,000 m³/day. Only total exploiting capacities of

Hanoi and Ho Chi Minh City are bigger than other. Total capacity of all water supply factories with groundwater source in Hanoi is 560,000 m³/day. In Ho Chi Minh City, it is 150,000 m³/day.

Rural water supply: Approximately 62% of urban people can get clean water supply. The expected national target of 120 - 130 L/person/day was not reached in 2005. To achieve this target, we need 4 billion m³/day with cost of around 4 billion USD. The areas with lowest rates of urban water supply under 55% are Gianh, Tra Khuc, Se San river basins. According to evaluation of the Ministry of Agriculture and Rural Development, the rate of rural water supply is 62%. However, if basing on the standards of clean water promulgated by the Ministry of Health, the average level only reaches 24 - 32%. While analyzing data, the most attentive problem is that percentage of clean water supply to the districts is too low, at only 10-24%, the highest in the Ma river basin is 24%, the lowest in Bang Giang - Ky Cung river basin is 10%. Scale of water supply for a town may be too small for Ministry of Construction to pay attention and too large for the Ministry of Agriculture and Rural Development to consider. This situation should be improved in the Strategy of Water Supply and Environmental Sanitation.

5. Water for Hydroelectricity Generation

Electricity sector has strong economic growth, rate of demand growth on average in period 1995 - 2005 is 11.4%. The current demand growth is 15% and it is possible to be increased rapidly in the near future and with up to 50% electricity demand in the Southern provinces. Hydroelectricity contributes about 42% of total nationwide electricity output of 26,177 MW, of which 25% is thermal power, 28% is gas power. The total capacity of hydroelectricity (up to 2010) is 10,255 MW, of which 11% from China and Laos. Hydroelectric power concentrated in the Red River, Dong Nai River (26% and 23%). In the future, all forms of pumped storage hydropower and nuclear power will be added. The pumped storage hydropower projects will be built in the river basins of Southeast. It is forecasted that total capacity of electricity in 2025 will be 181,754MW including 18% from hydropower, 67% from thermal power, 8% from gas power, 6% from nuclear power, 1% from diesel. The expected total capacity of hydropower in 2025 is 33,310MW, of which 83% is from sources of Vietnamese hydropower, 17% is imported from China, Cambodia and Laos.

6. Water for Waterway Transport

Total value of waterway transport in 2004 is 7,730 billion. The largest proportion is contributed by Dong Nai River with 43%, smaller ones are contributed by Red River with 32%, Mekong River with 17%, etc. The highest price of waterway transport also belongs to Dong Nai River with 1,076 VND/km, then Red River with 728 VND/km,

Mekong River with 725 VND/km. The remaining rivers have small value of waterway transport. The rivers in the Central and Central Highlands have not been exploited for waterway transport so far.

Table 2.3: Structure of water uses by sector (billion m³)

Structure of water uses (billion m ³ /year)																	
	Bang Giang - Ky Cung	Red River - Thai Binh River	Ma	Ca	Gianh	Thach Han	Huong	Vu Gia - Thu Bon	Tra Khuc	Kon	Ba	Dong Nai	Southeast River Group	Se San	Sre Pok	Mekong River	Total
Irrigation	0.274	17.245	4.280	1.701	0.061	0.095	1.292	1.278	0.743	0.907	1.636	4.775	1.420	0.183	0.764	29.120	65.77
Industry	0.000	1.849	0.077	0.022	0.001	0.000	0.105	0.141	0.070	0.009	0.006	0.335	0.300	0.016	0.015	0.008	2.95
Domestic water	0.011	0.854	0.081	0.099	0.008	0.007	0.060	0.052	0.010	0.024	0.033	0.516	0.116	0.009	0.040	0.413	2.33
Aquaculture	0.025	0.729	0.404	0.289	0.010	0.019	0.101	0.122	0.030	0.021	0.027	0.411	0.634	0.012	0.062	5.869	8.76
Total	0.311	20.677	4.842	2.111	0.080	0.120	1.559	1.593	0.852	0.961	1.702	6.037	2.469	0.220	0.881	35.410	79.83
Proportion of water use by river basin (%)																	
Irrigation	88.32	83.40	88.39	80.58	76.45	78.52	82.90	80.23	87.12	94.38	96.12	79.10	57.50	83.18	86.72	82.24	82.40
Industry	0.15	8.94	1.59	1.04	0.87	0.10	6.75	8.85	8.21	0.96	0.35	5.55	12.15	7.27	1.70	0.02	3.70
Domestic water	3.40	4.13	1.67	4.69	10.22	5.68	3.87	3.26	1.15	2.48	1.94	8.55	4.68	4.09	4.54	1.17	2.92

Structure of water uses (billion m³/year)																	
	Bang Giang - Ky Cung	Red River - Thai Binh River	Ma	Ca	Gianh	Thach Han	Huong	Vu Gia - Thu Bon	Tra Khuc	Kon	Ba	Dong Nai	Southeast River Group	Se San	Sre Pok	Mekong River	Total
Aquaculture	8.12	3.53	8.34	13.69	12.45	15.70	6.48	7.66	3.52	2.18	1.59	6.81	25.66	5.45	7.04	16.57	10.98
Proportion of water use by sector (%)																	
% of irrigation water	0.42	26.22	6.51	2.59	0.09	0.14	1.96	1.94	1.13	1.38	2.49	7.26	2.16	0.28	1.16	44.28	100
% of industrial water	0.02	62.68	2.61	0.75	0.02	0.00	3.56	4.78	2.37	0.31	0.20	11.36	10.17	0.54	0.51	0.27	100
% of domestic water	0.45	36.65	3.48	4.25	0.35	0.29	2.59	2.23	0.42	1.02	1.42	22.15	4.96	0.39	1.72	17.73	100
% of aquaculture water	0.29	8.32	4.61	3.30	0.11	0.22	1.15	1.39	0.34	0.24	0.31	4.69	7.23	0.14	0.71	67.00	100

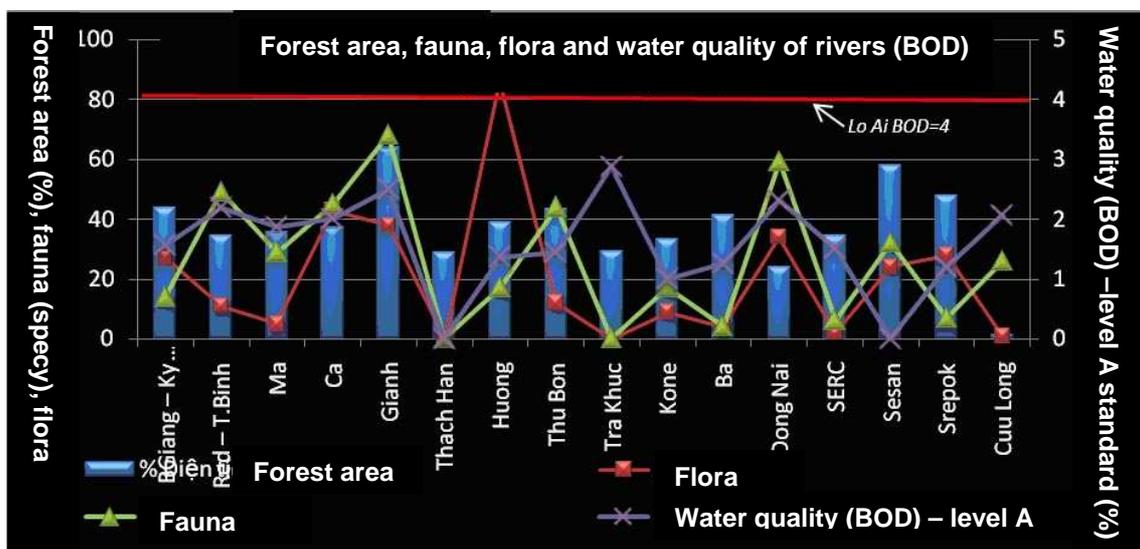
III. The Issues of Water Use

The improper exploitation and use of water resources will lead to the following:

1. Degradation of water quality and wetlands:

Water quality degradation has strong impacts to the ecosystem and vegetation. Water quality of almost rivers has not qualified for the level A standard (can be used for domestic water), but a number of river sections still have very good water quality. Thach Han, Tra Khuc, Ba, Southeast river basins have only a low index of species of fauna and flora, it is also similar to the low rate of natural forests. According to BOD index, water quality in some rivers is becoming very serious: Red, Ma, Ca, Gianh, Tra Khuc, Dong Nai, Mekong River and Southeast river group. Huong River has high index of vegetation species thank to biodiversity conservation of Bach Ma forest. Many areas where natural forests occupy high percentage but it can not ensure the life of the natural fauna and flora due to poor forest quality such as Se San, Sre Pok, Red, Ma River (*Figure 1*).

Figure 1: The water quality of rivers (BOD) and index of fauna and flora system



At present, many areas of wetlands have been lost due to development of aquaculture and fishery. River ecosystem suffered influence from industrial pollution and domestic waste water, river bottom dredging, dam crossing river, change of aquatic environment, disappearance of breeding zone for fish.

2. The impact of climate change to the water resources

Climate change is a global problem, it can be neither managed nor avoided. Vietnam is one of five countries that are influenced the most. Water resources sector is affected powerfully by global climate change.

The impact of climate change to the water cycle leads to be drier in dry season and more humid in rainy season. Other factors in the water cycle are affected as follows:

- ✓ Rainfall, precipitation regime: rainfall probably increases in high-latitude areas, especially in winter.
- ✓ The amount of evaporation increases when the air temperature increases. This leads to reduction of surface flow when evaporation rate increases. According to research in the United States about the relationship between surface flow and evaporation, in case rainfall is not change, the surface flow will decrease 3 - 12% if the temperature increase 2°C, and 7 - 21% will be reduced if the temperature increases 4°C due to increase of evaporation.
- ✓ Interactive relationship between surface water and groundwater is also affected. In the dry season, groundwater can contribute up to 93% of water volume in river. For example: the rate is 94% in the Northwest region, 90% in Northeast region and it is lowest in Southeast region with 90%. Decrease of rain water leads to reduction of groundwater and basically, flow in rivers also reduce in dry season.
- ✓ Flows: in the high-latitude areas, increase of rainfall will make the flow to increase. In contrast to some areas with lower latitudes, the flow reduction caused shortage of water become more serious due to a combination of decreasing rainfall and increasing evaporation.
- ✓ Reservoirs are affected easily by changes in climate. Changes of temperature and rainfall lead to change water balance of reservoir, bio-chemical properties of water and influence the ecosystem in the river (reducing diversity of species of aquatic system, reducing output, etc.). Some lakes are probably disappeared due to certain climatic condition.
- ✓ Water quality: rise of temperature reduces the amount of dissolved oxygen and influence to the aquatic animal life.

Frequency of happening flood, drought is possible to be raised in many river basins. Frequency and hardness of drought will increase in some places due to decreased rainfall. Drought will take place more frequently because of increase of

evaporation. Impact of climate change is very much in change of seasonal flow and floods, heavy rain caused major flooding. Damage due to floods and storms are concentrated on the rivers in Central region such as Ma, Huong, Vu Gia, Thu Bon, Tra Khuc and Kon Rivers. The rate of average damage in comparison with GDP is about 0.6%. The Northern mountainous regions are vulnerable to be affected by whirlwinds, flash floods, so landslide, hail and burst of house roof often happens. In the plains as the Red River Delta, the Mekong River Delta, floods also occur more often, salinization raises more that cause larger area of salinity, acid land and damages crop. Estuaries expand with cone-shaped tendency, especially in the poor-alluvial rivers such as Thai Binh, Quang Ninh, Hai Phong, Dong Nai. In dry season, water in river branches, river bottoms and stagnant canals is highly polluted and the rivers cannot play roles of drainage to the sea. By the time, level of pollution has become increasingly serious, so it affects residents living on two side of river. Inundation will cause changes of hydraulic system; the flow intensifies lateral erosion on river side threatening nearby residential area. On the rivers with strong dyke system, soil deposition occurs in the middle of river bottom create terrain at the bottom higher than plains on two sides of the river.

Water shortage in the dry season and flooding in rainy season are occurring more and more seriously in many localities.

Sea-level rising: *According to research scenarios of the Institute of Meteorology, Hydrology and Environment, every decade, the temperature increases by an average of 0.3°C; annually, there is average of 4.7 storm and this figure is increasing, great floods occur more frequently in coastal areas and the Mekong River Delta, Red River Delta; it will be more severe in the Southern region and Central Highlands. Sea level rises an average 5cm a decade and it will be 33 - 45cm in 2070 and 100cm in 2100. If sea level rises 1 m, 22.8% of the Vietnamese population is influenced, 12% of land is affected and 10% GDP is lost, 11,000 km² of the Mekong River Delta will be inundated. Consequently, coastal areas will be eroded; flood will be stronger in the downstream of river; salinization will be expanded in estuaries and impact to taking water from river-side sluices, affect groundwater nappe near the shore; sea dyke will be affected powerfully; drainage scale will be larger. Sea-level rising due to climate change will affect strongly to the system of exploitation, use, protection and development of water resources, the system of investigation and monitoring the quantity and quality of water.*

Change of rainfall and runoff: according to the scenario of change of rainfall and runoff, if temperature in Vietnam increases 2.4°C - 4.5°C, the runoff will change. If rainfall decreases 10%, the runoff can be reduced 10 - 30%. This significant change will occur at the South Central Coast and the Northeast. Especially in the dry season, runoff will be reduced 10 - 15% when rainfall decreases 10% and the temperature increases more than 1.5°C.

3. Natural disaster and flood

In the past years, natural disaster occurred in every area throughout the territory of Vietnam caused great damage of people, property, economic, cultural, social infrastructure, impacted bad to the environment. In recent 10 years (1997 - 2007), all kinds of natural disasters such as storms, floods, droughts and other natural disasters have done significant damage to people and property, caused deaths and thousands of missing persons. The value of damage to property was estimated about 0.6% of GDP. Natural disaster in Vietnam is increasing more and more in term of scale and repeated cycle accompanied by unexpected difficulties.

Table 2.4: Level and type of disaster by economic region

Disaster	Geographic and economic regions							
	Northeast and Southeast	Red River Delta	North Central Coast	South Central Coast	Central Highlands	Southeast	Mekong River Delta	Coastal Economic Region
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Storm	***	****	****	****	**	***	***	****
Flood	-	****	****	***	***	***	****	****
Flash flood	***	-	***	***	***	***	*	****
Whirlwind	**	**	**	**	*	**	**	**
Drought	***	*	**	**	***	***	*	***
Desertification	-	-	*	**	**	**	*	**
Salinization	-	*	**	**	*	**	***	**
Inundation	-	***	**	**	-	**	***	**
Landslide	**	**	**	**	*	**	***	**
Water level raising due to storm	-	**	**	**	**	**	***	**
Fire	**	*	**	**	-	***	***	***
Risk of industry and environment	-	**	**	**	***	***	**	***

Note: Very much: (****); Much: (***); Not so much: (**); Little: (*) and None: (-).

4. Degradation of groundwater sources

Although the groundwater reserve in areas of Northwest and Northeast of Vietnam is quite large, however, almost water layers are contaminated in the sand and clay layers, and in the limestone somewhere. Characteristic of the sand and clay layer is, supplying water through small wells and holes, which make them less sustainable

when they are exploited in large quantity. Depending on the depth of each water layer, the sand and clay layers could be suitable to small scale exploitation for the domestic purpose. The exploitation on large scale has made the structure of the water layers falling down in the past few decades, and also by the impact of stream, wave and wind. This phenomenon has occurred in the basin of the Red River area, the Southeast region, the Mekong River Delta and the coastal plain; they have a close relationship with activities on the ground. The basalt areas on Central Highlands and the highlands of Southeast region are also the sources of good quality groundwater, so most of the exploiting wells on large scale are located in this region, where the demand of domestic and industrial water are great, to support water in and around Ho Chi Minh City and a large amount of water to irrigate coffee in the Central Highlands and South Central Coast.

Capability and sustainability in exploiting the water layer in Viet Nam are not yet rated. Currently, groundwater potential is only preliminarily estimated number and calculated on a large scale. The calculation mainly based on rainfall or other data calculated from the amount of groundwater exit to the river. The calculation is assumed that 100% water transfer is dynamic reserve potential can be exploited. This method does not consider the impact of surface runoff, or other dependent ecosystem as well as related economical and social values. The calculation of groundwater reserve doesn't often consider the fact that exploitation often focuses on a small area and there are many risks of partial decrease of water level or the interaction between the drilling holes. Currently, the decrease in groundwater level has happened, although low, but there is no policy refers to groundwater exploitation limit to ensure that the impacts are acceptable. The increase on water demand causes pressure on water supply and also the groundwater, reduces economical and social value, and restricts development activities.

Arsenic pollution: In Hanoi, drawdown of groundwater level caused the increase of Arsenic pollution in the depth water layers, which supply the domestic water (which is drilled through the shallow layer). In some mountainous areas, the content of Arsenic also increases by the activities of mining. Recently arsenic is researched to filter out, although this method does not achieve the allow standard of the World Health Organization – WHO, 0.001 mg/L for drinking water, but it also reduced considerably the content of arsenic below 0.005 mg/L. In areas where the content of arsenic is high, with a high amount of iron, the filter is very effective. In other areas, removing arsenic in domestic water sources should be studied further.

5. Improper exploitation of water resources

The constructions on the river have caused many impacts on the hydrological regime as well as the health of rivers. Building constructions on the river have basically changed the flow rate, especially during the dry season; therefore the social and economical values are affected. The indicator of natural flow shows the rivers that are in quite intact level as river Gianh (83.7%) and Bang Giang Ky Cung (80.5%), Thu Bon (79%). Rivers in strong exploitation are Ba (26.6%), Dong Nai (32.7%), Kon River (34%). The hampered extent by constructions to the move of aquatic animals such as shrimp, fish, etc. with the indicator from 65% to 71% for the Ba, Thach Han, Ca and Red River. In fact, now there are many obstacles on the river in Vietnam, most of them are small and under the flows during the rainy season, but the accumulative activities of these obstacles in the dry season is very considerable. Currently, the minimum flow for use demand, community, and the environment is often cut down or does not receive proper care. There are very few river basins that have the regulator to ensure the flow demand in the downstream of the river, and in some cases the new design constructions even reduce the ability of the already ones on the river. The fact on river basins is the new constructions will be built continuously without solutions to ensure the natural flow of water or drain off to meet the demand at the downstream.

6. Lack of water during the dry season, there is no policy yet to share water during the dry season to ensure the water demand and social security

The dry season in Viet Nam lasts 6-9 months; the basins in the Central region of Vietnam have the longest dry season, up to 9 months. There are 7 basins with the amount of water in dry season under 33% of total water of the year - that is, only less than 1/3 amount of water for 75% time of the year. The amount of water in dry season of the Mekong Delta is only 23% of total water of the year, Bang Giang – Ky Cung ratio is 26%, the Southeast river group is 28%, Gianh River is 29%. The Mekong River Delta only has (on average per month) 3.2% of total water of the year (compared to 8% if the water was distributed regularly for every months of the year). There are 7 other watersheds that have the average ratio per month in dry season only 4% of total water of the year.⁽⁶⁾

The lack of water in dry season expresses at the point that in many river basin the exploitation is over the limit (according to world threshold), therefore the water sources that are 60% depending on the exploitation from foreign countries have not been considered sufficiently. It is also one of the reasons lead to the waste of water.

Vietnam has the policy “power saving” but there is no policy "water saving" yet. Irrigation water still loses 20-38%, and this number in domestic water is over 30%. Clean water is still used for things like car washing and much other waste.

During the dry season, only 4 river basins (Cuu Long, Se San, Vu Gia - Thu Bon and Gianh) can provide water per capita more than "sufficiency of water" level to support for community development. The 6 other river basins can only provide a bit more than that level. Capacity of Red - Thai Binh river basin is a bit less than "sufficiency of water" level. Ma river basin is at "lack of water" level, Dong Nai river basin is below “lack of water”. River group of Southeast region is also below this level and nearly reaches to "scarceness of water" level. With the forecasted growth of population for the river basins, especially in Dong Nai River groups and river group of Southeast region, the availability of water in the dry season are becoming serious problems in many areas of Vietnam.

So far, Vietnam has not had a specific policy on sharing water resources among competitive interests at the same time of water shortage.

IV. Orientation to use of water resources

In the last 10 years, Vietnam has many variations and impacts of the climate factors that affect water resources:

- Index of annual storms in Vietnamese coastal areas increases 0.4;
- The average temperature of year increases 0.1°C; in summer months it increases from 0.1°C to 0.2°C;
- Regional rainfall tends to be increased or decreased about 0.1% to 0.5%;
- The scenario CR1RO predicts that average temperature of year increases from 0.3°C to 0.7°C, rainfall does not change much, but maximum rainfall increases about 5% in the coastal regions in 2010.

1. Water source:

Surface water: Changes of climatic factors lead to reduction of water resources. According to the forecast, the total annual runoff is about 843 billion m³; it may drop to 807 billion m³ in 2025, to 765 billion m³ in 2070 and to 722 billion m³ in 2100. The current total runoff in dry season is about 102 billion m³, it may drop to 98 billion m³ in 2025, to 76 billion m³ in 2070 and to 72 billion m³ in 2100.

Groundwater: It is used mainly for domestic water supply. Total national dynamic reserves of groundwater is approximately 195,666,650 m³/day, equivalent to 2,264

m³/s. Total reserves of groundwater of level A and B is 986,500 m³/day. Usable reserves of groundwater of level C1 is 2,400,000 m³/day, of level C2 is 10,400,000 m³/day.

2. Water demand and capability for water balance in the future

Water demand: It is forecasted with the criterion of sufficient water supply under permit of economic and technical conditions. Total water demand for domestic use and development of socio-economic is increasing. In 2000, it is around 78,112 billion m³, about 103,588 billion m³ in 2010 and approximately 121,813 billion m³ in 2020. The water discharge for maintaining the downstream ecological environment in the dry season is about 4,300 m³/s. Other sectors' water demands (transport, water, environment ...) also need to be increased much. The quality and guarantee of water supply and sewerage (including irrigation and drainage) are becoming higher and more diversified.⁽⁴⁾

Table 5. Forecast of water demand increase⁽⁵⁾

Year	Increase level in comparison with 2000			
	Cultivation	Breeding, fisherry	Domestic use	Industry
2010	11%	60%	100%	80%
2020	13%	108%	230%	170%

Table 6. Current level of water use and estimated level in 2020

No.	Sector	At present	In 2020
1	Irrigation	82 %	72 %
2	Industry	5 %	9 %
3	Domestic use	3 %	5 %
4	Aquaculture	11 %	14 %

Ability to meet water demand: According to the calculation result of water balance, total water demand is 9 – 10% of total runoff in 2000, 12 - 13% in 2010, 15 - 16% in 2020. Therefore, the total runoff of year still can satisfy water demand safely. However, the runoff in dry season is very small, so most of the basin is lack of water, flows nearly disappears.

Conclusions

The water resource is much diversified including surface water (fresh water, brackish water, salt water...), ground water (fresh water, mineral water...). However, different projects on water resources and water uses have focused mostly on surface water (fresh water, salt water) and little on ground water. During the recent years, research on water resources and water uses has been paid uniformly more attention, in particular using of brackish water and salt water for fishery development.

CHAPTER III

IMPLICATION OF LESSONS LEARNED FROM FOUR CASE STUDIES

1. Assessment of the implication of lessons learnt from Case Study Xuan Thuy National Park (Case study #1)

The case study is a typical short term research on the complex relationship between Water, Food and Ecosystem in Xuan Thuy national park located on estuarine area of Red River in northern Vietnam. Based on research results of the case study it is possible to come to the following conclusion, lessons learnt and recommendations for further study:

1) Conclusion of the case study:

In Vietnam many studies on environmental impacts of dams and reservoirs in their upstream and downstream areas have been carried out, but studies of upstream water flows impacts on river estuarine and coastal zones are still limited. This case study carried out in Xuan Thuy National Park situated in the Ba Lat estuary of Red River system is one of the first efforts to remediate this situation. It shows that relationship between river estuarine water, marine coastal water, agricultural and aquaculture food production activities and ecosystem conservation in a wetland national park in northern Vietnam is very complex. For a good management of WFE relationship in this national park and similar places in Vietnam it is necessary to have a good understanding of this relationship and an appropriate management and institutional system.

2) Lessons learned from the case study:

- Water resources in Xuan Thuy National Park are used for many purposes: maintenance of ecosystems in mangrove forest in the park; supply water for agricultural, aquaculture production, socio-economic activities and domestic use for the living of people in the five communes situated in the national park buffer zone.
- Water resources in the study area are also strongly impacted by intensive socio-economic activities in Red river estuary upstream areas, where many industrial, agricultural, handicraft, construction, mineral exploitation activities are carried out and strongly polluting Red river water resources

- Sources of water flowing to the national park from people residential zones, agricultural production zone, aquatic farming zone in buffer zone area strongly and directly impact the quality and characteristics of water in the national park.
- Degradations of ecosystems and biodiversity have happened with Xuan Thuy National Park, especially after economic renovation in the late 1980 resulting from more intensive exploitation of fishery and forest exploitation in park area, population increase and intensification of agricultural activities in 5 communes in the park buffer zone.
- Direct impact to the park ecosystem and biodiversity is the change of water flow in the park area by the building in the year 1986 of a dam across the Vop river, one of the two rivers flowing in the area of the national park, for extending the shrimp farming area without taking account into the change in natural flow in this estuarine area.
- Water, Food and Ecosystem are closely interrelated but from administration and management aspects are depending from various ministries, provincial. district departments. For an optimal use and protection of water resources for sustainable food production and efficient ecosystem conservation it is necessary to have an adequate system of management at various levels of administration associated with strong public participation.

3) Recommendations for further research:

- Study on the impacts of Vop bridge to water flow, water quality, and other issues of hydraulic regime, erosion, sediment deposition, salinity, quality of water in the estuarine area and their impacts on the ecosystems of the national park.
- Design and setting up of a monitoring system with about 3 monitoring stations in the national park and surrounding area.
- Design and setting up of monitoring system under-dike sluices to monitor and assess the pollution by waste water from residential and agricultural areas in buffer zone.
- Research regarding the implementation of Decision Nr. 1822/2006/QD-UBND of People Committee of Nam Dinh province on coordination for management, protection and development of Xuan Thuy National Park.
- Research concerning the preparation and implementation of activities concerning development of rural handicraft; models of eco-tourism; development of environment

and sustainable development for people and schools teachers and pupil living and working in the buffer zone and in the national park area.

2. Assessment of the implication of lessons learnt from Case Study of Bac Duong Irrigation Scheme (case study # 2)

In Bac Duong irrigation scheme, Ngu Huyen Khe river is a natural drain. However, in fact, it is an irrigation water source for areas along both river banks. In dry season, the river water mainly is wastewater from industries, craft villages, domestic uses, agriculture etc. The study of **“Potential use of waste water for irrigation to mitigate water pollution while assuring sustainable and safe agriculture in the Bac Duong Irrigation Scheme”** has a great significance in both theory and practice.

1) Conclusion of the case study:

Wastewater reuse has clear negative impacts on farmer's health. Rice yields of areas using polluted water are higher than rice yields of areas using unpolluted water. The differences between these two types of areas are clearer in the summer (rainy) season. It may be explained that use of diluted wastewater for irrigation could make rice have higher yields in comparison with case of using undiluted wastewater.

In the future, because of high growth rate of economic and social development, water pollution in the scheme will be increased, if no any urgent measures are taken from now. The above proposed strategy should be considered and implemented by the relevant agencies at various levels and communities.

Wastewater reuse in the Bac Duong irrigation scheme has clear negative impacts on farmers' health, irrigation area health. It is necessary to have preliminary treatment before using the wastewater for irrigation at least. When water pollution level of the Ngu Huyen Khe is high, wastewater should be stored temporary for 7-10 days in canals, drains or ponds before taking it to crop fields. In case wastewater of the Ngu Huyen Khe is too serious, it is required to pump water from Cau river to dilute water pollution before pumping to the canals. However, this measure is considered as a compulsory situation solution. It should not be considered as a positive measure for wastewater reuse.

In order to control water pollution of the Ngu Huyen Khe river, it is required to implement necessary measures to manage the waste sources. Craft villages, industries should be reallocated to collect waste matters into planned places where waste matter treatment could be effectively, efficiently carried out. Polluters must have responsibilities for treatment before discharging into the water source and paying for their waste matters into environment. Awareness improvement on wastewater reuse for the communities and agencies should be well implemented. Water of the Ngu Huyen Khe river should be improved soon.

2) Lessons learned from the case study:

- The water quality in irrigation scheme is polluted and contaminated by many polluters such as industry, trade villages, rural and urban areas, tourism and agriculture itself. The reuse of wastewater in the scheme for irrigation is an inevitable demand. However, the pollution level of wastewater that used for irrigation should be careful considered.
- There is a need of strengthening the enforcement of existing legal documents for waste water discharge license for the provincial authorities which have function on environmental protection as well as irrigation management agencies.
- The cooperation between the Provincial Department of Environmental Protection, the Provincial Department of Agriculture and Rural Development, the North Duong Irrigation Management Company, local authorities within the Scheme and companies is very weak; The company do not have power to punish polluters because it is not one of the function of the company. The cooperation between provincial authorities and the Company should be strengthen through an appropriate mechanism with strong participation from farmer in the scheme.
- The DARD do not have enough power as well as expertise on water quality and environment in order to carry out the monitoring water quality and wastewater discharge licensing in the scheme even the Ministry of Agriculture and Rural Development has already issued a decision on wastewater discharge licensing in irrigation scheme.

3) Recommendations for further research:

Because main study #2 was carried out for 5 months of a rainy season, the collected data, information are still insufficient. The above conclusions and recommendations are initial ones. It is necessary to continue the study with the following aspects:

- (i) Surveying wastewater sources: re-identifying main waste sources in the scheme. Measuring wastewater discharges of the wastewater sources;
- (ii) Continuing water quality monitoring at crop fields, canals and drains (as phase 1) for 2 more years (in both dry and rainy seasons). However, some more water quality parameters should be tested (for instance, pesticide residuals);
- (iii) Continuing rice product, soil sampling and testing in areas selected in phase 1;
- (iv) Studying impacts of wastewater on other up-land crops (such as potato, vegetables etc.);
- (v) Studying feasible and simple wastewater treatment technologies for the area;
- (vi) Continuing study and having specific recommendations to legal framework, decision making process, organizational arrangements to wastewater reuse in the area;
- (vii) Supporting DARD and DONRE in wastewater licensing;
- (viii) Supporting DARD and DONRE to develop wastewater treatment proposals to craft villages, industries;
- (ix) Developing action plans for awareness improvement and capacity building for communities and agencies.

3. Assessment of the implication of lessons learnt from Case Study of Hoa Binh reservoir (case study # 3)

1) Conclusion of the case study:

From the point of view of economic valuation water should be considered as an economic good. Water valuation for different sectors of the national economy is very necessary and should be considered as base for effective water reservoir operation and management, especially for a optimal balance between water demand and supply. Hoa Binh reservoir is an important multipurpose water reservoir for flood control and water supply for downstream people living conditions and their industrial, agricultural, fishery, handicraft, river transportation activities. It is very important to continue to promote the rational and optimal balance and schedule of water release from Hoa Binh reservoir and related upper stream reservoirs on Red River system to downstream areas based on rational application of water valuation considering water and its impacts on food and ecosystem.

2) Lessons learned from the case study:

- The government should encourages the investment and development activities for water resources supply, exploitation, protection and rational use and protect the right of use of water resources developers.
- In the last decades, possibly by the impacts of global climate change, El Nino and La Nina effects serious floods and droughts have occurred in Vietnam. Therefore in the coming years a study on river multiple uses reservoirs operation, including reservoirs on Da river, on Lo river, on Chay river, Dong Nai river, and many other rivers in Vietnam based on water valuation considering its impacts on energy, food, ecosystem and other sides of integrated water resources use for human life and development is of specific importance.
- The cooperation between governmental agencies at national, provincial, and local levels related to integrated water resources uses, the newly founded rivers basins management committees, professional and community organizations is necessary for optimal water resources use operation.
- According to the case study author, it is also necessary to separate water resources use institutions from water resources management organizations.

3) Recommendations for further research:

- To continue the case study on Hoa Binh reservoir multipurpose water resources management before the completion of Son La water reservoir and other important reservoirs now in construction on Da River.
- To carry out the case study on Hoa binh reservoir multipurpose water resources management after the full completion of Tuyen Quang water reservoir on Lo River.
- To carry out the case study on Hoa Binh water reservoir multipurpose water resources management after full completion of important reservoirs on Da River and Lo River.
- To carry out research on “environmental flow” of Da River downstream of Hoa Binh dam.
- To carry out research on “environmental flow” of Chay River downs tream of Tuyen Quang dam.

4. Assessment of the implication from Case Study Ben Tre (case study #4)

The case study is a typical short term research on the complex relationship between the use of the same water resources sources available in the study area for agriculture and for aquaculture at Dai Hoa Loc and Binh Thoi communes in Binh Dai district of Ben Tre province in the Mekong River Delta.

1) Conclusion of the case study:

- The existing soil resources, water resources and other environmental conditions at the study area allow a good combination of aquaculture (shrimps farming) and rice cultivation. This system of combination was working since some year and positively contributed to the increase of local people income and amelioration of their living conditions
- With the existing infrastructure system of canals, dikes it is still difficult to supply of clean water to shrimp pounds and rice fields and to discharge polluted water from these areas. Polluted water from rice fields and shrimp pound are directly discharged to canals and river.
- The understanding of the value of water resources and the need of conservation and amelioration of water resources quality for better combination of aquaculture with rice cultivation of local people is still limited and should be ameliorated.
- A good management system at district and commune level is necessary commune for the combination of aquaculture and rice cultivation.

2) Lessons learned from the case study:

- It is possible to ameliorate to efficiency of use of water and land resources in some coastal areas of Vietnam by an appropriated combination of aquaculture and agriculture, especially the combination of aquatic rice cultivation and shrimp farming.
- This combination needs in necessary infrastructure construction; appropriate technical design for aquaculture and agriculture system; technical training for local workers; good understanding on environmental protection in local area; appropriate management, institutional system and appropriate market organization.
- The government, especially the province and district people committees in the coastal areas of in Mekong River and Red River Vietnam should encourages the combination of agriculture and aquaculture to increase the efficiency of use of water resources for food production and ecosystem protection and development.

3) Recommendations for further research:

- To carry out similar case studies in other places in the Mekong River Delta, to compare study results and to have conclusion and remarks with areas larger than the commune.
- To examine the possible impacts of climate change and natural disasters (typhoons, floods, droughts) on this way of combination of aquaculture with agriculture.

CHAPTER IV

WATER FOR FOOD AND ECOSYSTEM'S POLICIES ANALYSIS

I. Institutional arrangement for water resources management

1. The Organizational Structure of Water Resource Management in Vietnam

The Constitution of Vietnam, approved in 1992, states that the National Assembly is the highest legislative body and Government is the highest executive body of the State. The Government consists of the Prime Minister (who is elected by the National Assembly) and Deputy Prime Ministers and Cabinet Ministers (who are appointed by the Prime Minister). The Communist Party is the leading force of the State and of society in Vietnam. There are four levels of administration:

- ⇒ Central Government
- ⇒ Provincial and municipal authorities
- ⇒ Quarters (urban) and Districts (rural)
- ⇒ Blocks (urban) and Communes (rural)

Each level of administration is represented by People's Councils which in turn elect People's Committees that perform the administrative functions at each level of government. There are 64 provinces in Vietnam now.

This overall structure provides a very strong administrative mandate for provinces and districts and immediately creates some tensions for water management, where the hydrologic unit boundaries seldom, if ever coincide with the administrative boundaries.

This latter feature is common to virtually all countries, however the extremely rigid administrative structure mentioned above for Vietnam (and also for countries such as China) has traditionally made it difficult to introduce cross-province boundary water management arrangements. Various orders, circulars, decrees and so on, issued over recent years have emphasised the importance and logic of the hydrologic unit for water resource management rather than administrative boundaries. However, it was not until the recent passage of the new Water Resources Law that the legal backing and structure has been provided to enable this to readily occur.

After the Law on Water Resources had been enacted in 1998, some organizations were established to implement the Law. At first, Ministry of Agriculture and Rural Development (MARD) was responsible for the state management of water

resources. After the establishment of Ministry of Natural Resources and Environment (MoNRE) on November 11th, 2002, the function of state management of water resources was transferred from MARD to MoNRE in accordance with Decree No. 91/2002/ND-CP defining the functions, tasks, authorities and organizational structure of the Ministry of Natural Resources and Environment. However, according to Decree No. 86/2003/ND-CP dated July 18th, 2003, defining functions, tasks, authorities and organizational structure of the Ministry of Agriculture and Rural Development, management of river basin planning management boards was still managed and proceeded by MARD and Department of Water Resources was assigned to assist MARD to accomplish these tasks. Afterwards, the Office of the Government issued Notice No. 43/TB-VPCP of March 15th, 2007 to announced conclusion of Permanent Deputy Prime Minister Nguyen Sinh Hung about transferring river basin management to MoNRE.

Recently, Decree No. 25/2008/ND-CP of March 4th, 2008, re-defines functions, tasks, powers and organizational arrangements of MONRE. MONRE has main functions of water resources governance including guiding implementation of legal documents, policies, regulations on water resources; guiding implementation of national water strategy, national water programmes; taking a leading role of developing national water resources development and management plans. Afterwards, MoNRE assigned its Department of Water Resources Management to assist Minister in state management of water resources through through Decision No. 1035/QD-BTNMT dated May 19th, 2008.

In provinces, cities directly under the central government, the Departments of Natural Resources and Environment, in which Water Resources Divisions function to assist provinces to conduct state management of water resources in within provincial border.

According to Decree No. 01/2008/ND-CP of January 3rd, 2008, MARD is responsible for state management of water supply and sewerage, fresh water and sanitation of rural environment, irrigation and drainage, making operation procedure of irrigation and hydro-power reservoir, prevention and control of harmful effect caused by water (flood, draught, etc.). Department of Water Resources (main agency) and The Department of Dyke Management and Floods and Storms Control assist MARD directly to implement those tasks. At local level, the Departments of

Agriculture and Rural Development and, under them, irrigation divisions function state management of water resources.

The National Water Resources Council was established according to Decision No. 67/2000/QD-TTg of Prime Minister. Members of this Council works concurrently. The Chairman of Council is a Deputy Prime Minister, permanent councilman is a Minister in charge of water resources management, frequent members are Deputy Minister of eleven Ministries, Chief of Secretariat, specialists and unfrequent members are representatives of concerned central and local agencies.

At present, Office of National Water Resources Council is based in Department of Water Resources Management under MoNRE. Chief of Secretariat of this office is Director of Department of Water Resources Management and frequent member of Council either (*according to Decision No. 567/QD-TTg of May 21th, 2003, it was formerly functioned by MARD*).

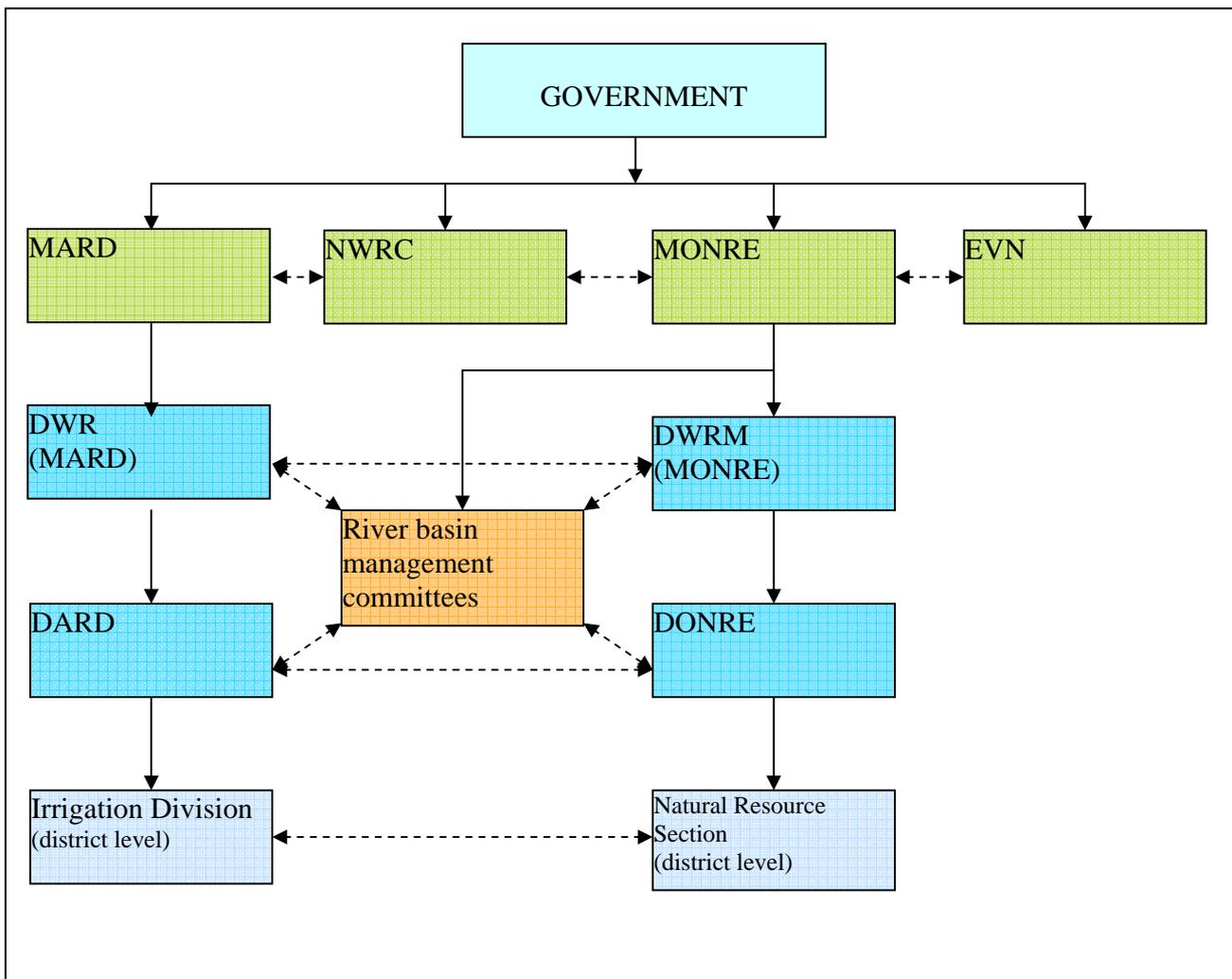


Figure 1.1. Scheme of organization structure on water resources management

2. Functions and roles of different ministries, sectors and organizations related to water resource management

A detailed functions and mandates of concerned agencies responsible for water resource management can be seen in Annex 1 and table 1.1. and 1.2.

Agency	Functions
<p>Ministry of Natural Resources and Environment (MONRE) In accordance with Decree 25/2008/ND-CP dated on 04/02/2008</p>	<p>State management on water resources, details as follows:</p> <ul style="list-style-type: none"> - Guiding and organizing implementation of legal documents and policies on water resources; - Guiding and assessing the implementation of strategies, projections on water resources, and general programs on prevention of degradation and depletion of water resources; exploitation, utilization, and sustainable development of water resources after having approval of the Prime Minister. - Leading the development of projections and plans for management and appropriate methods. - Issuing decision on classification of water resources list. - Guiding and assessing the effectuation of regulations on limit threshold for water extraction from rivers, aquifers, water-storage area, and area limiting extraction of ground water, etc. - Developing, managing, and exploiting a network of monitoring and measurement on water resources, etc. - Appraising sector water use projections, projects of inter-basin water diversion developed by ministries, sectors, and/or provinces. - Guiding and assessing the issuance and withdrawal of licenses on water resources as defined in legal documents. - Implementing methods to prevent water resources pollution, revive degraded/depleted water sources... - Leading liaisons in submitting documents related to international cooperation of water resources to the Prime Minister. - Being a Standing member of the National Water Resources Council, Vietnam National Mekong Commission.

Ministry of Agriculture and Rural Development In accordance with Decree 01/2008/NĐ-CP	State management on water resources as follows: <ul style="list-style-type: none"> - Guiding implementations of legal documents on irrigation and dykes: preventing impacts of salt water intrusion after having decision of authorized agencies. - Guiding the implementation of strategies, projections on irrigation, strategies on prevention and mitigation of natural disasters after having approval of the Prime Minister. - Leading in development of irrigation projection for region/ reservoirs to serve agriculture production, multi-purposes attached with socio-economic sectors. - Approving dyke and irrigation planning of 2 or more provinces. - Publicizing, leading, guiding, monitoring, assessing, synthesizing, and summarizing reports on the implementation of approved projections, plans of irrigation development in nationwide. - Proposing to the Prime Minister and organizations on implementation of methods mobilizing materials and means to prevent and repair damages caused by floods, droughts, waterlogging, failures of irrigation works and impacts of water, guiding flood diversion, flood retarding, people evacuation.
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Table 1.1. Functions and mandates of MoNRE and MARD

Other functions over water resources rest with the Ministry of Agriculture and Rural Development (MARD). The Ministry operates at the high-level policy planning, regulation and procedures level and leaves the operation of hydraulic works to provincial departments – except for control of large scale, inter-provincial and multipurpose works. Each province has a Provincial Agriculture and Rural Development Service (PARDS) which operates under provincial funding and administration but with technical links to MARD. Most PARDS supervise a number of autonomous enterprises that develop and manage water resources for the provincial peoples committee (PPC). This comprises a very strong set of administrative and technical arrangements for water management at provincial level.

In essence, the present arrangements for water management can be summarised as follows:

Agency	Function
Ministry of Planning and Investment (MPI)	MPI is the central agency for allocation of resources; receives sectoral submissions and prepares consolidated Public Investment Plan. MPI coordinates ODA and direct foreign investment.
Ministry of Trading and Industry (MOTI) in accordance with 189/2007/ND-CP dated on 27/12/2007	MOTI is responsible for hydropower, among other functions. MARD identifies development potential and establishes the operating rules for reservoirs. MOTI implements and operates hydropower schemes
Ministry of Science, Technology (MOST)	Created with the enactment of the Environmental Protection Law of 1993, MOSTE sets water quality standards, carries out research and environmental management through the EIA process.
Ministry of Construction (MOC) in accordance with Decree 17/2008/ND-CP dated on 04/02/2008	Responsible for urban water supply, drainage and sanitation - sets regulations, prepares, plans, designs, and constructs water supply and sanitation facilities through design and construction companies. Primary responsibility for urban water supply and sanitation
Ministry of Transport (MOT) in accordance with Decree 51/2008/ND-CP dated on 22/04/2008	MOT is responsible for prevention and protection against pollution of water resources used for marine navigation, and management of marine works and ports.
Ministry of Finance (MOF)	MOF distributes state finances to sectors. also regulates accounting and sets annual sector disbursement targets..

Table 1.2 Functions of Key National Agencies in the Water Sector Functions

Notwithstanding the key roles played by MARD, MONRE and their counterparts at provincial and commune levels, a large number of government agencies other than those ministries also have an influence in making decisions which affect the water sector. The broad responsibilities of these agencies in relation to the management and administration of water resources, are summarised in Table 1.3

Area of Governance Responsibility	Agency	Water Related Activity				
		Flood control	Irrigation and Drainage	Water for other Sectors	Flow Regime	Water Quality
Water Resources	MARD	①	①	②	②	②
Water Resources	MONRE	②	②	①	①	①
Land	MONRE	②	②	③	③	③
Environment	MONRE	③	③	②	②	①
Hydromet Data	MONRE	①	②	②	①	①
Forestry	MARD	②	②	③	②	③
Energy	MOIT	②	②	②	②	②
Agriculture	MARD	①	①	③	③	①
Aquaculture	MARD	①	③	③	③	①
Health	MOH	②	③	③	③	②
Transport	MOTC	③	③	③	②	③
Industry	MOIT	③	④	③	③	④
Tourism	MOCTS	③	④	③	③	④
Construction	MOC	③	②	①	③	②
Planning & Investment	MPI	②	②	②	②	②
Finance	MOF	②	②	②	②	②

Legend: ① Primary accountability; Major accountability ③ Minor accountability; ④ Compliance obligation

Table 1.3. Summary of functions and mamdates of concerned ministries related to water resource management

The Government Decrees on Ministries related to water management's function and responsibility is now more clearer than before but there are still some issues that could not solve completely, particularly the river basin management and it should be solved by a separate Decree.

II. Policies in Relation to Water-Food-Ecosystem Interaction

National Water Policy and Strategy The water sector has no overall integrated strategy and action plan at the national or regional basin level; however, strategies and action plans exist for a number of the sub-sectors:

- Water Resources Development Plan to the year 2000 and Tentative Development Plan to the year 2010 (MARD, June 1998)
- Direction and Duties of Water resources development to the year 2010 (MARD, September 1999)
- Strengthening Environmental protection in the period of National Industrialization and Modernization (Communist Party of Vietnam, Directive No. 36/CT-TW,1998)
- Strategy for Rural Agriculture Development in the Industrialization and Modernization Period to the year 2010 (MARD, July 2000)
- Agriculture and Rural development Plan (2001- 2005) (MARD, August 2000)
- National Strategy for Rural Water Supply and Sanitation (NRWSS)
- Second National Strategy and Action Plan for Disaster Mitigation and management in Vietnam 2001 to 2020 (MARD and Central Committee for Flood and Storm Control, December 2001.
- National Water Resources Strategy towards the year 2020

Law on Water Resources (LWR)

The Law on Water Resources was passed in 1998 and came into effect on January 1999. At present only partial progress has been made towards implementing the reforms embodied in the LWR. The second legislation required to implement the LWR is being developed (licensing of groundwater extractions, licensing of surface water utilization, waste water permits etc.). Unique to LWR is the coordinated and crosscutting approach to water management, this is expressed in the establishment of a National Water Resource Council (NWRC) working at a national level and Board for River Basin Planning and Management working on a local level. These organizations would work under the GoV as advisory, coordination and planning bodies. The LWR is basically formulated as a flexible legal framework, and has a number of later developed decrees added subsequently. These decrees define the responsibilities and duties of the institutional bodies for the implementing of LWR. The list of under the Law on water resources are as followed:

- Circular 05/2005/TT-BTNMT dated 22/07/2005, providing guidelines for implementing Government's Decree 34/2005/ND-CP dated 17/03/2005 that governs the sanction of administrative violations in the field of water resources.
- Circular No. 02/2005/TT-BTNMT dated 24/06/2005 of the MONRE guiding the implementation of the Government Decree 149/2004/ND-CP regulating the licensing of water resources exploration, exploitation, utilization and waste water discharge into water resources.
- Circular No. 05/2006/TT-BTC dated 19/01/2006 guiding natural resource tax on natural water used for hydroelectricity generation.
- Circular No. 18/2004/TT-BTNMT dated 23/08/2004 guiding the implementation of the Government's Decree No. 109/2003/ND-CP date 23/09/2003 on the conservation and sustainable development of submerged areas (wetlands).
- Circular No. 26/2008 TT-BTC dated 28/03/2008 guiding the implementation of number of articles of the Decree 154 dated 15/10/2007
- Circular No. 75/2004/TT-BNN dated 20/12/ 2004 guiding the setting up, consolidation and development of water-using cooperation organizations.
- Circular No. 93/2007/TTLT/BNN-BYT-BGDDT dated 22 Nov. 2007 guiding the coordination between the agriculture and rural development sector, the health sector, and the education and training sector in implementing the National Target Program on Rural Water Supply and Sanitation 2006-2010.
- Decision No. 104/2000/QD-Ttg dated 25/08/2000 of the Prime Minister approving the National Strategy on Rural Water and Sanitation Strategy up to 2020
- Decision No. 81/2006/QD-TTg dated 14/04/2006, approving the national strategy on water resources to 2020.
- Decision No. **277**/2006/QD-TTg dated 11/12/2006 approving the National Target Program for clean water supply and sanitation in the 2006-2010 period.
- Decree No. 04/2007/ND-CP dated 08/01/2007, supplementing decree 67/2003/ND-CP dated 13/6/2003 on environmental protection charges applicable to wastewater

- Decree No. 143/2003/ND-CP dated 28/11/2003 detailing the implementation of a number of Articles of the Ordinance on the Exploitation and Protection of Hydraulic Works
- Decree No. 149/2004/ND-CP dated 27/07/2004 of the Government on the issuing of permits for water resource exploration, exploitation and use, or for discharge of wastewater into water sources.
- Decree No. 154/2007/ND-CP dated 15/10/2007 of the Government modifying and supplementing some articles of Decree No. 143/2003/ND-CP dated 28/11/2003 detailing the implementation of a number of articles of the Ordinance on exploitation and protection of irrigation works.
- Decree No. 162/2003/ND-CP dated 19/12/2003 of the Government promulgating the Regulation on collection, management, exploitation and use of data and information on water resource
- Decree No. 179/1999/ND-CP dated 30/12/1999 of the Government stipulating the implementation of the Law on Water Resources
- Decree No. 34 /2005/ ND-CP dated 17/03/2005 of the Government on sanctions against administrative violations of water resources management regulations
- Direction No. 81/2007/TT-BNN dated 02/10/2007 about the implementation of National target program on rural clean water and sanitation
- Directions No. 02/2004/CT-BTNMT dated 02/06/2004 of the Ministry of Natural Resources and Environment about the reinforcement of ground water resource management
- Decree No115/2008/NĐ-CP dated 14/11/2008 on the revision and supplement some articles of the Decree No 143/2003/NĐ-CP dated 28/11/2003 on the impenetation of some articles of the Ordinance on Hydraulic works operation and protection.
- Decree No 67/2003/NĐ-CP dated 13/6/2003 of the Government on environment protection fee for wastewater.
- Inter ministerial circular No 125/2003/TTLT-BTC-BTNMT dated 18/12/2003 between MoF and MoNRE to guide the implementation of the Decree No 67/2003/NĐ-CP dated 13/6/2003 of the Government on environment protection fee for wastewater.

- The revised Law on Land
- Forestry protection Law

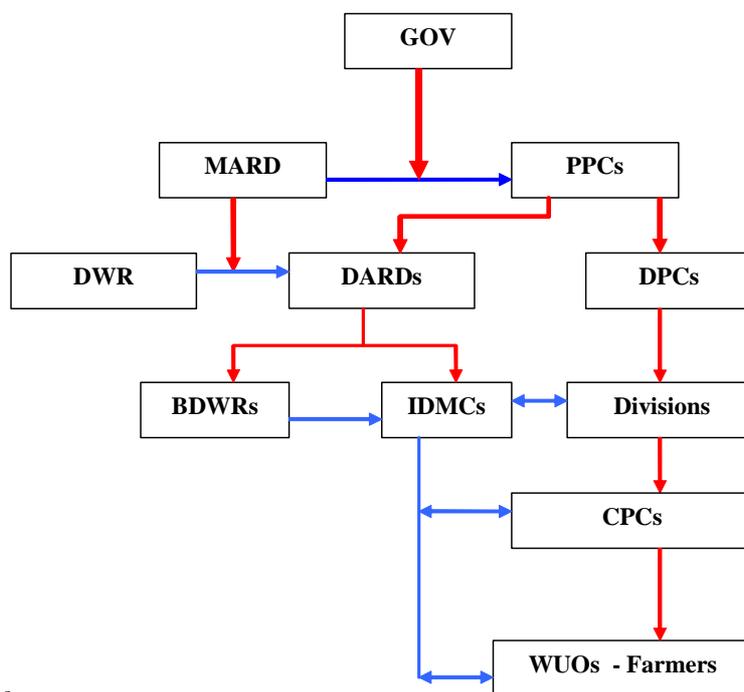
1. Irrigation management

State management function on irrigation and drainage management is given to MARD by the Government in accordance with Decree No. 01/2008/ND-CP dated 3 January 2008 on functions, tasks, powers and organizational structure of MARD. 11 functions and tasks regarding irrigation, flood, dyke, salt intrusion are stipulated in Article 2, Paragraph 9 of this Decree.

Current system of state management role of various agencies on irrigation and drainage is presented in the below diagram.

Management and operation of the irrigation & drainage systems are divided into two levels (i) The irrigation and drainage enterprises called irrigation and drainage management companies (IDMC) at main level of the system and (ii) The water user organizations (WUO) at low level. Up to now, there are 128 IDMCs in Vietnam. Almost IDMCs are state enterprises operated following the regime of a state owned enterprise (SOE) providing public services. However in recent years, there was several IDMCs has been changed into one member limited state companies (Thai Nguyen, Yen Bai, Phu Tho, Lang Son, Thua Thien Hue provinces) or joint stock company (Son La, Soc Trang and Vinh Long provinces). Annually, PPC assign irrigation and drainage targets together with budget. As a result of the Decree 154/2007/ND-CP, now 100% of the IDMC's financial source is provided from government budget.

Almost IDMCs manage headworks, main canals, and main structures, secondary and lower level canals are managed by WUOs. However, some WUOs can manage the entire irrigation schemes that are usually in mountainous locals with rather small scope, independent like in Tuyen Quang, Lao Cai.



Legend:



Direct relation (Personnel Management)



Professional relation (exchange information, reference, technical assists, etc.)

According to scope and importance the IDMCs has been classified into district, inter-district, provincial and central (MARD) levels as summarized in table bellow.

Table : Number of IDMCs at various levels

No	Region	IDMC level				
		Total	District	Inter district	Provincial	Ministry (MARD)
1	North mountainous	16	5	5	6	
2	Red river Plain	67	53	11	1	2
3	Northern Central	20	8	9	3	
4	Central costal	7	0	2	5	
5	Central High Land	4	0	0	4	
6	Southern East	7	0	0	6	1

7	Cuu Long River Plain	7	0	0	7	
	Total	128	66	27	32	3

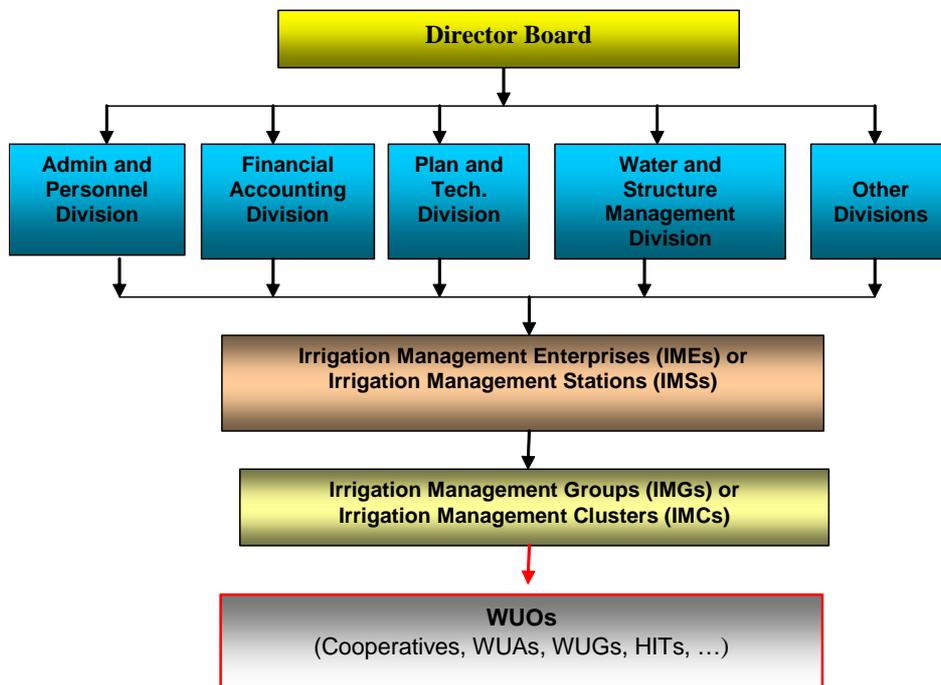
As can be seen from the above table, district and inter district level IDMCs are main types of IDMCs (89/128). This type IDMCs are mostly allocated in North region (mountainous, Red river plain, northern Central provinces) of which most in Red river plain area (64/89). Meanwhile 32 provincial level IDMCs are allocated rather steady in all 7 regions. IDMCs are concentrated with biggest amount in 3 regions having big plains including Red river, Cuu Long river and Northern Central (94/128) this show that state investment in irrigation is prioritized for food production.

Generally, an IDMC consists of (i) Head office including directorship and some specific divisions assisting the directorship in regular operations of the Company. Head office is also a clue unit connecting the company and other agencies in or out province such as DARD, DOF, DOM, PPC, consultant and research agencies, etc. related to irrigation services management (ii) Implementation component including irrigation management enterprises (IMEs) or irrigation management stations (IMs) under is irrigation management groups (IMGs) or irrigation management clusters (IMCs).

Besides four basic specific divisions including Administration and Organization, Finance and Accounting, Planning and Technical, and Water & Structure Management Divisions, in some IDMCs have also other divisions such as Project Management Unit, Design and Investigation Unit, Civil Works Unit, etc.

Number of staff and workers of an IDMC depends on tasks given and area irrigated. Normally, this number varies from hundred to several hundred. Number of staff of each IME, IMG is also different from one by one.

Common form of IDMC organization structure is presented in following chart:



Typical organizational structure of IDMC

The structure shows that irrigation management is still not closed, because WUOs are not included with IDMC organizational structure, however, WUOs are considered as voluntary organizations of farmers. This loose relationship leads to a gap between provider (IDMC) and water users, that causes water loss in irrigation water distribution process. These are considered as issues that IDMCs are facing.

In recent years, Vinh Phuc is first province improving relationship between IDMC and Cooperatives through way of paying salary for some cooperative's key staff responsible for irrigation management at on-farm level. These staff are considered as unofficial staff of IDMCs. As reported by Vinh Phuc DARD, in this way the irrigation service of IDMCs became better, more effective and efficient.

2. Fishery management

The fisheries sector in Vietnam has been growing considerably, strongly promoted by the government for hunger and poverty reduction. The sector provides about half of the supply of animal protein to the human diet. Total earnings make it the third most important export-oriented sector. More than three million people are directly employed and nearly 10% of the population derive its main income from fisheries.

Aquaculture has grown significantly in recent years, averaging over 12% annual growth since 1990, contributing more than 40% of total fishery production with a value in 2003 of 15,400 billion VND. In terms of aquaculture production, the freshwater sub-sector remains dominant at approximately 65-70%.

The household remains dominant for both capture fishing and aquaculture, and in 2001 these represented the main business of 4.3% of households and the primary employment of 5.1% of the national labour force. Most fishers and those involved in aquaculture are small-scale producers – 77% of households conducting aquaculture have under 0.1 ha of pond area and another 7% between 0.1 ha to 0.2 ha. More recently some cooperatives have been established. The biggest source of fishing and aquaculture income is generated within the Mekong Delta, where between 60% and 70% of households are involved in some form of aquaculture, involving employment for over 600,000 workers. Shrimp aquaculture accounts for more than half of this.

The value of production of aquaculture in river basins varies considerably – from 15,300 VND/m³ of water used in the Kone basin and 12,400 VND/m³ in the Gianh, to a low of 3,800 VND/m³ of water used in the Cuu Long. In terms of returns per areas of aquaculture, the Tra Khuc has the highest value at 198 million VND/ha and the Cuu Long at 93 million VND/ ha. Of some 400 registered processing plants, about 80% are in the south, 12% in the central region, and 8% in the north. The emergence of food safety requirements as barriers to accessing international markets has significantly shaped the industry structure. The United States and the European Union rules are increasingly strict and producers have to quickly adapt.

The targets for fisheries and aquaculture show that significantly greater export income (50% increase) is expected to be generated from only a small increase in total fisheries exploitation, in line with the focus on efficiency and effectiveness of the sector. The area under aquaculture is expected to almost double over the five years to 2010, which is expected to generate about a 50% increase in production.

Issues of fishery and aquaculture

(1) Performance of the State Fisheries Enterprises is a major issue for the sector – they are inefficient operators providing relatively small return for their investment. As well, they have very poor environmental performance, particularly for wastewater management. Equitisation has been slow and most equitised enterprises are small. Institutional issues are also significant. There is somewhat

of a conflict in terms of the natural resources issues as both fish exploitation and conservation are both functions of one organisation. A further issue is the relationship with MONRE which is the independent regulator for environmental protection and natural resource use.

(2) Information, research and capacity building: The subjects of environment management and conservation of fisheries resources is not well understood. Vocational training is a major limitation, a factor contributing to the lack of skilled local level workers and poor quality of services to the aquaculture sector.

3. Policies on water for food

A detailed review of relevant legal documents related to water resource for food can be found in Annex 2.

Concerning the water for agriculture (so for food), the Law on Water Resource regulates that: “Organizations and individuals that exploit and use water resource have the rights to exploit and use water resource for purposes of living, agricultural, forestry, and industrial production, mining, electricity generating, water transport, aquaculture, sea fishery, salt making, sport, recreation, tourism, medicine, health rehabilitation, scientific research and other purposes as prescribed by this Law and other provisions of law”. But this law underlines at the same time that: “The State shall invest in and support the exploitation and use of water resources for agricultural production”. *These are fundamental principles for the exploitation and use of water resources for agricultural production.*

As mentioned above, agriculture sector is the largest user of water but according to the Decree No 179/1999/ND-CP regulating the implementation of the Law on Water Resource, in times of drought or in cases of water shortage, water for food production is positioned only at 4th place among 5 priorities after water for domestic use, for breeding and for important industrial sites and scientific research.

About water quality for agriculture, the section 3 of the article 26 of the Law on Water Resource regulates that: “Organizations and individuals can only exploit and use waste water after ensuring that the quality of water meets the prescriptions of the competent State agency for agricultural production”.

About the protection of water resources, the Law on Water Resources regulates that next to the rights to exploit and use water resource, the users have responsibility to protect water sources. For example, the Law defines that: “Organisations and individuals that exploit and use the water source must comply with the regulations on prevention and combat against deterioration and depletion of the water source (article 11), the planning and management of the...concentrated population areas, major livestock raising and slaughtering areas..., must comply with the provisions of this Law and the legislation on the protection of the environment and ensure against pollution of the water source (article 13), Organisations and individuals using chemicals in agricultural production, raising aquatic and marine products must not cause pollution of the water source.(Article 15) and Organisations and individuals exploiting and using water resource for agricultural production must take measures to save water, prevent and combat acidity and salinity of water, slushiness and erosion without polluting the water source (Article 26).

Concerning financial aspect, the Law on Water Resources specifies that: “The organizations and individuals who exploit and use water resource have the financial duty and the duty to contribute manpower and budget to the building of works for the protection, exploitation and use of water resource, the prevention, fight and overcoming of the harm caused by water” (article 7). This regulation has been concretized in some legal document, such as: Decree No. 154/2007/ND-CP dated 15/10/2007 of the Government modifying and supplementing some articles of Decree No. 143/2003/ND-CP dated 28/11/2003 detailing the implementation of a number of articles of the Ordinance on exploitation and protection of irrigation works. Decree 04/2007/ND-CP dated 08/01/2007 supplementing decree 67/2003/ND-CP dated 13/6/2003 on environmental protection charges applicable to wastewater, Decree 34/2005/ND-CP dated 17/03/2005 on sanctions against administrative violations of water resources management regulations (circular guiding the implementation No. 05/2005/TT-BTNMT dated 22/07/2005)...etc

The item 1 of the article 14 of the Ordinance on Hydraulic Works exploitation and protection stipulates that:

Organization, individual use water and water services from hydraulic works for agriculture purpose should be pay water fee at the rate identified in the

Decree No 154/2007/NĐ-CP and Decree No 115/2008/NĐ-CP for water fee abolishment for agriculture, forestry, aquaculture. We would say that this policy of will assist the farmer and help them to improve their life and the welfare of th society. However, this Decree also made a lot of debates nationally and internationally, they said that the water fee abolishment would make the farmer forgetting their responsibility to maintaine and protect hydraulic works and more relied on the Government while the Company will receive subsidy from the Government so that the responsibility for the works will also reduce leading uneffective system operation and quick degradation of the works.

4. Water related policies on environment and ecosystem

MoNRE has primary responsibility for environmental management on behalf of the Government and people of Viet Nam. MoNRE administers the Law on Environmental Protection (LEP), the LWR, the Land Law (LL), and will also be responsible for the forthcoming Law on Biodiversity. The Provincial governments also administer these Acts, under delegation.

A detailed review of Law on Environmental Protection and its links to water resouce management can be found in Annex 2.

The Law on Environmental Protection 2005 regulates activities that ‘illegally exploit, or cause damage to, natural resources’ including surface water and groundwater resources, and water related environments; mandates the integration of environmental protection with development strategies and plans of all Government bodies and the PPCs; and manages development projects and existing establishments in accordance with their potential environmental impacts. The LEP specifically provides for the management of chemical, biological and nuclear substances and activities, and of industrial parks, export-processing zones and urban centres, service units, etc, and provides the framework for managing the impacts of all types of solid, liquid and air borne waste. Most importantly, the country’s environmental impact assessment and reporting framework and practices comes under the LEP, as does the rehabilitation of polluted and degraded areas, and the response to environmental pollution incidents. The LEP provides for environmental standards, environmental monitoring and assessment, and management of environmental information, as well as State of the Environment reporting. The LEP prohibits the discharge of wastes to water sources which are not at the environmental standards; and the discharge of

toxic, radioactive and other hazardous substances to water sources. The LEP provides regulations on water quality management and river water protection. The LWR requires the licensing of point source wastewater discharge to water resources, in theory including both surface waters and groundwater. The LL requires the reasonable exploitation of natural resources and the protection of the environment in all land use zoning and planning activities as a basis for land allocation.

Although these laws provide a sound basis for water and environmental management, the application and enforcement of the Laws in pollution control and environmental degradation is still limited and under development. Currently, very few enterprises comply with the legal requirements. The LEP provides a comprehensive basis for managing environmental quality. However, it is a relatively new Law and its implementation is not well advanced. Many of its provisions are new and guidelines on their application are being developed. As well, the LEP is not well known or understood in the community.

Other Government strategies and directions critical to environmental water management include the National Strategy for Environmental Protection 2001-2010, the National Water Resources Strategy, and the Government Directive on Strengthening Environmental protection in the period of National Industrialisation and Modernisation. A number of water related targets on environmental values have been incorporated into these government approved national strategies. Some specific targets include raising the quality of water in river basins to the standards of water used for agriculture, improving conditions for some aquatic animals, to restore 50% of the mineral-exploiting areas and 40% of the seriously deteriorated ecological systems, to raise the forest coverage to 43% of the total land area, to restore 50% of the deteriorated head-water forests, to increase the total acreage of nature conservation zones by 1.5 times the current level, and to restore the acreage of submerged forests to 80% of 1990' level.

Prime Minister's Decision No. 64/2003 approved the plan for thoroughly handling establishments which cause serious environmental pollution. The Decision identified 4,295 polluting establishments, with the worst of these, 439 in total, to be dealt with in Stage 1 (2003–2007). These included immediately dealing with the 51 highest priority polluting establishments (29 production businesses, 3 toxic chemical storage zones, 1 wartime bomb warehouse, 15 plant protection chemical warehouses and 3 rubbish dumps); preparing plans to handle the remaining 388 establishments

including upgrading technologies at 55 establishments, building waste treatment works at 200 establishments, controlling pollution, renovating and building pollution treatment systems at 49 former and existing rubbish dumps, and treating environmental pollution at 84 hospitals. Stage II (2008 - 2012) is to continue handling the remaining 3,856 establishments causing serious environmental pollution. However at the end of Stage I, only around 63% of the listed black spots have been resolved.

The government has acknowledged the role and importance of economic measures in environmental protection. Decree No. 67/2003 seeks to use pollutions charges to limit the environmental pollution caused by wastewater, to use clean water economically and to create a funding source for the Environmental Protection Fund, used to protect the environment and address the environmental pollution. The People's Councils decides on the specific rates of the environmental protection charges for domestic wastewater, but the rate must not exceed 10% of the non-VAT clean water selling price. The Finance Ministry coordinates with MoNRE in prescribing the charge rate for each pollutant in industrial wastewater. The Central budget receives 50% of the income which is added to the operation capital of the Viet Nam Environmental Protection Fund under Prime Minister's Decision No. 82/2002. The local authorities receive the other 50% to be used for environmental protection, new investment projects, sewerage, dredging, and repair and maintenance of local water drainage systems. The Environment Protection Fund provides finance for environmental protection nationwide (but not for profit). Since 2004, 13 projects have borrowed funds under preferential interest rates³.

The fee is not applied uniformly and not all provinces apply the fee. For example in 2005 provinces/cities in the Dong Nai River basin and the Cau and Day/Nhue sub-basins collected over VND 132 billion; from which the industrial wastewater fee was around VND 13.4 billion (10.2%) and the domestic wastewater fee around VND 118.7 billion (89.8%). However, the amount of fees collected is much lower than estimated.

In the 39 provinces that responded to a MoNRE survey, 198 licences have been issued for wastewater discharge to water sources under the LWR. Many provinces have not issued any such licences. In total these provinces estimate that in excess of

³ Environmental Monitor 2006, World Bank (2007)

another 2,700 wastewater discharge licences are required. Again, this is likely to be an underestimation of the requirement.

Integrated coastal zone management (ICZM) is recognised to be a high priority. With the establishment of MONRE, an Integrated Coastal Zone Management (ICZM) Division has been created within the Viet Nam Environment Protection Authority. This new division collaborates with other departments to develop ICZM schemes for coastal areas with the aim of protecting the fragile coastal areas. The ICZM Division plans to implement ICZM practices in 40% of the coastal provinces by 2008 and in all 29 coastal provinces by 2013. Over the last five years, MoNRE has made strong initial achievements such as constituting ICZM models from central to grassroots levels, and publishing the Atlas of Viet Nam's Coastal Zone as reference materials for environmentalists and local authorities in their decision making process.

The existing information and reporting system in Viet Nam comprises of a national network of environmental monitoring stations, as well as provincial level environmental monitoring. Monitoring of the water resources involves a number of ministries and agencies. The National Center of Hydrology and Meteorology within MONRE maintains a network of 235 hydrological monitoring stations responsibility for processing data lies with nine hydro-meteorological regional centres. MONRE maintains a National Groundwater Monitoring Network with 310 regional monitoring stations and more than 600 observation wells across Viet Nam. MoNRE also monitors ambient water quality but this network is not extensive and often only one or two readings a year are taken. Biological monitoring is extremely limited and localised. The Fisheries Department within MARD monitors water quality in aquaculture areas, and MOH is responsible for monitoring quality of drinking water.

Viet Nam ratified the RAMSAR Convention on September 20, 1988, and joined in 1989 as the 50th member - the first in South-east Asia. Two wetlands are recognised as RAMSAR sites – the Xuan Thuy in the Red River Delta and the newly established Bau Sau in Cat Tien National Park. At a recent meeting on biodiversity in six wetland areas in North Viet Nam, BirdLife International reported that Viet Nam has up to 25 wetland areas that meet the standards set out under the RAMSAR Convention. However, nomination under an international convention does not

necessarily mean greater environmental protection. For example a 2007 study⁴ of the Xuan Thuy Natural Wetland Reserve assessed the effectiveness of the Ramsar Convention by examining total mangrove extent, fragmentation, and density, as well as aquaculture extent following Ramsar nomination. The study found that although mangrove extent remained fairly constant since Viet Nam became a signatory to Ramsar, mangrove fragmentation increased, suggesting disruption to the natural habitat. The researchers found that the Ramsar site actually experienced a faster aquaculture conversion rate than the nearby Tien Hai Nature Reserve, a non-Ramsar site. The researchers concluded that without clear protection measures or proper protection of mangroves, the Ramsar Convention had limited impact at the site.

The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP) is a joint programme of the four riparian governments of the Lower Mekong Basin - Cambodia, Lao PDR, Thailand and Viet Nam - managed by the United Nations Development Programme (UNDP), the World Conservation Union (IUCN) and the Mekong River Commission (MRC), in collaboration with other key stakeholders. The programme tries to address the most critical issues for the conservation and sustainable use of natural resources in the Mekong wetlands.

⁴ Seto, K.C., and Fragkias, M. (2007). Mangrove conversion and aquaculture development in Viet Nam: A remote sensing-based approach for evaluating the Ramsar convention on Wetlands. *Global Environmental Change*, 17: 486-500. doi:10.1016/j.gloenvcha.2007.03.001

5. Policies on water related ecosystem

Water for ecosystems means the demands on quantity and quality of water (water is not polluted) which ensure the health and the development of ecosystems. Among existing legal documents on water resources, **the Decree 109/2003/ND-CP** dated 23/09/2003 relates directly to water for ecosystem issues. This decree focus on the conservation and sustainable development of wetlands. According to the Decree “Sustainable development of submerged areas means activities of rationally using and exploiting potentials for economic, cultural and social development within the allowed limit so as to maintain ecological functions and protect the environment in submerged areas”⁵. The Decree also specifies that it’s necessary to link the use and exploitation to conservation, maintaining water sources and ecological balance. Concerning the responsibility of organizations and individuals carrying out activities of agricultural cultivation and of aquaculture in submerged areas, the Decree highlights that:

- To restrict the use of chemical fertilizers, chemicals and plant protection drugs in cultivation, thus degenerating, deteriorating and depleting submerged land, especially coastal estuary land.

- The State encourages the use of organic fertilizers and microbiological fertilizers as well as the application of farming methods which do not cause adverse impacts on the ecological systems and bio-diversity of submerged areas.

- To encourage the application of the aqua-cultural forms which do not cause adverse impacts on the environment, combine industrial aquaculture with ecological aquaculture and aquaculture after the forestry-fishery or agriculture-fishery models.

- To restrict concentrated industrial aquaculture covering too large acreage in submerged areas which need to be conserved and sustainability developed.

A part from Decree 109/2003/ND-CP, there are some legal documents indirectly related to water for ecosystems issue (through regulations on water quality and quantity conservation), such as: Law on environmental protection – chapter VII regulates the main principles on the protection of marine, river and other water source environments as well as on investigation, quantification, assessment, prevention, control and treatment of water pollution. These contents has been concretized in

⁵ Section 2, article 3, Decree 109/2003/ND-CP dated 23/09/2003

different documents, such as: Decree No. 04/2007/NĐ-CP dated 08/01/2007, supplementing decree 67/2003/NĐ-CP dated 13/6/2003 on environmental protection charges applicable to wastewater, Decree No. 34 /2005/ ND-CP dated 17/03/2005 of the Government on sanctions against administrative violations of water resources management regulations (circular associated guiding the implementation No. 05/2005/TT-BTNMT dated 22/07/2005), Decree No. 149/2004/ND-CP dated 27/07/2004 of the Government on the issuing of permits for water resource exploration, exploitation and use, or for discharge of wastewater into water sources (circular associated guiding the implementation No 02/2005/TT-BTNMT dated 24/06/2005). In addition, some other documents also mention more or less about the protection of water sources environment, such as: Ordinance on Exploitation and Protection of Hydraulic Works, Law on inland waterway transportation and Fisheries Law, etc. According to the Ordinance on Exploitation and Protection of Hydraulic Works: “Irrigation works” mean infrastructure works built to tap the water’s usefulness; to prevent and combat harms caused by water, **protect the environment and balance the ecology**, which include: reservoirs, dams, sluices, pumping stations, wells, penstocks, canals, works on canals and embankments of all types. Concerning the protection of water sources, the chapter 17 and chapter 19 of this Ordinance specifies that, organizations and individuals who exploit and use irrigational works must protect water sources and meet the requirements for preventing and combating the degradation, depletion and pollution of water resources as well as other harms caused by water.

National Strategy on water resources to 2020 and its implication to water-food production and ecosystem interaction

Among existing legal documents on water resources, the **National Strategy on water resources to 2020** is the most important document in terms of water for ecosystems. That has been showed in one of the main guiding principles of this Strategy “The management, protection and development of water resources must ensure the systematism of river basins, not be divided by administrative boundaries and concurrently ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic

ecosystems”. These principles are concretized in the objectives related to water sources protection as following:

- To revitalize rivers, reservoirs, water-bearing beds and submerged areas, which are seriously polluted, degraded or exhausted, giving priority to rivers in the basins of Nhue and Day rivers, Cau river, Dong Nai and Sai Gon rivers as well as Huong river;

- To ensure the minimum water flow for maintenance of aquatic ecosystems under plannings approved by competent authorities, focusing on rivers with big and important reservoirs and dams.

- To protect the integrity of submerged lands and estuaries and use them efficiently for key rivers and important water-bearing beds;

- To put an end to the exploration, exploitation and use of water resources and the discharge of wastewater into water sources without permission of competent agencies according to the provisions of law;

- To control the pollution of water sources. To put an end to the use of toxic chemicals in industrial and agricultural production and aquaculture, which pollute water sources and decrease biodiversity;

- To thriftily and efficiently exploit and use water resources. To ensure that the exploitation of water shall not exceed the exploitation limits, for rivers or the exploitable deposits, for water-bearing beds;

- To distribute and share water resources in a harmonious and rational manner between branches and localities, giving priority to the use of water for daily life and for high economic benefits, ensuring environmental flows.

Concerning the Law on Water Resource, the river basin management approach has been mentioned but the integrated management concept and the interaction between water for food and ecosystems concept have not been existed in this document. That is partly proved by the inexistence of the notion ecosystem in the Law on water resources. In other word, the concept of “water resource is a part of ecosystem” doesn’t exist in this Law. That may cause important consequences such as many socio-economic projects have been approved and implemented without necessary attention to ensure the sustainability of water resources and to protect the aquatic ecosystems.

Approved in 2006 (8 years later after the approval of the Law on water resources), the *National Strategy on Water Resources up to 2020* has made good partly shortcomings of the Law on Water Resource, in particular in terms of water for ecosystems and of integrated management approach. Theoretically, this Strategy has met almost of principles of good international Integrated Water Resources Management practices. For example: concerning water for nature, according to the Strategy: Water resources constitute a major component of the living environment and the exploitation and use of water have to ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic ecosystems. The strategy also considers water resources as commodities and has intention to eliminate the subsidy mechanism as well as socializes the protection and development of water resources and the provision of water services. Concerning the institutional roles, the Strategy has identified the need to *formulate in a coordinated manner and ensure effectiveness of the system of state management of water resources at all levels; to clearly distinguish functions and tasks of state management agencies in charge of water resources from those of agencies managing the operation of works for exploitation and use of water resources and provision of water services and to amend and supplement the Law on Water Resources and other relevant legal documents in order to meet the requirement of integrated and uniform management of water resources; shift from the mode of administrative and subsidy management and demand satisfaction to the mode of demand management, considering water products a commodity.*

However, the implementation of the coordination effort of state management function in water resources in relation to food and ecosystem still faces a numbers of impediments.

Water quality deterioration is probably the greatest single environmental issue facing Viet Nam. The human health and livelihood consequences of pollution of surface waters and groundwater are significant but poorly understood. Once polluted, waters are extremely difficult and costly to clean up, and the impacts on dependent ecosystems, as well as dependent social and economic values, will be felt for a long time by the entire community, but particularly by poor and vulnerable communities that have a direct dependency on these resources in their natural state. The water

quality impacts of the various sectors are discussed in the following sections for each sector.

Inadequate, inaccurate and incomprehensive information and data on environment and water resources, and constraints on information sharing, is a major issue that is seriously impeding management progress. The current condition of national water and related resources has not been fully assessed, and the data are not reliable and comprehensive. Data and necessary information on water resources and water related environments, and the trend relating to these, are the basis for making socio-economic development plans but are not adequate and are infrequently updated. Water quality, ecology and groundwater information are particularly absent. Systems for providing data and information and reporting on the condition and health of water resources and their related environments, on water exploitation and use, do not support management needs.

River Basin Planning. As previously discussed, a suitable model for integrated river basin management has not been established, either institutionally or in practice. Integrated river basin management does not only cover quantity and quality of water resources but also such issues as the protection of water dependent environments and ecological assets. The impacts on water quantity, quality, and dependent ecosystems, and the consequent impacts on social and economic values dependent on these have been significant, and continue to increase. These are often best considered on a river basin basis.

Environmental impact assessment and regulation remains inadequate from a water resource and related environments perspective. The impacts of developments and activities are not adequately quantified, particularly early in the planning process, and the capacity to assess EIAs is low. There are no guidelines to help developers prepare their proposals in such a way as to protect water sources, nor to assist provincial staff consider the water related impacts of developments. The prevention or mitigation of impacts is generally not managed through a regulatory instrument such as a licence, and few developments are inspected, or made to take action to remedy impacts on water resources and related environments. The impacts of activities on groundwater resources (upon which so much of the population depends) are rarely considered.

Integrating environment into development planning. Despite the requirements of the Law on Environmental protection, strategic environmental assessment of sector

and provincial development plans is not formally undertaken, and consideration of the impacts of these on water resources and related environments is generally poor.

Forest systems: The degradation of forest areas has a significant impact on the quality and quantity of water resources, particularly where the forests are in significant upland catchment areas. The continued loss of native forests is a concern, particularly if they are replaced by plantations. Between 1992 and 2002, forest losses due to fire averaged 6,000 hectares annually. In the three years to 2005, MARD reports that authorities uncovered 134,000 cases of crime related to the prevention and control of forest fire rules and thousands of hectares of forests are degraded every year.

Conflicts between water use and environmental protection. There are many examples of conflicts between water development and use and environmental protection in Viet Nam, reflecting the lack of integrated planning that currently exists. The U Minh Thuong National Park, in Kien Giang Province plays a crucial role in supplying water to surrounding rice fields, especially during the dry season. A system of sluice gates regulates water flow from the park. The dry season of 2002 was particularly acute - crop losses were considerable and demands for water from U Minh Thuong placed additional pressure on the park's water management regime. The peat swamps became progressively drier during March 2002 and a fire spread to much of the park's forests, destroying a large part and of the peat that had been so effective in regulating water release.

Changes in the hydrological regime of river systems due to construction of dams for irrigation and hydropower causes loss of migrating routes for many fish species like the Clupanodon thrissa in the Red River and eels *Anguilla* spp. in various other rivers.

Environmental flows. Viet Nam is currently undertaking critical first steps towards the realisation of environmental flows in its river systems, but more sophisticated approaches need to be developed and taken. The goal of environmental flows is to provide a flow regime that is adequate in terms of quantity, quality and timing for sustaining the fundamental health of rivers and other aquatic ecosystems. The degree of 'good health' at which a river will be sustained is, however, a societal judgment that will vary from country to country and region to region, and this will determine appropriate environmental flows. Environmental flow assessments require the integration of a range of disciplines, including engineering, law, ecology,

economics, hydrology, political science and communications. It also requires negotiations in a river basin context between stakeholders to bridge the different interests that compete for the use of water, especially in those basins where competition is already fierce.

Freshwater wetlands: Rapid loss of wetlands continues. River ecosystems suffer from industrial and domestic pollution, dredging, damming, destructive fishing practices, and the clearance of fringing habitats. For example, in the 19th Century, the Mekong Delta was a mosaic of wetlands and forests spanning over 3.9 million ha. Today, the region has been converted to rice farming, shrimp ponds, and other human uses with natural freshwater wetlands reduced to a few isolated fragments that are unsuitable for agriculture, mainly in areas of acid sulphate soils. These remaining wetlands are under intense human pressure, and some will be lost if present trends continue.

Freshwater biodiversity is being damaged by domestic and industrial water pollution, dam and road construction, dredging, destructive fisheries techniques, aquaculture and over-fishing.

Coastal and marine ecosystems. Over the last 50 years of development, Viet Nam has lost more than 80% of mangrove forest. The surge in shrimp farming emerges as one of the leading causes of mangrove forest destruction. Other causes for mangrove losses include conversion to agricultural and construction lands, war destruction, fuel wood collection. The loss of mangrove forest area is largest in the Mekong (Cuu Long) Delta, Quang Ninh and Hai Phong provinces.

Protected Areas (Natural Parks, Nature Reserves, Wetlands): Encroachment of local communities onto forest land and clearance of land for shifting cultivation has affected biodiversity and river water downstream. Local people living in the buffer zone of the national park/Nature Reserves are a concern to forest resources. While the collection of forest products is a major source of income for the inhabitants of the buffer zone, natural habitats are threatened.

Unsustainable tourism development represents a further threat to biodiversity at Nature Reserves/Nature Parks. In addition to infrastructure development, visitors increase the risk of forest fire and especially cause pollution of both surface water and groundwater.

Administrative reforms at the central level have not yet progressed down to the provincial level where there have been no moves toward IWRM and there is a severe

lack of direction and capacity for water resource and environmental management. Coordination and collaboration among these agencies will require management and strong leadership from MONRE.

6. Analysis of some key policies related to water resource for food and ecosystem in according with the Integrated Water Resource Management approach

According to the Global Water Partnership, “Integrated Water Resources Management is a process, which promotes the coordination development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. (GWP, 2000-website IWRM Vietnam). This is a cross sectorial policy approach which is opposite of the fragmented sectorial approach that has led to poor services and unsustainable resource use. (see figure 4.1.)

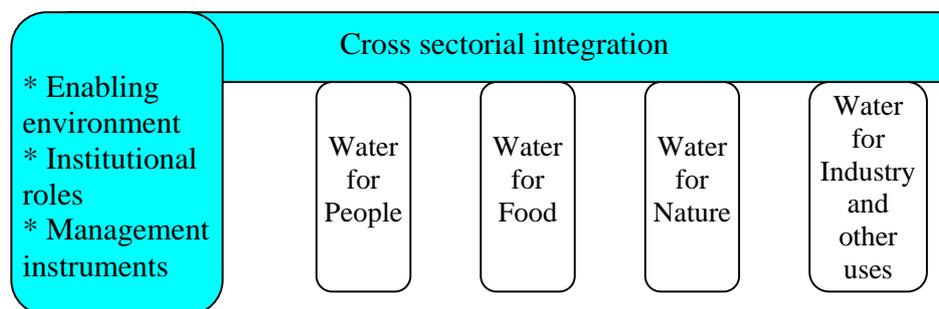
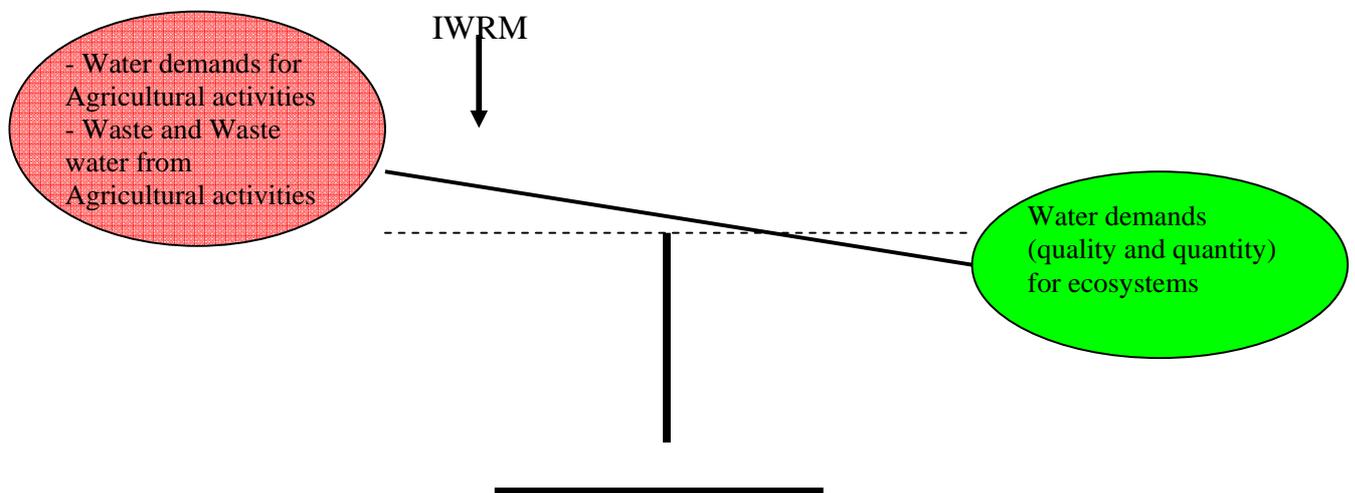


Figure: IWRM is a cross sectorial approach (GWP, 2000)

Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good. Integrated water resources management, including the integration of land and water-related aspects, should be carried out at the level of the catchment basin or sub-basin. So, the IWRM approach includes two scopes: the space (river basin management) and the purposes of use (multipurposes for multi sectors). This approach ensures the sustainability and the rationality in the use of water resources. As part of the project

“Water for food and ecosystem”, this research focus only on the relation between water, food and ecosystem or in other hand on the interaction between water for agriculture and for ecosystem in the existing policies and related legal documents, under an integrated management approach.

As we aware, water resource is a limited source while the demands increase more and more. Among different economic sectors, agriculture is the biggest user of water resource with an average rate of from 70% to 80% of global water use. In Vietnam, the annual demand on water use of agricultural activities was at about 75% in 2001 and estimated at 88% in 2010⁶. It means that more water resource is used for agriculture less water for domestic needs and industrial use and particularity for ecosystems. In addition, more agricultural sector develops more the quantity of wastewater discharged in the nature is important. In other words, the development of agriculture can degrade the water sources and cause negative impacts for ecosystems. According to the above analysis, water for food and ecosystem is part of the Integrated water resources management approach. In other word, the Integrated management approach is one solution which ensures the balance between the development of agricultural sector and the conservation of ecosystems.



⁶ Website IWRM Vietnam

Figure 4.2. The balance between water for food and ecosystems

In the legal documents system on water resource of Vietnam, there are some documents regulating the water for agriculture and for ecosystems issues (maintenance of the minimum water flow or conservation of water quality...). These documents mention, generally, the right of agriculture sector to use water resource and request at the same time the responsibility to protect water sources. However, almost related documents don't mention clearly in detail both issues: water for food and water for ecosystems. In particular, the sharing mechanism on water resource in general and between agriculture and ecosystem in this case is very limited in the existing legal document system on water resource. It's only undertaken during the dry season.

Water for agriculture

Concerning the water for agriculture (so for food), the Law on Water Resource regulates that: “**Organizations and individuals** that exploit and use water resource **have the rights to exploit and use water resource for** purposes of living, **agricultural**, forestry, and industrial production, mining, electricity generating, water transport, aquaculture, sea fishery, salt making, sport, recreation, tourism, medicine, health rehabilitation, scientific research and other purposes as prescribed by this Law and other provisions of law”. But this law underlines at the same time that: “The State shall invest in and support the exploitation and use of water resources for agricultural production”. These are fundamental principles for the exploitation and use of water resources for agricultural production.

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the conservation and sustainable development of wetlands. According to the Decree “Sustainable development of submerged areas means activities of rationally using and exploiting potentials for economic, cultural and social development within the allowed limit so as to maintain ecological functions and protect the environment in submerged areas”⁷. The Decree also specifies that it’s necessary to link the use and exploitation to conservation, maintaining water sources and ecological balance. Concerning the responsibility of organizations and individuals carrying out activities of agricultural cultivation and of aquaculture in submerged areas, the Decree highlights that:

- To restrict the use of chemical fertilizers, chemicals and plant protection drugs in cultivation, thus degenerating, deteriorating and depleting submerged land, especially coastal estuary land.
- The State encourages the use of organic fertilizers and microbiological fertilizers as well as the application of farming methods which do not cause adverse impacts on the ecological systems and bio-diversity of submerged areas.
- To encourage the application of the aqua-cultural forms which do not cause adverse impacts on the environment, combine industrial aquaculture with ecological aquaculture and aquaculture after the forestry-fishery or agriculture-fishery models.
- To restrict concentrated industrial aquaculture covering too large acreage in submerged areas which need to be conserved and sustainability developed.

A part from Decree 109/2003/ND-CP, there are some legal documents indirectly related to water for ecosystems issue (through regulations on water quality and quantity conservation), such as: Law on environmental protection – chapter VII regulates the main principles on the protection of marine, river and other water source environments as well as on investigation, quantification, assessment, prevention, control and treatment of water pollution. These contents has been concretized in different documents, such as: Decree No. 04/2007/ND-CP dated 08/01/2007, supplementing decree 67/2003/ND-CP dated 13/6/2003 on environmental protection charges applicable to wastewater, Decree No. 34 /2005/ ND-CP dated 17/03/2005 of the Government on sanctions against administrative violations of water resources

⁷ Section 2, article 3, Decree 109/2003/ND-CP dated 23/09/2003

management regulations (circular associated guiding the implementation No. 05/2005/TT-BTNMT dated 22/07/2005), Decree No. 149/2004/ND-CP dated 27/07/2004 of the Government on the issuing of permits for water resource exploration, exploitation and use, or for discharge of wastewater into water sources (circular associated guiding the implementation No 02/2005/TT-BTNMT dated 24/06/2005). In addition, some other documents also mention more or less about the protection of water sources environment, such as: Ordinance on Exploitation and Protection of Hydraulic Works, Law on inland waterway transportation and Fisheries Law, etc. According to the Ordinance on Exploitation and Protection of Hydraulic Works: “Irrigation works” mean infrastructure works built to tap the water’s usefulness; to prevent and combat harms caused by water, **protect the environment and balance the ecology**, which include: reservoirs, dams, sluices, pumping stations, wells, penstocks, canals, works on canals and embankments of all types. Concerning the protection of water sources, the chapter 17 and chapter 19 of this Ordinance specifies that, organizations and individuals who exploit and use irrigational works must protect water sources and meet the requirements for preventing and combating the degradation, depletion and pollution of water resources as well as other harms caused by water.

Among existing legal documents on water resources, the National Strategy on water resources to 2020 is the most important document in terms of water for ecosystems. That has been showed in one of the main guiding principles of this Strategy “The management, protection and development of water resources must ensure the systematism of river basins, not be divided by administrative boundaries and concurrently ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic ecosystems”. These principles are concritized in the objectives related to water sources protection as flowing:

- To revitalize rivers, reservoirs, water-bearing beds and submerged areas, which are seriously polluted, degraded or exhausted, giving priority to rivers in the basins of Nhue and Day rivers, Cau river, Dong Nai and Sai Gon rivers as well as Huong river;

- To ensure the minimum water flow for maintenance of aquatic ecosystems under plannings approved by competent authorities, focusing on rivers with big and important reservoirs and dams.
- To protect the integrity of submerged lands and estuaries and use them efficiently for key rivers and important water-bearing beds;
- To put an end to the exploration, exploitation and use of water resources and the discharge of wastewater into water sources without permission of competent agencies according to the provisions of law;
- To control the pollution of water sources. To put an end to the use of toxic chemicals in industrial and agricultural production and aquaculture, which pollute water sources and decrease biodiversity;
- To thriftily and efficiently exploit and use water resources. To ensure that the exploitation of water shall not exceed the exploitation limits, for rivers or the exploitable deposits, for water-bearing beds;
- To distribute and share water resources in a harmonious and rational manner between branches and localities, giving priority to the use of water for daily life and for high economic benefits, ensuring environmental flows.

Concerning the Law on Water Resource, the river basin management approach has been mentioned but the integrated management concept and the interaction between water for food and ecosystems concept have not been existed in this document. That is partly proved by the inexistence of the notion ecosystem in the Law on water resources. In other word, the concept of “water resource is a part of ecosystem” doesn’t exist in this Law. That may cause important consequences such as many socio-economic projects have been approved and implemented without necessary attention to ensure the sustainability of water resources and to protect the aquatic ecosystems.

Approved in 2006 (8 years later after the approval of the Law on water resources), the National Strategy on Water Resources up to 2020 has made good partly shortcomings of the Law on Water Resource, in particular in terms of water for ecosystems and of integrated management approach. Theoretically, this Strategy has met almost of principles of good international Integrated Water Resources Management practices. For example: concerning water for nature, according to the Strategy: Water resources constitute a major component of the living environment and

the exploitation and use of water have to ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic ecosystems. The strategy also considers water resources as commodities and has intention to eliminate the subsidy mechanism as well as socializes the protection and development of water resources and the provision of water services. Concerning the institutional roles, the Strategy has identified the need to: To formulate in a coordinated manner and ensure effectiveness of the system of state management of water resources at all levels; to clearly distinguish functions and tasks of state management agencies in charge of water resources from those of agencies managing the operation of works for exploitation and use of water resources and provision of water services and to amend and supplement the Law on Water Resources and other relevant legal documents in order to meet the requirement of integrated and uniform management of water resources; shift from the mode of administrative and subsidy management and demand satisfaction to the mode of demand management, considering water products a commodity.

Conclusions:

Up to 2008, Vietnam has had a relatively comprehensive system of legislations and policies related to water resources management with 7 Laws, 3 Ordinances, 18 Decrees, 14 Decisions, 6 Circulars and some other Directions. Vietnam has also an organization structure system for the management of water resources. However, there are still some limits concerning policy aspect as well as organizational structure aspect. For example: according to the Law on water resources and the National Strategy on water resources up to 2020, the water resources management has to be conducted by the river basins approach and not by administrative boundary. The article 64 of this Law has also mentioned the establishment of the agencies managing the planning of the river basins. However, the article 54 of the same law assigns the tasks and responsibilities on water resources management for the administrative agencies from national level to local level. This paradox and some other gaps of the related institutional system has obstructed the implementation of the integrated water resources management principles (such as water sharing between sectors, between

upstream and down stream areas, between water for industry, agriculture...and for maintenance of the minimum water flow for ecosystems...)

Even has been mentioned in different legal documents, the integrated water resources management approach has not been really implemented in Vietnam. In fact, almost of projects related to water resources has been implemented independently by some ministries, sectors or agencies without participation or with limited participation of other related ministries, sectors, agencies and concerned stakeholders. These projects have always focused on one or two objectives and have paid little attention to the needs of the rivers or aquifers for their long-term viability, nor measures to protect the fundamental health of water sources. Cumulative impacts of developments have also not been considered. For example, according to the National Water Resources Strategy up to 2020 “Some hydropower reservoirs are only operated to increase electricity output, with no consideration of the flows required to supply water for downstream needs and protecting the environment other reservoirs only focus on supplying irrigation water”.

The water sharing in general and water sharing between agricultural sector and ecosystem in particular has not been mentioned clearly and concretely in legal documents on water resources. That is one gap needing to be improved.

The enhancement of the participation of social organizations and communities in elaboration, inspection and supervision of the implementation of river basin planning and projects on water resources is a new and very good point of the National Strategy on water resources up to 2020. However, this policy has not been concretized in the existing legal document system on water resources (for example, how to participate? what are the roles of communities and social organizations?..)

As we known all, Vietnam is one of five countries which are most influenced by climate change. This phenomenon will surely impact heavily on water resources in general and on water for food and ecosystem issue in particular. So that we need to invest on the research on impacts of climate change on different sectors, of which water resources, as well as to propose appropriate policies in order to adapt and mitigate potential impacts of climate change.

In the context where more than 60% of surface water of Vietnam originates from outside of the country, the international cooperation on water resources plays a very important role. Actually, the international relation on water resources has been

established for the Mekong delta. However, there has not been any mechanism or structure at national level on international cooperation for other big river basins, in particular the Red River basin.

References

to be completed!!!!

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Annexes

Annex 1 - Functions and roles of different ministries, sectors and organizations related to water resource management

State management of water resource – Ministry of Natural Resource and Environment (MONRE)

According to Decree No. 25/2008/ND-CP, MONRE functions to perform state management of water resources including the grant of permits of exploiting water resources and discharging sewage to water sources and supplying water to meet requirement of economic branches, namely:

- a) To direct, guide and organize the implementation of legal documents, mechanisms and policies on water resources after they are promulgated by competent authorities;
- b) To direct, guide and examine the implementation of strategies, master plans on water resources and overall programs and plans on prevention and control of degradation and exhaustion of water resources and integrated use and sustainable development of water resources after they are approved by the Prime Minister;
- c) To assume the prime responsibility for formulating master plans and plans on management and measures for using water resources for sustainable development and multi-purpose use, and proactive prevention and control of the degradation and exhaustion of water sources;
- d) To decide on the classification and listing of water resources (rivers, lakes, streams and other forms of natural reservoirs); to set and announce manufacturer standards or submit to the Minister of Science and Technology for promulgation of national standards; to formulate and promulgate according to its competence national technical regulations on the use and conservation of water resources according to Clause 3 of this Article;
- đ) To guide and examine the implementation of the law on setting water exploitation limits for rivers, layers of water, water reserve areas, and areas where underground water exploitation is restricted; to assume the prime responsibility for, and coordinate with concerned agencies in guiding and examining the implementation of the plan on balancing and allocating water resources among branches and localities regionally and nationally;

- e) To build, manage and exploit a water resources observation network; to organize basic surveys on and inventory and assessment of water resources nationwide; to notify branches, localities of water source potential so that they can adopt master plans and plans to use water rationally, economically and efficiently;
- g) To appraise master plans on exploitation and use of water, and projects on regulating water between rivers formulated by ministries, branches and localities before they are submitted to competent authorities for approval according to law;
- h) To assume the prime responsibility for, or coordinate with concerned agencies in, elaborating and promulgating according to its competence or submitting to competent authorities for promulgation of mechanisms, policies, taxes, fees, charges, other revenues and forms of incentive related to the exploitation, use and conservation of water resources;
- i) To guide, examine and organize the grant and withdrawal of water resources permits according to law;
- k) To take measures on conservation of water sources, prevention and control of water source, and restoration of degraded or exhausted water sources after they are approved by the Prime Minister;
- l) To act as the key agency and take the prime responsibility for proposing to the Prime Minister international cooperation in the water resources domain; to guide and examine the implementation of treaties to which the Socialist Republic of Vietnam has signed or acceded in order to ensure sustainable development, fairness and rationality in exploiting and using international water sources; to exchange information concerning international water sources; to assume the prime responsibility for, and coordinate with concerned agencies in, settling disputes over international water sources;
- m) To act as a standing member of the National Water Resources Council and the Vietnam Mekong River Commission.

Department of Water Resources Management

Basing on the above functions, the Minister of Natural Resources and Environment assigned Department of Water Resources Management to assist MoNRE to implement state management of water resources as the following tasks (through Decision No. 1035/QĐ-BTNMT dated May 19th, 2008):

- a) To set and submit the Minister legal documents, policies, strategies, long-term plan, five-year plan and annual plan, program and objective of protection, exploitation, utilization, development of water resources; to monitor and inspect the implementation after being approved by authorised state agencies;
- b) To set and submit the Minister process, procedures, standards, norms of economy and technique of water resources management which are assigned by Ministry; to direct and inspect the implementation after being approved by the Minister;
- c) To set and submit the Minister rules of assignment, decentralization of baseline survey on water resources; to conduct, monitor and examine implementation after approved by authorised state agencies;
- d) To set and submit the Minister rules of measures for water resources protection, prevention and control of degradation, exhaustion and pollution of water resources, restoration of water sources in order to improve efficiency of integrated management of river basins, reservoirs, water layers, appropriate, economical, safe, sustainable exploitation and utilization of water resources; to monitor and inspect the implementation after being approved by the Minister;
- đ) To cooperate with agencies of MONRE, other ministries, branches, localities concerning prevention and control harmful effect caused by water;
- e) To synthesize data, manage results of baseline surveys, inventory, water resources assessment; to build database and national system for exchanging information of water resources in accordance with assignment by Ministry;
- f) To set and submit the Minister rules of authorities, procedures of grant, extension and withdrawal of permits of survey, prospect, exploitation, utilization of water resources; to organize, direct and inspect the implementation after being approved by authorised state agencies;
- g) To consider and decide projects, constructions of water resources baseline survey, planning, plan, project specialized in protection, exploitation, utilization and integrated development of water resources according to assignment by Ministry; to inspect the implementation after being approved ;
- h) To submit the Minister decisions on policies, measures, specific operation mechanism for public service agencies of water resources sector; to direct and inspect the implementation assigned by Ministry;

- i) To direct and guide profession, skill of water resources management for state management agencies of water resources at localities;
- k) To conduct international cooperation in water resources sector assign by Ministry;
- l) To implement programs, projects, researching subjects, application of advanced science, technology, training, capacity development of profession, skill of water resources management assigned by Ministry;
- m) To propagand, guide organizations and citizens to comply with the Law on Water Resources; to response organizations, individuals about policies, legislation of water resources according to assignment by Ministry;
- n) To maintain relationship with associations, non-governmental organizations; to monitor and report the Minister about activities of associations, non-governmental organizations in water resources sector;
- o) To undertake tasks of the Office of National Water Resources Council in water resources sector;
- p) To implement inspection and collaboration with inspector of Ministry, settle complaints, accusations, disputes in water resources according to assignment by Ministry;

Specialized divisions of People’s Committees of all levels for water resources

According to Clause 5 of Article II of Joint Circular No. 03/2008/TTLT-BTNMT-BNV dated July 15th, 2008, agencies specialized in natural resources of People’s Committees of all levels have functions, tasks, powers concerning water resources as follows:

- a) To assume the prime responsibility and cooperate with concerned agencies to make planning, plans of management, utilization, protection of water resources, prevention and control degradation and exhaustion of water resources; to conduct implementation after it is approved;
- b) To consider and decide programs, projects of water exploitation and utilization, water movement among river basins under authorized approvals of Provincial People’s Committees;
- c) To conduct to define limits of water exploitation of rivers, water layers, water storage areas, stricted water exploitation areas; to plan regulation, allocation of water resources in an area;

- d) To organize consideration and decision on extension files, period changes, content modification, suspension of effect and withdrawal of permits of prospect, exploitation, water utilization, waste water discharge to water source, underground water drilling profession depending on authorities; to undertake grant of permits and collect fees, charges of water resources complying with legal rules; to examine and inspect activities about water resources stipulated in permits;
- đ) To organize baseline survey, inventory, keeping of water resources data in an areas; to conduct management, exploitation of water resoutces observation structures constructed by localities;
- e) To synthesize situation of water exploitation and utilization, sewage discharge point to local water source; to list polluted, degraded, exhausted water sources;
- g) To guide and inspect well backfilling out of legal rules;
- h) To participate inter-branch cooperation organizations of central government, permanent inter-branch cooperation organizations of localities for management, exploitation and protection of water sources of river basin;

National Water Resources Council

The National Water Resource Council has the task of giving consultancy to and assisting the Government in making important decisions concerning the water resource within the ambit of the latter's tasks and powers.

Consultancy on the national strategy and policies on water resource;

Consultancy on examining and approving the planning on the basins of major rivers;

Consultancy on the shifting of water among the basins of major rivers;

Consultancy on the projects of protecting, exploiting and using the water resource decided by the Government; preventing, fighting and overcoming the aftermath of floods and other damages caused by water;

Consultancy on the management, protection, exploitation and use of international water resources and settling disputes arising there from;

Consultancy on the settlement of disputes concerning water resources among the ministries and branches and between the ministries and branches on one side and the People's Committees of the provinces and centrally-run cities on the other and among the provinces and centrally-run cities.

Ministry of Agriculture and Rural Development

Ministry of Agriculture and Rural Development (MARD) is a governmental agency performing state management functions in the fields of agriculture, forestry, salt production, water resources and rural development nationwide, including state management functions with regard to delivery of public services and management of the State's ownership of rural state owned enterprises in accordance with legal documents (Decree 01/2008/NĐ-CP). Of which, the state management functions in the fields of agriculture, forestry, water resources and rural development directly relate to the water resources usage and management. This leads to the fundamental relation between MARD and MONRE.

In details: (item 8, article 2, Decree 01/2008/NĐ-CP)

- a) Guide and introduce the legal documents on water resources, dyke maintenance; on prevention and mitigation of water logging risks following guidelines issued by authorized levels;
- b) Guide and introduce strategies on water resource planning, natural disaster mitigation following approval by the Prime Minister;
- c) Take a lead in making regional plan on water resource development, reservoirs for agriculture and for multi-purposes of socio-economic sectors;
- d) Approve the relevant dyke and water resources planning of more than two provinces for prevention and resistance of floods, drainage, water supply, of droughts, salt penetrating, soil improvement, riverside breaking, rural water supply;
- đ) Publicize and organize to guide, instruct, M&E, review the reports on the approved water resources development plans nationwide;
- e) Consult to the Prime Minister and organize to implement measures on mobilizing materials and facilities to prevent, resist and overcome difficulties after floods, droughts; to treat irrigation construction breakdowns and other negative impacts by water; take a lead in flood division, slowing down, operation of large reservoirs and inter-reservoirs as decentralized;
- g) Guide the decentralization to provincial People's committee to approve irrigation planning, dyke planning and flood resistance plans within the boundary of the province;

- h) Issue, monitor and follow the implementation of natural technical standards, regulations and techno economic norms on construction, exploitation and protection of irrigation systems, dykes resistance of floods, storms, droughts and rural water supply and drainage;
- i) Regulate a permitted load and license to vehicles transporting on dykes; guide provincial People's committee to issue, revoke or extent licenses within the boundary of irrigation system protection;
- k) Organize, guide, instruct and monitor the implementation of specific regulations regarding urgent situations of flood division, slowing down, moving people to safer places to ensure living and production of local people, overcome consequences of floods, subsidies to effected people, measures on prevention, resistance and mitigation of natural disasters like storms, floods, droughts, land breaking, salty penetrating, tidal and Tsunami;

The Department of Water Resources is one agency belongs to MARD, performing the state management mandates regarding water resources sub-sector nationwide (according to the Decision 25/2008/QĐ-BNN, dated 28th January 2008)

DWR is assigned by the Minister to perform the state management mandates in terms of irrigation planning, exploitation and usages of irrigation systems, river development, and management work of prevention, resistance of droughts, water supply and drainage works and rural water supply within the MARD's state management scope. The DWR's mandates relating to water resources management are as follows:

Basic survey and irrigation planning management (*according to item 5, article II*):

- a) To preside over, organize to develop and appraise basic surveys, planning projects, adjust regional/inter-provincial irrigation plans, irrigation schemes serving irrigation, for multi purposes related to socio-economic sectors, prevent damages caused by flooding, drought, saline intrusion;
- b) To manage the results of basic irrigation surveys according to the legal regulations;
- c) To preside over, organize to appraise plans on protection, exploitation and utilization of integrated water resources and protection, prevention of damages caused by water for regions, inter-regions, inter-provinces, and irrigation system planning;

d) To conduct, guide, check, evaluate the implementation of strategies, plans, projects on irrigation development after approval.

Investment and construction management (upgrading, repairing rural irrigation, drainage, water supply and sanitation schemes) (*according to item 6, article 2*):

a) To preside over, organize to appraise, submit to the Ministry for approval of work construction investment projects or technical-economic reports and approval of adjustments on work construction investment projects or technical-economic reports relating to construction investment projects for upgrading, repairing irrigation schemes, rural water supply and sanitation schemes as designated by the Minister; to direct, organize and implement the tasks of the investment owner of construction investment projects for upgrading, repairing irrigation schemes, rural water supply and sanitation schemes according to regulations;

b) To preside over, organize to appraise, submit to the Ministry for approval of tender plans, tendered evaluation results, procurement of goods related to projects under its management according to regulations;

c) To preside over, organize to appraise or sign technical agreements for irrigation construction investment projects (upgrading, repairing) belonging to Group B within the state governance scope of the Ministry that are invested in by localities as decentralized by the Ministry;

d) To preside over, organize to appraise and give decisions on approval of tender documents of projects on upgrading, repairing irrigation schemes, rural water supply schemes as assigned to manage by the Minister (except for projects of which investment owners are authorized by the Minister in the decision on approval of tender plan), tendering results of contract packages as decentralized and tender plans approved by the Ministry;

đ) To preside over, organize to appraise and guide the implementation of small and medium hydro-electric projects, rural water supply and drainage projects within the governance scope of the Ministry in accordance with legal regulations;

e) To coordinate with the Financial Department to appraise, submit to the Ministry for approval of final payment of irrigation construction projects, rural water supply and sanitation projects as designated by the Minister;

g) To guide the implementation of making, submitting, archives of works construction documents, papers according to regulations of the State.

Management, exploitation, utilization and protection of irrigation, water supply and drainage, rural water supply and sanitation schemes (*according to item 7, article 2*):

- a) To develop, submit to authorized levels for issuance of national technical standards, techno-economic norms related to exploitation and protection of irrigation schemes, water supply and sanitation schemes, water quality management of the system of irrigation schemes; to organize, direct, guide, check the implementation of the above regulations once they are approved;
- b) To preside over, organize to make, submit to the Ministry for approval of water regulating procedures for hydrological, irrigation reservoirs, the inter-reservoir operation procedures within the state governance of the Ministry;
- c) To issue, withdraw, extend licenses for activities that must have licenses within the scope of protecting irrigation schemes, discharging waste water into irrigation schemes system according to legal regulations;
- d) To direct the implementation of plans on construction, exploitation management, utilization and protection of rural water supply and drainage schemes;
- đ) To preside over to make, submit to the Ministry the policies on water resources protection, prevention of water resources depletion; ensure the safety of reservoirs; construct and protect irrigation schemes; prevent water pollution; exploit, use the integrated water resources economically, safely and effectively; tackle arisen conflicts according to legal regulations;
- e) To direct, summarize the development and implementation of management models of irrigation, rural water supply, drainage and sanitation schemes.

Manage the prevention of damages caused by water (according to item 8, article 2): :

- a) To submit to the Ministry methods of mobilizing resources, materials, means for protection, prevention and repairing consequences of droughts, flooding, salinity, water pollution for irrigation schemes; repair the breakdowns of irrigation schemes;
- b) To organize, direct, guide, check the protection, prevention, overcoming consequences caused by droughts, flooding, salinity, repairing breakdowns of irrigation schemes to serve production, overcome consequences of flooding, droughts, saline intrusion and reduce water pollution for irrigation schemes.

Department of Dyke Management, Flood and Storm Control (according to article 2, item 5b, Decision 94 /2003/QĐ-BNN dated on 4th September, 2003)

- To propose to the Central Steering Committee on Flood and Storm Control to regulate floods for Hoa Binh, Thac Ba reservoirs, deflect floods for Day River and regulate floods for other rivers in cases where floods exceed design level;
- To organize, manage, operate the Day river flood deflection head works; implement flood deflection at the request of the authorized levels;

Ministry of Planning and Investment (MPI)

is Responsible for allocation of resources between the sectors, receiving ODA funds and direct investment from the annual allocation (including national and international sources) in the sectors, including the water sector (*According to the Decree No. 61/2003/NĐ-CP on the functions, duties, authority and organization structure of the MPI*).

Ministry of Finance (MOF)

participates in fund allocation, management and annual financing balance account to the sectors according to the allocated plans.

(According to the Decree No. 77/2003/NĐ-CP of 01 July 2003 on the functions, duties, authority and organization structure of the MOF).

Ministry of Construction (MOC)

has responsibilities for urban water supply and drainage (According to the Decree No. 17/2008/NĐ-CP of 04/02/2008 on the functions, duties, authority and organization structure of the MOC).

Ministry of Science and Technology (MOST)

is Responsible for regulating water quality standards, ensuring compliance with environmental standards through the environmental impact assessment (EIA) process, and investigating environmental issues (*According to the Decree No. 28/2008/NĐ-CP of 28/03/2008 on the functions, duties, authority and organization structure of the MOST*).

Ministry of Health (MOH)

is Responsible for water quality particular drinking water standards and regulation (According to the Decree No. 188/2007/NĐ-CP of 27/12/2007 on the functions, duties, authority and organization structure of the MOH).

Ministry of Transportation (MOT)

is Responsible for river channels and water transportation (According to the Decree No. 34/2003/NĐ-CP of 04/04/2003 on the functions, duties, authority and organization structure of the MOT).

The Electricity of Vietnam(EVN)

is Responsible for hydropower generation, coordinating with MARD to issue operational regulations and protocols for reservoirs. (*According to the Decision No. 74-CP of 1 November 1995 on the functions, duties, authority and organization structure of EVN*).

Planning Management Council for River Basins

In the beginning, the Planning Management Council for River Basins depended on the MARD. However, Since 15 March, 2007, the Government Office decided to transfer the responsibility of river basins management from MARD to MONRE.

The management of the river basin planning comprises the following:

- a) To elaborate , submit for approval and follow the implementation of the planning of the river basin, to ensure the unified management of the planning combined with the administrative zoning;
- b) To conduct the co-ordination with the concerned agencies of the Ministries, branches and localities in the basic survey, inventorying and evaluation of the water resource of the river basin, and in the elaboration, submission for approval and monitoring of the implementation of the planning of the basins of the affluences;
- c) To suggest the settlement of disputes on water resource in the river basin.

Vietnam National Mekong River Committee

Vietnam National Mekong Committee headed by the Minister of MONRE, is responsible to assist the Prime Minister in directing, managing all corporation activities with the Mekong River Commission and to submit for the Government's consideration all policies on the Mekong corporation with the aim to soundly developing, using and protecting the water and related resources of whole Mekong basin in general and of the Mekong Delta and the Central Highlands in particular.

According to the Decision No. 860/Ttg of 30 December, 1995, the Vietnam National Mekong Committee has the following duties and powers:

- To cooperate with the member countries in elaborating and implementing the Agreement on the Cooperation for Sustainable Development of the Mekong River Basin;
- To survey, monitor and manage water and related resources in the Mekong river basin, to protect the interests of Vietnam through the Basin Development Plan and the Mekong basin-wide projects, especially the mainstream projects;
- To cooperate with the co-basin countries, other countries, NGOs, international organizations and the ministries, agencies at the ministerial equivalent level, the Government's organs and local People's Committees concerned for proposing and the Mekong projects with the aim to protecting and developing the Mekong Delta and the Central Highlands;
- To define, together with the member countries and the Mekong Secretariat, procedures for management and implementation of the international Mekong projects;
- To take part, together with the Minister of Planning and Investment, Ministry of Finance and specific ministries, in allocating national counterpart budget for the national and the basin-wide projects which are of Vietnam in the Mekong cooperation; to be allowed in taking part in appraisal of plans and projects concerned in the Mekong basin of sectors and provinces in the Mekong Delta and the Central Highlands;
- To attend in meetings of the Mekong River Commission and to report the results of these meetings to the Prime Minister;
- To be allowed in requesting the sector, provinces to inform results of meetings of the Greater Mekong Sub-region consisting of the six countries in the Mekong basin which related to the Committees activities. To take part in the GMS's activities as assigned by the Prime Minister.

Annex 2 – Review of some key legal documents and of some other important documents related to water resource management

Law on Water Resource

Law on Water Resources is a legal document of the highest validity in the field of water resources in Vietnam. This Law was issued on 20/5/1998 by the National Assembly of the Socialist Republic of Vietnam. The Law stipulates the management, protection, exploitation, utilization of water resources, prevention and overcoming negative consequences caused by water. The Law includes 10 Chapters with 75 articles of which Chapters II and III have the important content concerning the protection, exploitation and utilization of water resources. Chapters VII, VIII, IX, X focus on other issues concerning management, organization, inspection, incentives and punishments in relation to water resources. In the following texts, we analyse some contents directly related to water for foods and eco-systems from the point of view of the integrated water resources management approach:

In the Item 1, Article 5 of Chapter I, the Law on Water Resources stresses the protection, exploitation, utilization of water resources, prevention and overcoming negative consequences caused by water must follow the river basin planning, ensure the systematic character of the river basin, not be divided according to administrative boundary. In other words, water resources management needs to be implemented in an integrated approach – river basin management approach.

This can be one of new and most important points of the Law on Water Resources. This help to manage the water resources integratedly and ensure the sustainability and equality in exploiting, using water resources by beneficiaries, sectors, regions in a basin.

About the ownership of water resource, according to this Law, the water resource comes under the ownership of the entire people under the unified management of the State. Organizations and individuals are entitled to exploit and use the water resource for life and production. At the same time they have the responsibility to protect the water resource, prevent, combat and overcome the harmful effect caused by water.

About the protection of water resource: the chapter II of the Law assigns that all Organizations and individuals must have the responsibility to protect water

resource. And the State needs to have plans to protect and develop upstream forests and other forests, build water conservancy projects, prevent water pollution, restore the deteriorated and depleted water source.

To protect and conserve the water quality, the Law assigns that:

- organisations and individuals who exploit water resource, must not discharge unprocessed waste water or waste water processed not up to the permissible standards into the water source leading to the pollution of the water source. They must have permission of the competence State agencies and must have to pay the fee for permit issuing, the fee for discharging waste water into water sources as prescribed by law (*for details, see Decree No. 04/2007/ND-CP*).

- and all plan of socio-economic development of the whole country and in each locality, must have a plan to prevent and fight against water pollution and restore the quality of the polluted water source.

Concerning the conservation of water reserves, the Law assigns that: organizations and individuals must exploit and use water rationally and economically in order to protect the water resource. Organizations and individuals use one important quantity of water for business, services, industry...must comply with the order and norms on technical safety, prevention against the deterioration and depletion of underground water source and against causing serious depression of the ground surface.

About the exploitation and use of water resource

One of the main principles of the exploitation and use of water resource is presented in the article 20 of the Law on water resource, that is: “The regulation and distribution of water resource for use purposes must be based on the planning of the river basin and the real potential of the water source and must ensure the principle of fairness, reasonability, and priority in the quantity and quality of water for living”.

This Law assigns the right to exploit and use water resource for purposes of living, agricultural, forestry, and industrial production, mining, electricity generating, water transport, aquaculture, sea fishery, salt making, sport, recreation, tourism, medicine, health rehabilitation, scientific research and other purposes as prescribed by this Law and other provisions of law. But at the same time, the Law requests that these exploitation and use must be in accordance with the approval river basin plans and

that, organizations and individuals⁸ exploit and use water resource must have the permission of the competence State agencies.

The Law on water resource defines also the responsibilities of organizations and individuals who exploit and use water resource, those are: To fully carry out the provisions of law on water resource; To use water for the right purposes, economically, safely and efficiently; To supply information with a view to inventor and evaluate water resource when requested; Not to cause obstruction or damage to the legitimate exploitation and use of water resource by other organizations and individuals; To protect the water resource under exploitation and use; To fulfill their financial obligation, to compensate for the damage caused by themselves in the exploitation and use of water resource as prescribed by law.

About the prevention, control and overcoming of the consequences causing by flood and other harmful effects of water

The chapter IV of the Law on water resource concerns the prevention, control and overcoming of the consequences causing by flood and other harmful effects of water, such as: drought, saline intrusion, rising and spill of sea water, hail and acid rain. Among these issues, the law concentrates deeply and more in details on the prevention, control and overcoming of the consequences causing by flood. That is comprehensible because flood is the most dangerous natural disaster and occurs frequently in Vietnam. As the subject of this report focus on water for food and ecosystems, we have not analyzed deeply the issues related to disasters or harmful effects of water. The details of the flood prevention and control are concritized in the Ordinance on Storm and Flood Control.

Comments: according to the article 37: “The State managing agency on water resource has the duty to set the norms for preventing and fighting floods in each area of the river basin ”. In the reality, MONRE ensures the State management on water resource but MARD is in charge of flood and storm prevention and control and so in charge of setting of the norms for preventing and fighting floods. This is one more inappropriate point of the Law on water resource in comparison with the reality and other existing legal documents.

⁸ Apart from small exploitation and use of : sources of surface water and underground water of small scale for the family needs or of rain water, surface water and surface sea water on the land already assigned or leased according to prescriptions of law

About the exploitation and protection of water conservancy works

According to the Law on water resources, water conservancy works: “is a works for the exploitation of the benefits of water, preventing and fighting against the harmful effect caused by water and protecting the environment and the ecological balance”. So, a rational exploitation and use of water conservancy works is a part of water resource management. That improves the efficiency of water use, especially for agriculture and ecosystem. For ...the chapter V of the Law on water resource defines the rules of duties of the users, of protection solutions, of the area of protection of the water conservancy works include the works itself and the neighboring areas and of the forbidden acts. The details about the exploitation and protection of water conservancy works and dyke are concretized in the Ordinance on Dyke, No. 20/2000/ PL-UBTVQH 10 and the Ordinance on Exploitation and Protection of Hydraulic Works, No. 32/2001/PL-UBTVQH 10.

About the international cooperation in water resource

The two biggest Rivers in Vietnam is Cuu Long River and Hong River. Both of them flow from oversea countries (Hong River from from southwestern China and Cuu Long –or Mekong- River from the Tibetan Plateau). That explains partly why the more than 60% of Viet Nam surface water generated outside the country. In this context, the international co-operation policies of on water resources is very important. A sound and rational policy will facilitate and improve efficiently the integrated water resource management in the whole river basin. For Vietnam, the main principles applied for international co-operation on water resource are:

- Respect for the sovereignty, territorial integrity, and interests of the countries sharing the same source of water;
- Ensuring justice, reasonability, mutual benefit and sustainable development in exploiting and use of international water sources;
- Not to harm the rights and interests of the countries sharing the same source of water in conformity with the international conventions which the Socialist Republic of Vietnam has signed or acceded to;
- Observance of Vietnamese law and implementation of the international conventions which the Socialist republic of Vietnam has signed or acceded to; and respect for international law.

Management competence of the State on water resource

Chapter VII of the Law on Water Resource concerns the State management of water resource, including: the contents of the State management of water resource (that was mentioned in the section 3 about the functions and roles of ministries, sectors and organizations in water resource management), Management competence of the State on water resource, Competence in ratifying the general planning and projects on water resource, Basic survey, inventory and evaluation of water resource, Competence in issuing and revoking permits on water resource, Settling disputes on water resource, National Water Resource Council, Management of the river basin planning and Guiding and commanding the prevention, combating and overcoming the consequence of floods.

The Law on water resource was issued in 1998 and until now it has not been reviewed while there were important changes in organization structure and legal documents related to water management (for example: the creation of Ministry of Natural Resources and Environment in 2002). This has created some inappropriate points with the reality. For example: Article 58 of this Law assigns MARD as responsible Ministry for the State management on water resource or in accordance with Article 59, MARD shall ratify the general planning on river basins, the general planning on water conservancy, however, these responsibilities and tasks were assigned to Ministry of Natural Resources and Environment. That can create some difficulties (caused by misunderstanding, overlap) for the implementation of regulations and policies on water resource.

Law on Environmental protection

In the Law on Environmental protection, there are two chapters which concern directly the water resource management issue: Chapter VII and chapter VIII.

The chapter VII of the Law on Environmental protection includes 3 sections about the protection of marine, river and other water source environments. These sections relate to the protection and conservation principles of water resources as well as the control and treatment of water pollution. In which, these following points are emphasised:

- the protection and conservation of marine, river and other water source environments must be integrated in the master plans of related areas and regions as well as connected closely with the integrated natural resources management.

- manufacturing, business, services, domestic, construction, transportation, exploitation...activities on the marine areas, river basin areas must be realized in accordance with the approved master plan of related areas and must comply with the environmental regulations and other relevant laws. These activities need also preventive solutions and responses to stop and reduce the negative impacts for environment, in particular the water environment. Owners of important projects or of projects which has potentially important impacts for marine, river and other water source environments must prepare environmental impact assessment reports in accordance with the law.

- Waste sources of above activities must be investigated, quantified and assessed, and control and treatment measures must be applied in accordance with the existing regulations. The details about discharge of wastewater into water sources are defined in the Decree No. 149/2004/ND-CP of 27/07/2004.

Concerning the Organization of water environmental protection, the MONRE is responsible for the direction and the instruction of the implementation of. The related Provincial People's Committees (PPP) must organize directly and co-ordinate with relevant bodies and other Provincial People's Committees (Provincial people's committees in upstream localities shall co-ordinate with people's committees in downstream localities) to control the pollution, to investigate and identify, water pollution sources, to evaluate the damages and to apply the necessary measures (for compensation and treatment).

Finally, the section 4 of the chapter VIII is the concretization of the waste water management, including: Collection and treatment of waste water and Waste water treatment systems

National Strategy on Water Resources to 2020

On april 14th 2006, the Prime Minister of Vietnam issued the Decision No. 81/2006/QD-TTg approving the National Strategy on Water Resources to 2020. This strategy is a very important document and makes a turning-point of water resources management in Vietnam. The strategy has introduced, in comparision with existing related legal documents, new options and approachs towards the Integrated Water Resources Management. The general objectives of the strategy are: To protect, efficiently exploit and sustainability develop national water resources; to take

initiative in prevention, mitigation and minimization of harms caused by water; to step by step create a multi-sector water economy; to raise international cooperation efficiency on water resources.

Concerning the content, there are three main parts in this strategy: (i) Viewpoints and guideline principles; Objectives (including specific objectives on water resources protection, exploitation and use of water resource, water resources development, minimization of harms caused by water and improvement of water resource-management capacity); (iii) Major tasks and solutions (in which each task is determined in correspondence with specific objective and the solutions include: communication and education, enhancement of public awareness and encourage participation of communities, enhancement of legislation, increase of investment and boost of the socialization of water services, development of human resource and of science and technology, expansion and raise of the effect of international cooperation and reform of financial mechanisms).

For the implementation of the strategy, there are two main key organizations. They are:

- Ministry of Natural Resources and Environment has the responsibility to direct, organize, review, inventory and assess (conduct annual preliminary reviews and five-year final review, assessment of, and draw experience) the implementation of this strategy and to direct the review, inventory, assessment, direct and coordinate with relevant ministries, branches and localities in the execution of priority investment projects and schemes
- National Water Resource Council has the responsibility to advise the Government and the Prime Minister on making important decision and taking appropriate measures on water resource during the implementation of this strategy.

The National Strategy on Water Resources to 2020 has five main viewpoints on water resources. Apart from some similar viewpoints with the Law on Water Resources such as the ownership and the management of water resources on the basis of river basins, this strategy proposes some new viewpoints, as following:

- All organizations and individuals have the right to exploit and use water resources to meet their daily-life and production demands, and have also the responsibility to protect and develop water resources in a sustainable manner,

- The water use structure must conform to economic restructuring in the period of accelerated national industrialization and modernization,
- Water resources must be developed in a sustainable manner; exploited and used thriftily, efficiently, in an integrated manner and for multi-purposes. Water products must be considered commodities; subsidy mechanism must be soon eliminated and the protection and development of water resources and the provision of water services be socialized.

In addition, the Strategy insists that the equity and rationality principle in cooperation and sharing of benefits must be applied not only for the prevention and mitigation of harms caused by water but also for the exploitation, use, protection and development of water resources. Particularly, according to this Strategy “**Water resources constitute a major component of the living environment**, a particularly important element to ensure the successful implementation of socio-economic development strategies, planning and plans as well as the maintenance of national defense and security”.

One other new point of the National Strategy on Water Resources relates to the water for ecosystems issues. That is: the management, protection and development of water resources must ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic ecosystems.

Concerning the tasks, in accordance with 5 specific objectives, the Strategy propose 6 tasks including: To enhance the protection of water sources and aquatic ecosystems, To ensure the sustainability and efficiency of water resource exploitation and use, To develop water resources in a sustainable manner, To minimize harms caused by water, To perfect institutions and organizations, To enhance the investigation, technological research and development capacity. Among these tasks and objectives, there are some salient points, as following:

- the first objective and task relates to the conservation of aquatic ecosystems through: the revitalization of water areas, which are seriously polluted, degraded or exhausted; control and limitation of the discharge of pollution sources in water sources and ensuring of the minimum water flow for maintenance of aquatic ecosystems. This is a

new point in comparison with the Law on Water Resource and other existing related legal documents.

- the exploitation and use of water resource must be realized in accordance not only with the river basin planning (as mentioned in the Law on Water resource) but also with the socio-economic development planning and land planning. Concerning the sharing of water resources, the Strategy has defined specific objectives to 2010 for different sectors such as agriculture, hydropower, fishery. In addition,

- regarding the minimization of harms caused by water, the Strategy has defined the objectives for the main river basins, such as: to ensure safety of the Red river - Thai Binh river dike system; to raise the anti-flood capacity of dyke systems in coastal areas of Central Vietnam, the Central Highlands and Eastern South Vietnam; to consolidate the sea dike system and improve the flash flood-warning capacity in mountainous provinces; to establish flood-free areas in shallow submerged regions, ensuring living conditions and safety for people in deep submerged regions in the Mekong river delta.

Among the tasks and objectives related to the minimization of harms caused by water, there are two points which has not been mentioned in the Law on Water Resources, those are: to combine harmoniously construction and non-construction measures in order to ensure safety for humans and minimize damage and to make general evaluation of advantages and disadvantages of floods, thereby working out solutions to tapping floods' benefits. That has been also integrated in the **National Strategy on Natural Disaster prevention and mitigation up to 2020.**

- the last objective related to the capacity building on water resources management has a very important role. It directs toward the correction of existing gaps of the legal document system on water resource as well as of the overlaps of the organization structure on water resource management. To obtain this objective, the Strategy has proposed: to amend and supplement the Law on Water Resources and other relevant legal documents; shift from the mode of administrative and subsidy management and demand satisfaction to the mode of demand management, considering water products a commodity and to boost the administrative reform along the direction of amending and supplementing functions and tasks of state management agencies in charge of

water resources from central to local levels, clarifying the division of tasks between ministries and branches and enhance the decentralization of the integrated management of water resources to localities.

- For the implementation of the proposed tasks, six groups of solution have been identified. Apart from traditional solutions such as: legislation enhancement, development of human resource and of science and technology and expanse and raise of the effect of international cooperation, the Strategy has proposed some other new options related to the encouragement of the participation of communities and the socialization of water services.

Comments: In comparison with the existing legal documents on water resources, the National Strategy on water resources has proposed many new viewpoints. In particular, the contents of the Strategy have showed clearly the Integrated Water Resources Management approach. However, there are some points which have not been developed in detail yet; for example, concrete policies and mechanism for the participation of communities are always missing.

National Rural Clean Water Supply and Sanitation Strategy up to year 2020

On August, 25th 2000, the Prime Minister of Vietnam issued the Decision No 104/2000/QD-TTg approving the National Rural Clean Water Supply and Sanitation Strategy up to 2020. This is the most important document related to water for living in the rural areas. The Strategy has fixed objectives on the supply of clean water for domestic use and on sanitation needs of households for all rural areas in the country in the next 20 years. These objectives includes:

General objectives:

- Improved health through reduced water and sanitation related diseases by improving water supply, latrines and promote hygienic practices of people.
- Improved living conditions through better access to water and sanitation, narrowing down the gap between urban and rural areas.

- Reduce to the lowest level untreated human and livestock excreta which cause environmental pollution, smell and flies and reduce organic pollution of water resources

Specific objectives:

- By year 2020: All rural residents will use clean water of national quality standards with at least 60 liters/capita/day and use improved hygienic sanitation facilities. Universal good personal hygiene practices and good environmental sanitation of communes and villages through focused Information, Education and Communication
- By year 2010: 85% of rural population will use clean domestic water and 70% of rural households will have access to and use of improved hygienic latrines and have good personal hygienic practices.

The main principle of the Strategy is the sustainable development. It means that all planning and implementation shall give priority to sustainability rather than to other factors such as speed of implementation. At the same time it must be ensured that immediate development shall not produce harmful effects for the future and water resources shall be reasonably exploited. This principle will be developed in accordance with the demand responsive approach. It means, the user have to pay and socialization of Rural Water Supply and Sanitation sector. The Strategy has showed that “only when the user - in this case farmers -become the real owners of the facilities can sustainability be achieved”

This approach will replace the former supply- driven approach and there are changes in the roles of users and the Government as following: after to be advised, the users shall: decide on the selection of technology, site of full piped water, supply scheme, level of service and operational arrangement that they want as well as provide financial resource for the construction of related infrastructures. Government agencies will not do all these for users but act as managerial and advisory agency.

To obtain the objectives mentioned above, the National Rural Clean Water Supply and Sanitation Strategy has proposed four main solutions including: Information, Education and Communication, Financial mechanism, organization consolidation and

strengthening effectiveness of the State management and human resource development and studying and application of appropriate technology. Up to now, the National Target Program for Rural Water Supply and Sanitation for the 1998-2005 period was accomplished and the National Target Program for the 2006-2010 are implementing.

5.2.2 Analysis of some key policies related to water resource for food and ecosystem in according with the Integrated Water Resource Management approach

According to the Global Water Partnership, “Integrated Water Resources Management is a process, which promotes the coordination development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. (GWP, 2000-website IWRM Vietnam). This is a cross sectorial policy approach which is opposite of the framed sectorial approach that has led to poor services and unsustainable resource use. (see figure)

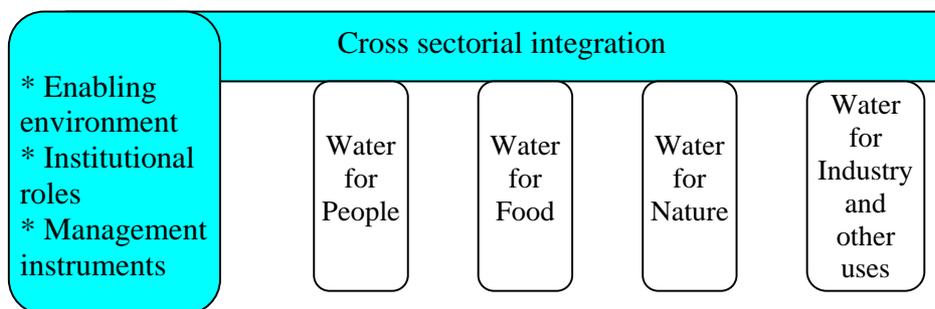
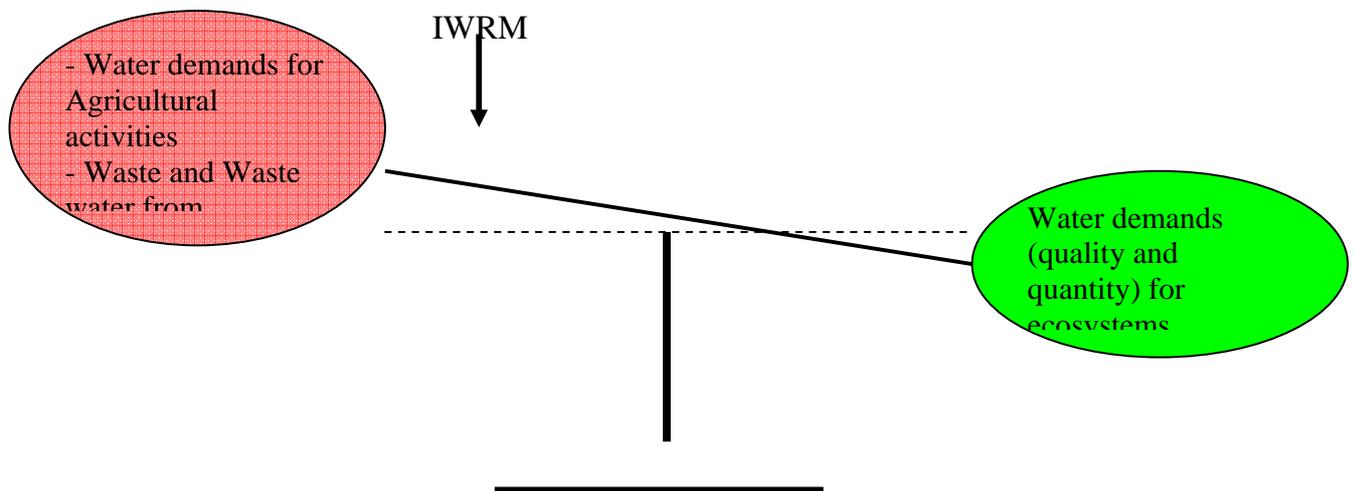


Figure: IWRM is a cross sectorial approach (GWP, 2000)

Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good. Integrated water resources management, including the integration of land and water-related aspects, should be carried out at the level of the catchment basin or sub-basin. So, the IWRM approach includes two scopes: the space (river basin management) and the purposes of use (multipurposes for multi sectors). This approach ensures the sustainability and the rationality in the use of water resources. As part of the project

“Water for food and ecosystem”, this research focus only on the relation between water, food and ecosystem or in other hand on the interaction between water for agriculture and for ecosystem in the existing policies and related legal documents, under an integrated management approach.

As we aware, water resource is a limited source while the demands increase more and more. Among different economic sectors, agriculture is the biggest user of water resource with an average rate of from 70% to 80% of global water use. In Vietnam, the annual demand on water use of agricultural activities was at about 75% in 2001 and estimated at 88% in 2010⁹. It means that more water resource is used for agriculture less water for domestic needs and industrial use and particularity for ecosystems. In addition, more agricultural sector develops more the quantity of wastewater discharged in the nature is important. In other words, the development of agriculture can degrade the water sources and cause negative impacts for ecosystems. According to the above analysis, water for food and ecosystem is part of the Integrated water resources management approach. In other word, the Integrated management approach is one solution which ensures the balance between the development of agricultural sector and the conservation of ecosystems.



⁹ Website IWRM Vietnam

Figure: The balance between water for food and ecosystems

In the legal documents system on water resource of Vietnam, there are some documents regulating the water for agriculture and for ecosystems issues (maintenance of the minimum water flow or conservation of water quality...). These documents mention, generally, the right of agriculture sector to use water resource and request at the same time the responsibility to protect water sources. However, almost related documents don't mention clearly in detail both issues: water for food and water for ecosystems. In particular, the sharing mechanism on water resource in general and between agriculture and ecosystem in this case is very limited in the existing legal document system on water resource. It's only undertaken during the dry season.

Water for agriculture

Concerning the water for agriculture (so for food), the Law on Water Resource regulates that: “**Organizations and individuals** that exploit and use water resource **have the rights to exploit and use water resource** for purposes of living, **agricultural**, forestry, and industrial production, mining, electricity generating, water transport, aquaculture, sea fishery, salt making, sport, recreation, tourism, medicine, health rehabilitation, scientific research and other purposes as prescribed by this Law and other provisions of law”. But this law underlines at the same time that: “The State shall invest in and support the exploitation and use of water resources for agricultural production”. These are fundamental principles for the exploitation and use of water resources for agricultural production.

As mentioned above, agriculture sector is the largest user of water but according to the Decree No 179/1999/ND-CP regulating the implementation of the Law on Water Resource, in times of drought or in cases of water shortage, water for food production is positioned only at 4th place among 5 priorities after water for domestic use, for breeding and for important industrial sites and scientific research.

About water quality for agriculture, the section 3 of the article 26 of the Law on Water Resource regulates that: “Organizations and individuals can only exploit and use

waste water after ensuring that the quality of water meets the prescriptions of the competent State agency for agricultural production”.

About the protection of water resources, the Law on Water Resources regulates that next to the rights to exploit and use water resource, the users have responsibility to protect water sources. For example, the Law defines that: “Organisations and individuals that exploit and use the water source must comply with the regulations on prevention and combat against deterioration and depletion of the water source (article 11), the planning and management of the...concentrated population areas, major livestock raising and slaughtering areas..., must comply with the provisions of this Law and the legislation on the protection of the environment and ensure against pollution of the water source (article 13), Organisations and individuals using chemicals in agricultural production, raising aquatic and marine products must not cause pollution of the water source.(Article 15) and Organisations and individuals exploiting and using water resource for agricultural production must take measures to save water, prevent and combat acidity and salinity of water, slushiness and erosion without polluting the water source (Article 26).

Concerning financial aspect, the Law on Water Resources specifies that: “The organizations and individuals who exploit and use water resource have the financial duty and the duty to contribute manpower and budget to the building of works for the protection, exploitation and use of water resource, the prevention, fight and overcoming of the harm caused by water” (article 7). This regulation has been concretized in some legal document, such as: Decree No. 154/2007/ND-CP dated 15/10/2007 of the Government modifying and supplementing some articles of Decree No. 143/2003/ND-CP dated 28/11/2003 detailing the implementation of a number of articles of the Ordinance on exploitation and protection of irrigation works. Decree 04/2007/ND-CP dated 08/01/2007 supplementing decree 67/2003/ND-CP dated 13/6/2003 on environmental protection charges applicable to wastewater, Decree 34/2005/ND-CP dated 17/03/2005 on sanctions against administrative violations of water resources management regulations (circular guiding the implementation No. 05/2005/TT-BTNMT dated 22/07/2005)...etc.

Water for ecosystems

Water for ecosystems means the demands on quantity and quality of water (water is not polluted) which ensure the health and the development of ecosystems. Among existing legal documents on water resources, the Decree 109/2003/ND-CP dated 23/09/2003 relates directly to water for ecosystem issues. This decree focus on the conservation and sustainable development of wetlands. According to the Decree “Sustainable development of submerged areas means activities of rationally using and exploiting potentials for economic, cultural and social development within the allowed limit so as to maintain ecological functions and protect the environment in submerged areas”¹⁰. The Decree also specifies that it’s necessary to link the use and exploitation to conservation, maintaining water sources and ecological balance. Concerning the responsibility of organizations and individuals carrying out activities of agricultural cultivation and of aquaculture in submerged areas, the Decree highlights that:

- To restrict the use of chemical fertilizers, chemicals and plant protection drugs in cultivation, thus degenerating, deteriorating and depleting submerged land, especially coastal estuary land.
- The State encourages the use of organic fertilizers and microbiological fertilizers as well as the application of farming methods which do not cause adverse impacts on the ecological systems and bio-diversity of submerged areas.
- To encourage the application of the aqua-cultural forms which do not cause adverse impacts on the environment, combine industrial aquaculture with ecological aquaculture and aquaculture after the forestry-fishery or agriculture-fishery models.
- To restrict concentrated industrial aquaculture covering too large acreage in submerged areas which need to be conserved and sustainability developed.

A part from Decree 109/2003/ND-CP, there are some legal documents indirectly related to water for ecosystems issue (through regulations on water quality and quantity conservation), such as: Law on environmental protection – chapter VII regulates the main principles on the protection of marine, river and other water source environments as well as on investigation, quantification, assessment, prevention,

¹⁰ Section 2, article 3, Decree 109/2003/ND-CP dated 23/09/2003

control and treatment of water pollution. These contents has been concretized in different documents, such as: Decree No. 04/2007/NĐ-CP dated 08/01/2007, supplementing decree 67/2003/NĐ-CP dated 13/6/2003 on environmental protection charges applicable to wastewater, Decree No. 34 /2005/ ND-CP dated 17/03/2005 of the Government on sanctions against administrative violations of water resources management regulations (circular associated guiding the implementation No. 05/2005/TT-BTNMT dated 22/07/2005), Decree No. 149/2004/ND-CP dated 27/07/2004 of the Government on the issuing of permits for water resource exploration, exploitation and use, or for discharge of wastewater into water sources (circular associated guiding the implementation No 02/2005/TT-BTNMT dated 24/06/2005). In addition, some other documents also mention more or less about the protection of water sources environment, such as: Ordinance on Exploitation and Protection of Hydraulic Works, Law on inland waterway transportation and Fisheries Law, etc. According to the Ordinance on Exploitation and Protection of Hydraulic Works: “Irrigation works” mean infrastructure works built to tap the water’s usefulness; to prevent and combat harms caused by water, **protect the environment and balance the ecology**, which include: reservoirs, dams, sluices, pumping stations, wells, penstocks, canals, works on canals and embankments of all types. Concerning the protection of water sources, the chapter 17 and chapter 19 of this Ordinance specifies that, organizations and individuals who exploit and use irrigational works must protect water sources and meet the requirements for preventing and combating the degradation, depletion and pollution of water resources as well as other harms caused by water.

Among existing legal documents on water resources, the National Strategy on water resources to 2020 is the most important document in terms of water for ecosystems. That has been showed in one of the main guiding principles of this Strategy “The management, protection and development of water resources must ensure the systematism of river basins, not be divided by administrative boundaries and concurrently ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic ecosystems”. These principles are concretized in the objectives related to water sources protection as following:

- To revitalize rivers, reservoirs, water-bearing beds and submerged areas, which are seriously polluted, degraded or exhausted, giving priority to rivers in the basins of Nhue and Day rivers, Cau river, Dong Nai and Sai Gon rivers as well as Huong river;
- To ensure the minimum water flow for maintenance of aquatic ecosystems under plannings approved by competent authorities, focusing on rivers with big and important reservoirs and dams.
- To protect the integrity of submerged lands and estuaries and use them efficiently for key rivers and important water-bearing beds;
- To put an end to the exploration, exploitation and use of water resources and the discharge of wastewater into water sources without permission of competent agencies according to the provisions of law;
- To control the pollution of water sources. To put an end to the use of toxic chemicals in industrial and agricultural production and aquaculture, which pollute water sources and decrease biodiversity;
- To thriftily and efficiently exploit and use water resources. To ensure that the exploitation of water shall not exceed the exploitation limits, for rivers or the exploitable deposits, for water-bearing beds;
- To distribute and share water resources in a harmonious and rational manner between branches and localities, giving priority to the use of water for daily life and for high economic benefits, ensuring environmental flows.

Concerning the Law on Water Resource, the river basin management approach has been mentioned but the integrated management concept and the interaction between water for food and ecosystems concept have not been existed in this document. That is partly proved by the inexistence of the notion ecosystem in the Law on water resources. In other word, the concept of “water resource is a part of ecosystem” doesn’t exist in this Law. That may cause important consequences such as many socio-economic projects have been approved and implemented without necessary attention to ensure the sustainability of water resources and to protect the aquatic ecosystems.

Approved in 2006 (8 years later after the approval of the Law on water resources), the National Strategy on Water Resources up to 2020 has made good partly shortcomings of the Law on Water Resource, in particular in terms of water for ecosystems and of integrated management approach. Theoretically, this Strategy has met almost of

principles of good international Integrated Water Resources Management practices. For example: concerning water for nature, according to the Strategy: Water resources constitute a major component of the living environment and the exploitation and use of water have to ensure the natural disposition of aquatic systems, water basins and ecosystems, especially of precious and rare aquatic species of scientific and economic value; preserve and develop the diversity and originality of Vietnam's aquatic ecosystems. The strategy also considers water resources as commodities and has intention to eliminate the subsidy mechanism as well as socializes the protection and development of water resources and the provision of water services. Concerning the institutional roles, the Strategy has identified the need to: To formulate in a coordinated manner and ensure effectiveness of the system of state management of water resources at all levels; to clearly distinguish functions and tasks of state management agencies in charge of water resources from those of agencies managing the operation of works for exploitation and use of water resources and provision of water services and to amend and supplement the Law on Water Resources and other relevant legal documents in order to meet the requirement of integrated and uniform management of water resources; shift from the mode of administrative and subsidy management and demand satisfaction to the mode of demand management, considering water products a commodity.