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**SOME MAIN FEATURES OF FLOOD CONTROLLING PLAN
IN CUU LONG (LOWER MEKONG) RIVER BASIN IN VIETNAM**

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1. TENDENCY OF FLOOD DAMAGE IN RECENT YEARS.

CuuLong river delta includes 13 provinces/cities: Long An, Tiền Giang, Đồng Tháp, Vĩnh Long, Trà Vinh, Hậu Giang, Sóc Trăng, Bến Tre, An Giang, Kiên Giang, Bạc Liêu, Cà Mau and Cần Thơ city with total natural areas approximately of 3,96 mil.ha which accounts for 5% of MeKong river basin area, the population is of 17 mil. people.

Lower Mekong Delta plays an important role in social economic development in the country, with the foreseen significant potential on agriculture, in the recent years, the lower Mekong river basin always contribute more than 50% of total national food production, 60% of aquaculture production and 70% of fruit production. However, the changes on natural condition in the past years, especially historical flood in 1996, 2000, 2001 and together with changes on large scale on rural development and agriculture crop pattern (from 2001, *especially aquaculture*) had been raised a lots of works for water development, especially flood protection in Cuu Long river basin in Vietnam.

Year by year, flood season in CuuLong River Basin last from July (VII) to November (XI), it is one month later than in upstream and two months later than in the farm in term of rainfall. The flood is always proceed in slow smooth, moderation with speed of 10-15cm/day, highest of 20 cm/day, the fluctuation of flood is only of 3-4 m and the changes between flood peaks is nomally of 0,5-1,0m. The flood in Lower Mekong Delta always has one peak which occured at the end of November and begin of December, but in some years has 2 peaks (such as 1978, 2000...) and always occures in big flood years. The flood in international Mekong River and from the inundation areas in Cambodia overflows to the mainstream in Vietnam at Lower Delta (Tien, Hau river inside Vietnam). The total discharge at peak if of 38.000 m³/s (relative to water level at Tan Chau 4,40 m and Chau Doc 3,88 m), in big flood years, the discharge can reach to 40.000-45.000 m³/s, in which it contributes approximately 32.000-34.000 m³/s to the main stream (accounts for 75-80%), overflow through borderline of 8.000- 12.000 m³/s (account for 20-25%), in which through the triangle area of Long Xuyen (TGLX) 2.000-4.000 m³/s and through Dong Thap Muoi (DTM) area of 6.000-9.000 m³/s. In the main stream, the discharge through Tân Châu is of

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24.000-26.000 m³/s (account for 82-86%) and through Châu Đốc 7.000-9.000 m³/s (account for 14-18%). The total flood runs into Lower Mekong river Delta is approximately of 350-400 bil.m³, in which it contributes approximately 80-85% of flood discharge to the mainstream, and 15-20% overflow through the borderline.

In Lower Mekong River Delta, the flood will flush into the East Sea, partly run through channel and conduit system in two main inundation of Quadrangle of Long Xuyen and Dong Thap Muoi) and Vam Co river to the West sea.

The record on damages cause by flood in the basin is mentioned in the following table:

TT	Year	Unit	1994	1996	2000	2001	2002
	Total loss	Bil. VND	2,295. 57	2,182. 29	4,597. 20	1,456. 02	456.83
I	People died	<i>People</i>	407	217	568	412	170
II	Loss in Agriculture	Bil. VND	1.326. 37	1.036. 02	1.450. 43	373	
III	Loss in properties	Bil. VND	255.21	391.66	2.311. 22		
IV	Loss on transportation	Bil. VND	327.07	398.23	671		
V	Loss on hydraulic works	Bil. VND	97.6	208.45	150		
VI	Loss in education	Bil. VND	59.76	52.39	41		1.403. 00
VI I	Loss in Health	Bil. VND	19.61	21.31	16.12	105	51
VI II	Loss in Aquaculture	Bil. VND			83.46	13.494	2.446. 10
IX	Loss in other infrastructure foundation	Bil. VND	209.95	74.23	40.89		

2. THE RESPONSIBILITIES OF DEPARTMENT OF WATER RESOURCES IN FLOOD PROTECTION AND MANAGEMENT:

The water resources Department is assigned by the Minister to perform the State management over the water resources profession on exploitation, utilization, protection of water resources facilities, rural water drainage and supply system; river basin management; tapping, use and general development of rivers; management of flood, drought control and prevention in the whole nation under the state management of the Ministry. Related to the plan on flood protection and management in CuuLong Delta, the Department of Water Resources will help the Ministry to give the official decision to implement and monitor; Preside the appraisal of this planning projects and plans after being approved and manage the implementation of planning projects and plans after being approved.

3. EXPERIENCE FOR COUNTERMEASURE OF FLOOD:

Living together with flood and controlling floods to some extent are quite a sound policy. It is recommended that the Government continue to realize criteria set in Decision 173-TTg, which relate to 129 multipurpose structures to be implemented

during 2004-2008, say, 2,000 billion VND will be invested in the construction annually.

Objectives and measures for flood controlling in Dong Thap Muoi, Long Xuyen Quadrangle and area between Tien and Hau rivers have been identified in Cuu Long River Delta flood planning project. It is also mentioned in the following description in this paper. The flood controlling measure concerns 4 main structural groups: (1) the structure along the coast of west sea (2) structures *controlling border overwhelming flood* (3) on-farm canals to drain flood water into west sea and (4) structures controlling flood from Hau river to Long Xuyen Quadrangle.

Policy for floodplain: The government emphasizes on socio-economic development. This orientation is reflected in following policies: Decision No. 01/1998/QĐ-TTg, 99/QĐ-TTg and 173/QĐ-TTg relating to the development program for Cuu Long River Delta by 2010. at the same time, in line with the economic shifting policy, the government also focuses on the development of all economic sector in order to improve the living standards of people, especially ones of ethnic people, so that they can be equal to others in the whole country.

An important issue which is pressed in the flood controlling plan is to limit the flood flow from the border into the Cuu Long River Delta floodplain. However, in the past 4 years, the flood controlling structures have not been constructed nor improved. During 2001-2004, investments are only put in a small amount of flood drainage canals, ring dyke protecting population and fruit trees; 3 sluices for flood drainage and fish raising. The total investment cost is 721.257 billion VND, in which 491,843 billion VND is under the management of MARD. This capital is mostly used in the construction of 292 km of canal, 55 km of ring dyke, 918 ha of embankment protecting fruit tree gardens, 155 m of sluices and dams etc...As a result, investments in flood controlling structure are too limited (only 181 billion VND per year or 3.3% of the necessary capital), comparing to the required capital (about 22,000 billion VND). Especially, the construction of some structures has been canceled due to the lack of fund. This means an inefficient operation.

3. CERTAIN POLICIES ON INFRASTRUCTURE FOR FLOOD CONTROL:

Since 1975, consider the important of CuuLong Delta on agriculture production, the Government and Communist Party had paid much intention to the area in order to optimize exploitation the potential of CuuLong Delta. Series of hydraulic works and embankments was built up to now in order to keep fresh water and rice farmland out of saline intrusion, sulphate acid soil, inundation or flood control in every August. So far, in CuuLong river Delta, the number of crops are raise from 1-2 to 2-3 crops with high production. The total production in 1976 is 4,7 mil. tons, yet in 2002 is 17,8 mil. tons. The rate of development is 6,53%/ year that help the country to achieve the strategy on national production security successfully.

In December 1995, the Ministry of Water Resources (and now is Ministry of Agriculture and Rural Development) has submitted the "Orientation on flood protection in CuuLong River Delta". The detail proposal on this document is basement for the Prime Minister to release the Decision 99/TTg in which request the Ministry of Agriculture and Rural Development to study the basic options for water resources development in order to set up the Strategy on flood protection in Cuu Long river Delta (CLRD).

In 21/6/1999, The PM has approved the project on “Flood protection and flood water utilization in CLRD plan until 2010”. In this project, the purposes and measurements applied for 3 large regions in CLRD including Long Xuyen Quadrangle, Dong Thap Muoi and the area between Tien and Hau river are clearly defined.

Through this flood planning project, a series of flood controlling structures have been constructed in floodplains to protect rice, crops and fruit trees, especially in Long Xuyen Quadrangle. These structures have prevented effectively the flood damages and ensure stable socio-economic development and livelihood of local people of 5,500,000 (50% of population in floodplains). Existing structures such as rubber dam of Trà Sư, Tha La, Vĩnh Tế canal, flood drainage system along west sea, Tân Thành-Lò Gạch canal, floodways in the south of Nguyen Van Tiep canal and ring dyke protecting towns of Châu Đốc, Tân Hồng, Tân Hưng, Vĩnh Hưng, Mộc Hoá, residential quarters in 7 communes..., embankment protecting fruit tree gardens in Tiền Giang, Vĩnh Long, Cần Thơ..., highways of No. 1, 30, 80, 91... have been upgraded to survive 2000 floods. These above mentioned structures have confirmed the efficiency of flood controlling measures which have been proposed in the project.

4. INFRASTRUCTURE IS NEEDED ON FLOOD PROTECTION:

In spite of its favorable location in downstream of Mekong river, the area still faces a lot of difficulties regarding the natural conditions, hydrological regimes, upstream exploitation activities and tidal fluctuations in East and West sea. That means Cuu Long River Delta always confronts with various conflicts between economic development and sustainable development of ecosystem and environment.

Flood control structures in Cuu Long River Delta have played a successful role in socio-economic development of the country in general and of the delta in particular in the past few years. However, due to the asynchronous structure system and the fact that most of the investments are put in Long Xuyen Quadrangle, only controlling floods in the agriculture is successful as required in short-term flood planning, yet Dong Thap Muoi area has not been studied and invested. The lack of many necessary structures results in the complex process of flow channel in terms of discharge and water level.

- The construction of infrastructure can not catch up with technical and production requirements. The quality of infrastructure is low so the annual repair and maintenance are costly and waste.

- Lack of operation and management procedures; coordination and cooperation between different sectors and localities and suitable monitoring on development. The sense of responsibility, obedience and maintenance of structures of local people is not good which is reflected in some damaged structures.

- The investment is scattered and limited which can be explained by the financial situation of the country and people.

- This planning partly resolves and orients problems; proposes solutions and recommends different options for the construction of flood control structures to ensure national food security, accelerate agriculture economic growth and rural development in modern way.

- However, for area where flood to be controlled, there should be efficiency studies and assessments of different types of production; studies, investigation and

measurement of the flow influence regarding its discharge and water level under the effects of flood control structure and impacts of environmental, economy and socio-cultural aspects. There should be more investments in the proper operation, exploitation and management to enhance the investment efficiency. The establishment of criteria, specifications and policies for management and investment should be done for the flood control system in Cuu Long River Delta.

Detailed structural measures for each region

The floodplains of Cuu Long River Delta cover 4 large areas of Long Xuyen Quadrangle, Dong Thap Muoi, west of Hau River and GSTSH. The objectives and solutions to flood control of each areas are identified as follows:

a. Long Xuyen quadrangle

Basing on natural and socio-economic conditions, the objectives of flood control for this area are identified as follows:

- + To protect residential zones, township and urban areas.
- + Ensuring smooth transport all year round in arterial national highway and provincial roads as highways 80, 91, N1, N2 and roads of Long Xuyen -Hue Duc, Long Xuyen - Tri Ton.
- + To reduce water level in the beginning and in the end of cropping time to ensure 2 stable rice crops of winter-spring and summer-autumn.
- + To reduce the peak of main flood in the sub-region in the west and along Highway No. 80
- + To reclaim sulphate soil in Ha Tien quadrangle to grow food crops and aquaculture.
- + To construct a complete hydraulic system for socio-economic development together with other existing structures. At the same time, to modernize the rural areas through the construction of transport structure and residential quarters.
- The solution for controlling Long Xuyen quadrangle will concern 4 main structures:
 - + Structure for controlling floods flowing across the borders to reach Long Xuyen quadrangle and diverting them to west sea.
 - + Arterial channel to drain flood to west sea.
 - + Sluice system to drain flood, control saline intrusion and keep fresh water for coastal area along west sea.
 - + Flood control structure system to prevent flood in Hau River from flowing into Long Xuyen quadrangle.

The construction of flood control structure for Long Xuyen quadrangle should be carried out from West sea so that the saline intrusion can be first controlled. Moreover, such arterial roads as ones for transport in flood in 2000, flood control structures to protect towns, cities and residential areas should be built.

b. West of Hau River

- Objectives:

- + To ensure safety for towns, cities, residential areas and arterial transport routes as highways No. 01, 80, provincial roads of Can Tho-Long My, Can Tho-Vi Thanh-Go Quao- Rach Gia.

- + To ensure flood control year-round for more than 42,000 ha of fruit trees.
- + To ensure flood control year-round for the cultivation of 3 crops in most of rice land.
- + To enrich the farm with alluvia from Hau River.
- + Together with other hydraulic structures, to complete a sound system to serve for the development of agriculture. The construction of transport structures and modern rural areas are also encouraged.
- Flood controlling measure:
 - + To prevent flood in Long Xuyen quadrangle from flowing into west of Hau River. To control flood from Hau River to get alluvia to enrich cultivation soil. To drain water in fields to Cai Lon – Cai Be river through anti-tidal structure which prevent tide water from Cai Lon – Cai Be river and take advantage of tidal foot to drain water. In order to realize this option, the followings should be done:
 - + To construct flood control system along highway No. 80.
 - + To construct flood control system all year round for fields (sub-regions of *Cai San-Xa No, in the east of highway No. 1, west of highway No. 91, ring dyke for protection of 3 blocks in project Cai San-Thot Not, Thot Not-O Mon and O Mon-Xa No (a WB funded project)* and ring dyke in small and medium scale for sub-region of Can Tho-Long My, depending on the local terrain and production condition.
 - + To control August flood for deep and medium flood plains from Cai San canal to Vinh Te-Giang Thanh canal with the ring embankment.

c. Dong Thap Muoi

- Objective:
 - + To ensure safety for towns, cities, residential areas and arterial transport routes as highways No. 01, 30, N1, N2, 62, 50, 864 and provincial roads of north Nguyen Van Tiep, Cai Lay - Kien Binh, Dong Phuoc Xuyen and Tram Chim-Tan Hong, So Ha - Cai Co.
 - + To control early and late floods to ensure stable production of 2 crops of winter-spring and summer-autumn in north of Nguyen Van Tiep canal .
 - + To control flood all year round for south of Nguyen Van Tiep canal. This area is for fruit trees, cash trees in the east of Bo Bo canal, Tan Lap farm (*Củ Chi*) and Bac Dong-Cho Bung area.
 - *Flood control measure for Dong Thap Muoi area concerns 5 main structural group:*
 - + The 1st structural group – to control border overwhelming flood
 - + *The 2nd structural group* - to drain flood in combination with irrigation for central area.
 - + *The 3rd structural group* – south of Nguyen Van Tiep canal.
 - + The 4th structural group – *area between 2 rivers of Vam Co, including ring dykes for some urban and residential areas.*
 - + The 5th structural group – *to protect population and environment*
 - + To prevent early flood (mid-July) for north region of Vinh An canal through 7-commune canal and the ring dyke.
 - + To control August flood for deep and medium flood plains from Nguyen Van Tiep canal to So Ha - Cai Co canal near Dong Thap Muoi .

d. Area between Tien and Hau Rivers

- *Objectives:* to ensure flood control for 7 sub-regions of (1) north of Vinh An canal, (2) Than Nong canal, (3) Chợ Mới canal, (4) north of Lap Vo, (5) south of Lap Vo, (6) north of Mang Thit and (7) Cho Lach - Chau Thanh (*Ben Tre*). Some small islands are also included.

- *Measure:*

+ North of Vinh An canal is located in the same route as the flood way from Tien river to Hau River, so flood will not be controlled.

+ Floods in the remaining areas are controlled all year round in respective embanked blocks. The area of each embanked block depends on each region, preferably from 200-1000 ha.

5. WHAT ARE THE DIFFICULT ISSUES ON FLOOD MANAGEMENT?

Base on the difficulties on implementing this project. It is recommended to conduct many integrated measurements as following:

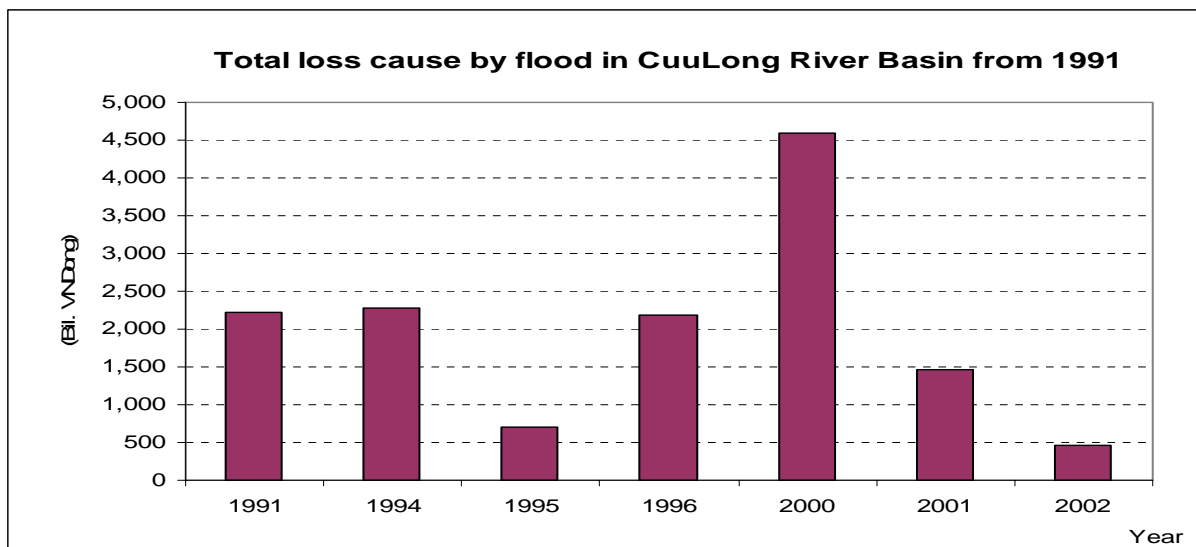
First of all, it is highly recommended that, the Government should push all related activities on this field. The big finance should be more invested to this project because of the its important role on contributing the food production to the country and for export to other country. Constructing many hydraulic works in the area should spend much money. So, it is necessary to call for international support on implementing all activities concerning to construction and finance management.

Secondly, right after the sub-projects of this plan have been approved, it is needed to organize the monitoring system including mechanism and staffs to assess the progress of the implementing process. A steering Board should be establish to harmonize the project activities with other development project in the region.

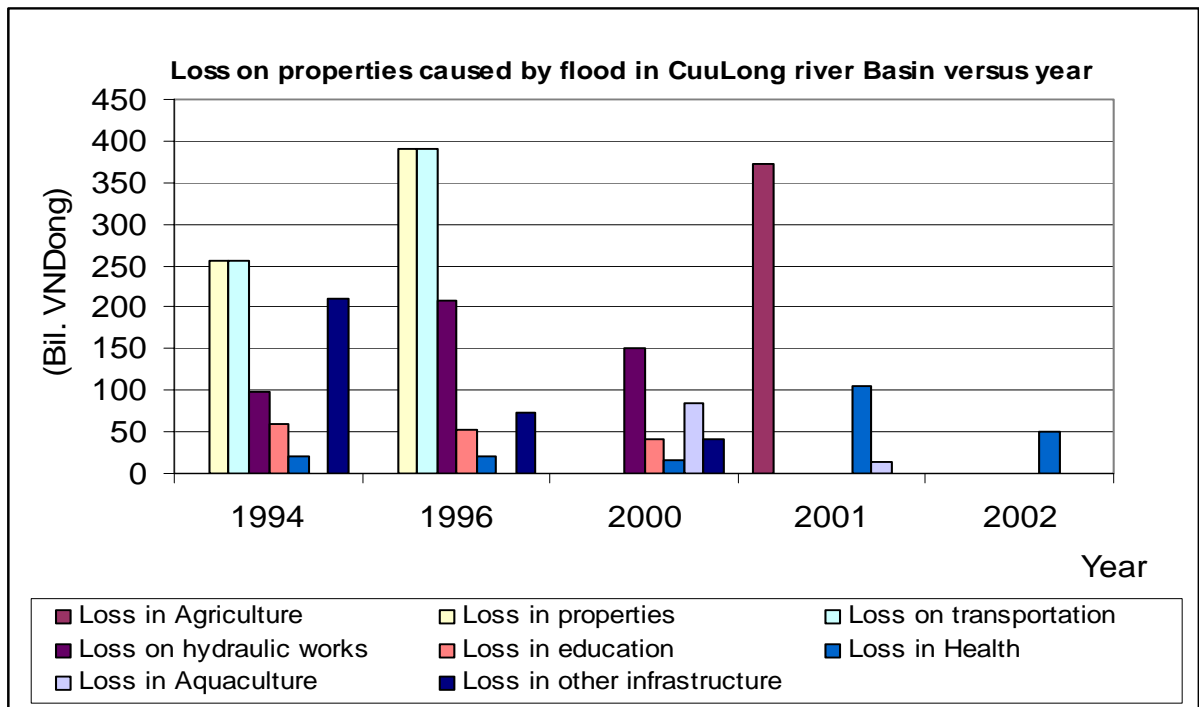
Thirdly, it is needed to conduct more study to predict of the total flood discharge from the upstream in order to have active measurements on having effective plan on flood water utilisation and management.

Fourthly, The cooperation with International Mekong River Commission should be maintain to have latest information of water using situation of upstream country of Mekong River.

Picture 1: Total loss caused by flood occurred in CuuLong River Basin from 1991-2002



Picture 2: Loss on properties caused by flood in Cuu Long River Basin from 1994



Picture 3: Number of People died by flood occurring in CuuLong River Basin from 1991

