

**Table 11.2 Estimation of Probable Flood Damage (1/8)**  
**(Huong River Basin, Without Project, in 2001)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood								Total
		Crops			1. House			2. River facilities and infrastructure /1 h=g x 33%	3. Business activities /2 i=g x 36%	4. Welfare and cultural facilities /3 j=g x 6%	5. Other /4 k=g x 29%	Sub-total l=g+h+i+j+k	
		Paddy	Upland crop	Sub-total	House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f						m=d+l	
Huong River	2	-	-	-	108,522	10,430	118,952	39,254	42,823	7,137	34,496	242,662	242,662
	5	2,767	-	2,767	295,193	33,738	328,931	108,547	118,415	19,736	95,390	671,019	673,786
	10	5,489	-	5,489	501,476	70,981	572,457	188,911	206,085	34,347	166,013	1,167,813	1,173,302
	20	5,489	-	5,489	841,726	142,769	984,495	324,883	354,418	59,070	285,504	2,008,370	2,013,859
	50	5,489	-	5,489	1,208,585	208,660	1,417,245	481,123	523,549	86,227	419,585	2,927,729	2,933,218
	100	5,489	-	5,489	1,670,088	283,924	1,954,012	644,824	703,444	117,241	566,663	3,986,184	3,991,673

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	242,662	121,331	60,666	60,666	4.03
	5	0.20	0.30	673,786	458,224	137,467	198,133	13.15
	10	0.10	0.10	1,173,302	923,544	92,354	290,487	19.28
	20	0.05	0.05	2,013,859	1,593,581	79,679	370,166	24.57
	50	0.02	0.03	2,933,218	2,473,539	74,206	444,372	29.49
	100	0.010	0.01	3,991,673	3,462,446	34,624	478,997	31.79

**Table 11.2 Estimation of Probable Flood Damage (2/8)**  
**(Huong River Basin, Without Project, in 2020)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood								Total
		Crops		Sub-total	1. House			2. River facilities and infrastructure /1 h=g x 33%	3. Business activities /2 i=g x 36%	4. Welfare and cultural facilities /3 j=g x 6%	5. Other /4 k=g x 29%	Sub-total	
		Paddy	Upland crop		House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f	h=g x 33%	i=g x 36%	j=g x 6%	k=g x 29%	l=g+h+i+j+k	m=d+l	
Huong River	2	-	-	-	124,626	12,265	136,891	45,174	49,281	8,213	39,698	279,257	279,257
	5	2,767	-	2,767	350,149	45,762	395,911	130,651	142,528	23,755	114,814	807,659	810,426
	10	5,489	-	5,489	614,292	102,413	716,705	236,513	258,014	43,002	207,844	1,462,078	1,467,567
	20	5,489	-	5,489	1,095,893	217,559	1,313,452	433,439	472,843	78,807	380,901	2,679,442	2,684,931
	50	5,489	-	5,489	1,573,527	317,969	1,891,496	624,194	680,939	113,490	548,534	3,858,653	3,864,142
	100	5,489	-	5,489	2,174,386	432,663	2,607,049	860,326	938,538	156,423	756,044	5,318,380	5,323,869

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	279,257	139,629	69,814	69,814	4.63
	5	0.20	0.30	810,426	544,842	163,452	233,267	15.48
	10	0.10	0.10	1,467,567	1,138,997	113,900	347,166	23.04
	20	0.05	0.05	2,684,931	2,076,249	103,812	450,979	29.93
	50	0.02	0.03	3,864,142	3,274,537	98,236	549,215	36.45
	100	0.010	0.01	5,323,869	4,594,006	45,940	595,155	39.50

**Table 11.2 Estimation of Probable Flood Damage (3/8)**  
**(I-B.1: With Max. Ta Trach only, in 2001)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood								Total
		Crops			1. House			2. River facilities and infrastructure /1	3. Business activities /2	4. Welfare and cultural facilities /3	5. Other /4	Sub-total	
		Paddy	Upland crop	Sub-total	House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f	h=g x 33%	i=g x 36%	j=g x 6%	k=g x 29%	l=g+h+i+j+k	m=d+l	
Huong River	2	-	-	-	12,294	1,389	13,683	4,515	4,926	821	3,968	27,913	27,913
	5	-	-	-	24,339	2,655	26,994	8,908	9,718	1,620	7,828	55,068	55,068
	10	-	-	-	32,403	3,500	35,903	11,848	12,925	2,154	10,412	73,242	73,242
	20	-	-	-	46,747	4,793	51,540	17,008	18,554	3,092	14,947	105,141	105,141
	50	-	-	-	173,020	17,354	190,374	62,823	68,535	11,422	55,208	388,362	388,362
	100	-	-	-	262,046	28,798	290,844	95,979	104,704	17,451	84,345	593,323	593,323

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	27,913	13,957	6,978	6,978	0.46
	5	0.20	0.30	55,068	41,491	12,447	19,425	1.29
	10	0.10	0.10	73,242	64,155	6,416	25,841	1.71
	20	0.05	0.05	105,141	89,192	4,460	30,300	2.01
	50	0.02	0.03	388,362	246,752	7,403	37,703	2.50
	100	0.010	0.01	593,323	490,843	4,908	42,611	2.83

**Table 11.2 Estimation of Probable Flood Damage (4/8)**  
**(I-B.1: With Max. Ta Trach only, in 2020)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood								Total
		Crops		Sub-total	1. House			2. River facilities and infrastructure /1	3. Business activities /2	4. Welfare and cultural facilities /3	5. Other /4	Sub-total	
		Paddy	Upland crop		House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f	h=g x 33%	i=g x 36%	j=g x 6%	k=g x 29%	l=g+h+i+j+k	m=d+l	
Huong River	2	-	-	-	14,022	1,584	15,606	5,150	5,618	936	4,526	31,836	31,836
	5	-	-	-	27,760	3,029	30,789	10,160	11,084	1,847	8,929	62,809	62,809
	10	-	-	-	36,959	3,992	40,951	13,514	14,742	2,457	11,876	83,540	83,540
	20	-	-	-	53,317	5,466	58,783	19,398	21,162	3,527	17,047	119,917	119,917
	50	-	-	-	200,603	21,805	222,408	73,395	80,067	13,344	64,498	453,712	453,712
	100	-	-	-	309,112	38,531	347,643	114,722	125,151	20,859	100,816	709,191	709,191

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	31,836	15,918	7,959	7,959	0.53
	5	0.20	0.30	62,809	47,323	14,197	22,156	1.47
	10	0.10	0.10	83,540	73,175	7,317	29,473	1.96
	20	0.05	0.05	119,917	101,729	5,086	34,560	2.29
	50	0.02	0.03	453,712	286,815	8,604	43,164	2.86
	100	0.010	0.01	709,191	581,452	5,815	48,979	3.25

**Table 11.2 Estimation of Probable Flood Damage (5/8)**  
**(I-B.2: With Max. Ta Trach + Max. Huu Trach, I-B.3: With Max. Ta Trach + Min. Huu Trach,**  
**I-B.6: With Max. Ta Trach + Man. Huu Trach + Max. Co Bi, I-B.7: With Max. Ta Trach + Man. Huu Trach + Min. Co Bi,**  
**I-B.8: With Max. Ta Trach + Min. Huu Trach + Max. Co Bi, I-B.9: With Max. Ta Trach + Min. Huu Trach + Min. Co Bi, in 2001)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood							Total	
		Crops		Sub-total	1. House		2. River facilities and infrastructure /1	3. Business activities /2	4. Welfare and cultural facilities /3	5. Other /4	Sub-total		
		Paddy	Upland crop		House	Household durable goods							g=e+f
a	b	c	d=b+c	e	f	g=e+f	h=g x 33%	i=g x 36%	j=g x 6%	k=g x 29%	l=g+h+i+j+k	m=d+l	
Huong River	2	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-	-	-	-	-
	20	-	-	-	13,857	1,612	15,469	5,105	5,569	928	4,486	31,557	31,557
	50	-	-	-	72,649	6,837	79,486	26,230	28,615	4,769	23,051	162,151	162,151
	100	-	-	-	184,617	18,716	203,333	67,100	73,200	12,200	58,967	414,800	414,800

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	-	-	-	-	-
	5	0.20	0.30	-	-	-	-	-
	10	0.10	0.10	-	-	-	-	-
	20	0.05	0.05	31,557	15,779	789	789	0.05
	50	0.02	0.03	162,151	96,854	2,906	3,695	0.25
	100	0.010	0.01	414,800	288,476	2,885	6,579	0.44

**Table 11.2 Estimation of Probable Flood Damage (6/8)**  
**(I-B.2: With Max. Ta Trach + Max. Huu Trach, I-B.3: With Max. Ta Trach + Min. Huu Trach,**  
**I-B.6: With Max. Ta Trach + Man. Huu Trach + Max. Co Bi, I-B.7: With Max. Ta Trach + Man. Huu Trach + Min. Co Bi,**  
**I-B.8: With Max. Ta Trach + Min. Huu Trach + Max. Co Bi, I-B.9: With Max. Ta Trach + Min. Huu Trach + Min. Co Bi, in 2020)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood								Total
		Crops			1. House			2. River facilities and infrastructure /1	3. Business activities /2	4. Welfare and cultural facilities /3	5. Other /4	Sub-total	
		Paddy	Upland crop	Sub-total	House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f	h=g x 33%	i=g x 36%	j=g x 6%	k=g x 29%	l=g+h+i+j+k	m=d+l	
Huong River	2	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-	-	-	-	-
	20	-	-	-	15,805	1,839	17,644	5,823	6,352	1,059	5,117	35,995	35,995
	50	-	-	-	82,860	7,796	90,656	29,916	32,636	5,439	26,290	184,937	184,937
	100	-	-	-	214,672	23,773	238,445	78,687	85,840	14,307	69,149	486,428	486,428

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	-	-	-	-	-
	5	0.20	0.30	-	-	-	-	-
	10	0.10	0.10	-	-	-	-	-
	20	0.05	0.05	35,995	17,998	900	900	0.06
	50	0.02	0.03	184,937	110,466	3,314	4,214	0.28
	100	0.010	0.01	486,428	335,683	3,357	7,571	0.50

**Table 11.2 Estimation of Probable Flood Damage (7/8)**  
**(I-C.2: With Min. Ta Trach + Max. Huu Trach, I-C.6: With Min. Ta Trach + Max. Huu Trach + Max. Co Bi,**  
**I-C.7: With Min. Ta Trach + Max. Huu Trach + Min. Co Bi, in 2001)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood								Total
		Crops			1. House			2. River facilities and infrastructure /1 h=g x 33%	3. Business activities /2 i=g x 36%	4. Welfare and cultural facilities /3 j=g x 6%	5. Other /4 k=g x 29%	Sub-total l=g+h+i+j+k	
		Paddy	Upland crop	Sub-total	House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f					m=d+l		
Huong River	2	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-
	10	-	-	-	21,200	2,431	23,631	7,798	8,507	1,418	6,853	48,207	48,207
	20	15,805	1,839	17,644	41,322	4,321	45,643	15,062	16,431	2,739	13,236	93,111	110,755
	50	82,860	7,796	90,656	85,601	7,859	93,460	30,842	33,646	5,608	27,103	190,659	281,315
	100	214,672	23,773	238,445	175,456	18,156	193,612	63,892	69,700	11,617	56,147	394,968	633,413

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	-	-	-	-	-
	5	0.20	0.30	-	-	-	-	-
	10	0.10	0.10	48,207	24,104	2,410	2,410	0.16
	20	0.05	0.05	110,755	79,481	3,974	6,384	0.42
	50	0.02	0.03	281,315	196,035	5,881	12,265	0.81
	100	0.010	0.01	633,413	457,364	4,574	16,839	1.12

**Table 11.2 Estimation of Probable Flood Damage (8/8)**  
**(I-C.2: With Min. Ta Trach + Max. Huu Trach, I-C.6: With Min. Ta Trach + Max. Huu Trach + Max. Co Bi,**  
**I-C.7: With Min. Ta Trach + Max. Huu Trach + Min. Co Bi, in 2020)**

**(1) Estimation of Flood Damage by Magnitude of Flood**

Unit: VND Million

River System	Return Period (Year)	Early Flood			Major Flood							Total	
		Crops			1. House			2. River facilities and infrastructure /1 h=g x 33%	3. Business activities /2 i=g x 36%	4. Welfare and cultural facilities /3 j=g x 6%	5. Other /4 k=g x 29%		Sub-total l=g+h+i+j+k
		Paddy	Upland crop	Sub-total	House	Household durable goods	Sub-total						
a	b	c	d=b+c	e	f	g=e+f					m=d+l		
Huong River	2	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-
	10	-	-	-	24,179	2,773	26,952	8,894	9,703	1,617	7,816	54,982	54,982
	20	-	-	-	47,131	4,927	52,058	17,179	18,741	3,123	15,097	106,198	106,198
	50	-	-	-	97,632	8,962	106,594	35,176	38,374	6,396	30,912	217,452	217,452
	100	-	-	-	204,016	23,108	227,124	74,951	81,765	13,627	65,866	463,333	463,333

Note: /1 This item includes the damages to the facilities for flood prevention, water utilization, transportation, fishery, electricity, and post office.

/2 This item includes the damages to crops, forest, livestock, aquaculture, factories, shops, offices, machines, materials, and products.

/3 This item includes the damages to the facilities for cultural sector, health care, and education.

/4 This item includes the damages to administrative sector, armaments, and others.

**(2) Estimation of Annual Mean Flood Damage**

River System	Return Period	Exceedance	Difference of Exceedance	Damage (VND Million)		Annual Damage (VND Million)		Equivalent US\$ million
				Amount	Mean	Segment	Cumulative	
Huong River	-	1.00						
	2	0.50	0.50	-	-	-	-	-
	5	0.20	0.30	-	-	-	-	-
	10	0.10	0.10	54,982	27,491	2,749	2,749	0.18
	20	0.05	0.05	106,198	80,590	4,030	6,779	0.45
	50	0.02	0.03	217,452	161,825	4,855	11,633	0.77
	100	0.010	0.01	463,333	340,393	3,404	15,037	1.00



Table 11.3 Agricultural Benefit of Huong River Project (1/2)

(1) Incremental Crop Benefit

Crop	Net Income per ha (US\$/ha)								Total	
	Unit Price		Unit Yeild ton/ha	Gross Income US\$/ha	Product. Cost		Net Income US\$/ha	Planted Area ha	Net Income US\$	
	US\$/ton	adjust			US\$/ha	adjust				
<b>Present Condition</b>							\$307 /ha	<b>44,386 ha</b>	<b>7,949,000</b>	
<b>1. Winter - Spring Crop</b>		-	-	-	-	-	-	<b>25,900 ha</b>	<b>4,366,000</b>	
Paddy	Irrigated	125	-	2.80	350	210	60%	140	18,022 ha	2,523,000
Maize	Rainfed	144	-	1.20	173	104	60%	69	78 ha	5,000
Sweet Potatoes	Rainfed	63	-	4.80	302	181	60%	121	4,838 ha	585,000
Groundnuts	Rainfed	375	-	1.20	450	270	60%	180	706 ha	127,000
Vegetables	Rainfed	208	-	6.00	1,248	749	60%	499	2,256 ha	1,126,000
<b>2. Summer - Autumn Crop</b>		-	-	-	-	-	-	-	<b>18,486 ha</b>	<b>3,583,000</b>
Paddy	Irrigated	125	-	3.00	375	225	60%	150	15,197 ha	2,280,000
Maize	Rainfed	144	-	1.20	173	104	60%	69	79 ha	5,000
Groundnuts	Rainfed	375	-	1.20	450	270	60%	180	954 ha	172,000
Vegetables	Rainfed	208	-	6.00	1,248	749	60%	499	2,256 ha	1,126,000
<b>Future Condition</b>							\$864 /ha	<b>51,800 ha</b>	<b>22,376,000</b>	
<b>1. Winter - Spring Crop</b>		-	-	-	-	-	-	-	<b>25,900 ha</b>	<b>11,062,000</b>
Paddy	Irrigated	125	100%	5.00	625	250	40%	375	19,912 ha	7,467,000
Maize	Irrigated	144	115%	4.00	576	230	40%	346	460 ha	159,000
Sweet Potatoes	Irrigated	63	50%	7.00	441	176	40%	265	3,456 ha	916,000
Groundnuts	Irrigated	375	300%	1.50	563	225	40%	338	72 ha	24,000
Vegetables	Irrigated	208	166%	10.00	2,080	832	40%	1,248	2,000 ha	2,496,000
<b>2. Summer - Autumn Crop</b>		-	-	-	-	-	-	-	<b>25,900 ha</b>	<b>11,314,000</b>
Paddy	Irrigated	125	-	5.00	625	250	40%	375	19,912 ha	7,467,000
Maize	Irrigated	144	-	4.00	576	230	40%	346	460 ha	159,000
Groundnuts	Irrigated	375	-	1.50	563	225	40%	338	3,528 ha	1,192,000
Vegetables	Irrigated	208	-	10.00	2,080	832	40%	1,248	2,000 ha	2,496,000
<b>Increment</b>	0.90 (SCF)	139	per ton					\$557 /ha	<b>7,414 ha</b>	<b>14,427,000</b>
								Irrigation Area	25,900 ha	

**Table 11.3 Agricultural Benefit of Huong River Project (2/2)**

**(2) Estimation of Unit Value of Livestock and Aquaculture**

**1) Livestock**

1 Livestock Gross Output of 1999 /1	VND 25,388 billion	(Adjusted to 2001 constant price)
2 Conversion to Head Number of Cattle (Ox)		
(1) Head Number in Whole Country		
(a) Cattle (Ox)	3,638,900 heads	
(b) Buffalo	2,955,700 heads	
(c) Pig	16,306,400 heads	
(2) Conversion Rate		
Weight Ratio is used.		
Weight Ratio is derived from daily water consumption rate. /2		
(a) Cattle (Ox)	35 lit/head/day	
(b) Buffalo	35 lit/head/day	
(c) Pig	15 lit/head/day	
(3) Converted Head Number to Cattle (Ox)		
(a) Cattle (Ox)	3,638,900 heads	
(b) Buffalo	2,955,700 heads	
(c) Pig	6,988,500 heads	
<b>Total</b>	<b>13,583,100</b>	
3 Gross Output per Converted Head Number of Cattle (Ox)	VND 1,869,087	per head

**2) Aquaculture**

1 Aquaculture Gross Output of 1999 /1	VND 7,978 billion	(Adjusted to 2001 constant price)
2 Aquaculture Area	535,000 ha	
3 Gross Output per Pond Area	VND 14,912,100	per ha
/1: Ref.	"Statistical Data of Vietnam, Agriculture, Forestry and Fishery 1975 - 2000"	
/2: Ref.	"Guideline for the Preparation of National Master Water Plans, Water Resources Series No.65, ESCAP, 1989"	

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**(3) Incremental Livestock Benefit**

Livestock	Cattle (Ox)	Buffalo	Pig	Converted Cattle (Ox)	Gross Output	Water Concerned 90%	Production cost 85%	Net Output	Economic net output SCF=0.9	Equivalent
1) Expected net output (2020)	68	42	666	395	738,289	664,460.1	564,791	99,669	89,702	6.0
2) Present condition (2010)	33	35	227	165	308,399	277,559.1	235,925	41,634	37,470	2.5
3) Incremental net output	35	7	439	230	429,890	386,901.0	328,866	58,035	52,232	3.5

**(4) Incremental Aquaculture Benefit**

Aquaculture	Coastal Shrimp	Inland Fish	Total Aquaculture	Gross Output	Water Concerned 100%	Production cost 50%	Net Output	Economic net output SCF=0.9	Equivalent
1) Expected net output (2020)	4,514	3,693	8,207	122,384	122,384	61,192	61,192	55,073	3.7
2) Present condition (2010)	1,010	920	1,930	28,780	28,780	14,390	14,390	12,951	0.9
3) Incremental net output	3,504	2,773	6,277	93,603	93,603	46,802	46,802	42,121	2.8

**Table 11.4 Benefit of Hydropower Generation**

<b>Alternative</b>	<b>Project component</b>	<b>Power generation (GWh)</b>	<b>Economic benefit (US\$ million)</b>
I-B.1	Max. Ta Trach Reservoir only	70.0	3.50
I-B.2	Max. Ta Trach + Max. Huu Trach Reservoirs	70.0 80.6	7.53
I-B.3	Max. Ta Trach + Min. Huu Trach Reservoirs	70.0 68.0	6.90
I-B.6	Max. Ta Trach + Max. Huu Trach + Max. Co Bi Reservoirs	70.0 80.6 0	7.53
I-B.7	Max. Ta Trach + Max. Huu Trach + Min. Co Bi Reservoirs	70.0 80.6 0	7.53
I-B.8	Max. Ta Trach + Min. Huu Trach + Max. Co Bi Reservoirs	70.0 68.0 0	6.90
I-B.9	Max. Ta Trach + Min. Huu Trach + Min. Co Bi Reservoirs	70.0 68.0 0	6.90
I-C.2	Min. Ta Trach + Max. Huu Trach Reservoirs	70.0 71.0	7.05
I-C.6	Min. Ta Trach + Max. Huu Trach + Max. Co Bi Reservoirs	70.0 71.0 0	7.05
I-C.7	Min. Ta Trach + Max. Huu Trach + Min. Co Bi Reservoirs	70.0 71.0 0	7.05

Note: Assuming of kWh value of 5 US Cents.

**Table 11.5 Annual Project Cost of the Huong River Project (Economic Price)  
Alternative I-B.2: Max. Ta Trach and Max. Huu Trach Reservoirs**

Unit: Million US\$

Cost Item	Total (Million VND)	Equivalent (Million US\$)	Year																	
			2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1. Max. Ta Trach Reservoir including hydropower facilities																				
(1) Direct Construction Cost	1,165,533	77.35	-	-	-	-	3.36	7.77	8.81	8.81	9.12	10.28	15.58	13.62	-	-	-	-	-	-
(2) Indirect Construction Cost																				
a. Resettlement cost	146,019	9.69	2.42	2.42	2.42	2.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Engineering cost	61,537	4.08	-	-	0.24	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.24	-	-	-	-	-
c. Administration cost			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d. Physical contingency	137,309	9.11	0.24	0.24	0.27	0.29	0.38	0.82	0.93	0.93	0.96	1.07	1.60	1.38	-	-	-	-	-	-
Subtotal of (2)	344,865	22.88	2.66	2.66	2.93	3.17	0.83	1.27	1.38	1.38	1.41	1.52	2.05	1.62	-	-	-	-	-	-
Total of (1) + (2)	1,510,398	100.23	2.66	2.66	2.93	3.17	4.19	9.04	10.19	10.19	10.53	11.80	17.63	15.24	-	-	-	-	-	-
2. Max. Huu Trach Reservoir including hydropower facilities																				
(1) Direct Construction Cost	341,725	22.68	-	-	-	-	-	-	-	-	-	-	-	1.12	3.74	5.25	5.61	4.30	2.66	-
(2) Indirect Construction Cost																				
a. Resettlement cost	36,000	2.39	-	-	-	-	-	-	0.60	0.60	0.60	0.59	-	-	-	-	-	-	-	-
b. Engineering cost	24,854	1.65	-	-	-	-	-	-	-	-	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	-
c. Administration cost			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d. Physical contingency	40,258	2.67	-	-	-	-	-	-	0.06	0.06	0.08	0.08	0.11	0.40	0.55	0.59	0.45	0.29	-	-
Subtotal of (2)	101,112	6.71	-	-	-	-	-	-	0.66	0.66	0.89	0.88	0.32	0.61	0.76	0.79	0.65	0.49	-	-
Total of (1) + (2)	442,837	29.39	-	-	-	-	-	-	0.66	0.66	0.89	0.88	1.44	4.35	6.01	6.40	4.95	3.15	-	-
3. Irrigation and Drainage Facilities																				
(1) Direct Construction Cost	675,245	44.81	-	-	-	-	-	2.24	4.03	4.03	4.03	4.03	4.03	4.48	4.48	4.48	4.48	4.50	-	-
(2) Indirect Construction Cost																				
a. Resettlement cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Engineering cost	67,524	4.48	-	-	0.22	0.36	0.36	0.36	0.36	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.34	-	-
c. Administration cost	20,257	1.34	-	-	0.07	0.11	0.11	0.11	0.11	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.11	-	-
d. Physical contingency	76,303	5.06	-	-	0.03	0.05	0.05	0.27	0.45	0.44	0.44	0.44	0.44	0.49	0.49	0.49	0.49	0.49	-	-
Subtotal of (2)	164,084	10.88	-	-	0.32	0.52	0.52	0.74	0.92	0.84	0.84	0.84	0.84	0.89	0.89	0.89	0.89	0.94	-	-
Total of (1) + (2)	839,329	55.69	-	-	0.32	0.52	0.52	2.98	4.95	4.87	4.87	4.87	4.87	5.37	5.37	5.37	5.37	5.44	-	-
4. Domestic and Industrial Water Supply Facilities																				
(1) Direct Construction Cost	539,058	35.78	-	-	-	-	2.50	7.16	7.16	2.50	1.07	3.94	1.07	1.07	1.07	3.22	0.36	0.36	3.58	0.36
(2) Indirect Construction Cost																				
a. Resettlement cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Engineering cost	31,190	2.07	-	-	0.21	0.37	0.37	0.37	0.37	0.38	-	-	-	-	-	-	-	-	-	-
c. Administration cost	16,172	1.07	-	-	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.06
d. Physical contingency	58,642	3.89	-	-	0.03	0.04	0.29	0.76	0.76	0.29	0.11	0.40	0.11	0.11	0.11	0.33	0.04	0.04	0.37	0.04
Subtotal of (2)	106,004	7.03	-	-	0.30	0.47	0.72	1.19	1.19	0.73	0.17	0.46	0.17	0.17	0.18	0.40	0.11	0.11	0.44	0.10
Total of (1) + (2)	645,062	42.81	-	-	0.30	0.47	3.22	8.35	8.35	3.23	1.24	4.40	1.24	1.24	1.25	3.62	0.47	0.47	4.02	0.46
5. Whole Projects																				
(1) Direct Construction Cost	2,721,561	180.62	-	-	-	-	5.86	17.17	20.00	15.34	14.22	18.25	20.68	20.29	9.29	12.95	10.45	9.16	6.24	0.36
(2) Indirect Construction Cost																				
a. Resettlement cost	182,019	12.08	2.42	2.42	2.42	2.43	-	-	-	0.60	0.60	0.60	0.59	-	-	-	-	-	-	-
b. Engineering cost	185,105	12.28	-	-	0.67	1.18	1.18	1.18	1.18	1.14	0.76	0.97	0.97	0.76	0.52	0.52	0.51	0.54	0.20	-
c. Administration cost	36,429	2.41	-	-	0.13	0.17	0.17	0.17	0.17	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.18	0.07	0.06
d. Physical contingency	312,512	20.73	0.24	0.24	0.33	0.38	0.72	1.85	2.14	1.72	1.57	1.99	2.23	2.09	1.00	1.37	1.12	0.98	0.66	0.04
Subtotal of (2)	716,065	47.50	2.66	2.66	3.55	4.16	2.07	3.20	3.49	3.61	3.08	3.71	3.94	3.00	1.68	2.05	1.79	1.70	0.93	0.10
Total of (1) + (2)	3,437,626	228.12	2.66	2.66	3.55	4.16	7.93	20.37	23.49	18.95	17.30	21.96	24.62	23.29	10.97	15.00	12.24	10.86	7.17	0.46

**Table 11.6 Financial Cash Flow Statement for Implementation of the Projects  
(Huong River Water Resources Development Plan)**

Alternative I-B.2: Max. Ta Trach reservoir, Max. Huu Trach reservoir, hydropower generation, irrigation improvement, and water supply Unit: Million US\$

Year in order	Year	Capital Cost												Cost covered by foreign loan	Foreign Loan Accumulated	A part of capital cost allocated by the Government	Cash Outflow							Cash Inflow					Balance (b) - (a)					
		Reservoir & hydropower			Irrigation & drainage			Water supply			Total						O & M cost				Replace-ment cost	Repayment of Loan		Total (a)	Irrigation water	Hydro-power	Water supply	Government subsidy		Total (b)				
		Eligible	Non-elig.	Total	Eligible	Non-elig.	Total	Eligible	Non-elig.	Total	Eligible	Non-elig.	Total				Reservoir	Hydropower	Irrigation	Water sup.		Interest	Capital											
TOTAL		194	30	225	101	7	109	74	6	80	370	43	413	310		103						67	310											
											89%	11%	100%	75%		25%																		
1	2001																																	
2	2002		3.11	3.11								3.11	3.11			3.11																		
3	2003		3.26	3.26								3.26	3.26			3.26																		
4	2004	0.24	3.54	3.78	0.24	0.09	0.33	0.29	0.11	0.40	0.77	3.74	4.51	0.77	0.77	3.74																		
5	2005	0.46	3.82	4.28	0.49	0.18	0.67	0.55	0.12	0.67	1.50	4.12	5.62	1.50	2.27	4.12						0.01	0.01							0.01	0.01			
6	2006	6.28	0.50	6.78	4.00	0.34	4.34	5.25	0.34	5.59	15.53	1.18	16.71	12.97	15.24	3.74						0.04	0.04							0.04	0.04			
7	2007	14.55	0.89	15.44	7.47	0.51	7.98	12.03	0.65	12.68	34.05	2.05	36.10	28.01	43.25	8.09						0.27	0.27							0.27	0.27			
8	2008	17.23	1.02	18.25	7.11	0.50	7.61	12.61	0.69	13.30	36.95	2.21	39.16	30.39	73.64	8.77						0.78	0.78							0.78	0.78			
9	2009	18.08	2.14	20.22	7.46	0.53	7.99	5.24	0.36	5.60	30.78	3.03	33.81	26.24	99.88	7.57						1.33	1.33							1.33	1.33			
10	2010	19.61	2.28	21.89	7.83	0.55	8.38	1.76	0.20	1.96	29.20	3.03	32.23	25.01	124.89	7.22						1.80	1.80							1.80	1.80			
11	2011	23.38	2.65	26.03	8.21	0.58	8.79	7.70	0.48	8.18	39.29	3.71	43.00	33.37	158.25	9.63						2.25	2.25							2.25	2.25			
12	2012	27.96	2.93	30.89	8.61	0.61	9.22	1.94	0.22	2.16	38.51	3.76	42.27	32.80	191.06	9.47						2.85	2.85							2.85	2.85			
13	2013	26.07	1.49	27.56	9.03	0.64	9.67	2.03	0.24	2.27	37.13	2.37	39.50	30.65	221.71	8.85	0.34	0.13	0.32	1.76		3.44		6.00	0.31	3.11	1.87	0.71	2.85	6.00				
14	2014	6.48	0.44	6.92	9.47	0.67	10.14	2.24	0.25	2.49	18.19	1.36	19.55	15.17	221.38	4.38	0.71	0.28	0.68	3.70		3.99	15.50	24.86	1.40	6.52	4.45	12.49	24.86					
15	2015	9.39	0.58	9.97	9.94	0.70	10.64	8.05	0.52	8.57	27.38	1.80	29.18	22.64	228.52	6.54	0.74	0.29	0.71	3.88		3.98	15.50	25.11	1.69	6.84	5.31	11.27	25.11					
16	2016	10.50	0.64	11.14	10.43	0.73	11.16	1.01	0.21	1.22	21.94	1.58	23.52	18.25	231.27	5.27	0.78	0.31	0.74	4.07		4.11	15.50	25.52	2.01	7.17	6.11	10.23	25.52					
17	2017	8.52	0.56	9.08	10.94	0.77	11.71	1.06	0.22	1.28	20.52	1.55	22.07	17.13	232.90	4.94	0.82	0.32	0.78	4.27		4.16	15.50	25.86	2.36	7.52	7.02	8.95	25.86					
18	2018	5.67	0.44	6.11				9.54	0.62	10.16	15.21	1.06	16.27	12.63	230.03	3.64	0.86	0.34	0.82	4.48		4.19	15.50	26.19	2.60	7.89	8.08	7.62	26.19					
19	2019							1.16	0.24	1.40	1.16	0.24	1.40	1.09	215.61	0.31	1.11	0.60	0.86	4.70		4.14	15.50	26.92	2.73	17.81	9.29	-	29.83	2.91				
20	2020							1.40	0.25	1.65	1.40	0.25	1.65	1.28	201.39	0.37	1.17	0.63	0.90	4.93		3.88	15.50	27.02	2.87	18.69	10.77	-	32.32	5.31				
21	2021														185.89	-	1.23	0.66	0.94	5.18		3.63	15.50	27.13	3.01	19.60	11.30	-	33.91	6.77				
22	2022														170.39	-	1.29	0.70	0.99	5.43		3.35	15.50	27.25	3.15	20.56	11.85	-	35.57	8.32				
23	2023														154.89	-	1.35	0.73	1.04	5.69		3.07	15.50	27.38	3.31	21.57	12.43	-	37.31	9.93				
24	2024														139.39	-	1.41	0.77	1.09	5.97		2.79	15.50	27.53	3.47	22.63	13.04	-	39.14	11.60				
25	2025														123.89	-	1.48	0.80	1.14	6.27		2.51	15.50	27.71	3.64	23.74	13.68	-	41.06	13.35				
26	2026														108.39	-	1.56	0.84	1.20	6.57		2.23	15.50	27.90	3.82	24.90	14.35	-	43.07	15.16				
27	2027														92.89	-	1.63	0.89	1.26	6.90		1.95	15.50	28.12	4.01	26.12	15.05	-	45.18	17.05				
28	2028														77.39	-	1.71	0.93	1.32	7.23		1.67	15.50	28.37	4.20	27.40	15.79	-	47.39	19.02				
29	2029														61.89	-	1.80	0.97	1.39	7.59		1.39	15.50	28.64	4.41	28.74	16.57	-	49.71	21.08				
30	2030														46.39	-	1.88	1.02	1.45	7.96		1.11	15.50	28.93	4.62	30.15	17.38	-	52.15	23.22				
31	2031														30.89	-	1.98	1.07	1.52	8.35		0.84	15.50	29.26	4.85	31.63	18.23	-	54.71	25.45				
32	2032														15.39	-	2.07	1.12	1.60	8.76		0.56	15.50	29.61	5.09	33.18	19.12	-	57.39	27.77				
33	2033														-	-	2.18	1.18	1.68	9.19		0.28	15.50	30.00	5.34	34.80	20.06	-	60.20	30.20				
34	2034														-	-	2.28	1.24	1.76	9.64		-	-	14.92	5.60	36.51	21.04	-	63.15	48.23				
35	2035														-	-	2.39	1.30	1.85	10.11		-	-	15.65	5.87	38.30	22.07	-	66.24	50.59				
36	2036														-	-	2.51	1.36	1.94	10.61		-	-	16.42	6.16	40.17	23.15	-	69.49	53.07				
37	2037														-	-	2.63	1.43	2.03	11.13	79.68	-	-	96.90	6.46	42.14	24.29	24.00	96.90	-				
38	2038														-	-	2.76	1.50	2.13	11.67	83.58	-	-	101.64	6.78	44.21	25.48	25.18	101.64	-				
39	2039														-	-	2.90	1.57	2.24	12.24	111.22	-	-	130.17	7.11	46.37	26.73	49.96	130.17	-				
40	2040														-	-	3.04	1.65	2.35	12.84	116.67	-	-	136.54	7.46	48.65	28.04	52.40	136.54	-				
41	2041														-	-	3.19	1.73	2.46	13.47	55.00	-	-	75.85	7.83	51.03	29.41	-	88.26	12.42				
42	2042														-	-	3.35	1.81	2.58	14.13	103.83	-	-	125.70	8.21	53.53	30.85	33.11	125.70	-				
43	2043														-	-	3.51	1.90	2.71	14.82	48.40	-	-	71.34	8.61	56.15	32.36	-	97.13	25.78				
44	2044																																	

**Table 11.7 Environmental Evaluation**

Components <sup>1/</sup>  Environmental Elements <sup>3/</sup>	Environmental Evaluation <sup>2/</sup>					
	Ta Trach Dam		Huu Trach Dam		Domestic/industrial water supply	
	Construction Stage	Operation Stage	Construction Stage	Operation Stage	Construction Stage	Operation Stage
<b>1. Social Aspects</b>						
Land acquisition and resettlement	-/○	-/△	?	?	-/△	×
Economic activities	+/-○	+/△	+/-○	+/△	+/-△	×
Traffic and public facilities	-/○	-/○	-/○	-/○	×	×
Change or split of communities	-/○	-/△	?	?	×	×
Water rights and fishing rights	×	×	×	×	×	×
Health and sanitary condition	-/△	-/△	-/△	-/△	×	×
Cultural/historical heritage	×	×	×	×	×	×
Noise and dust	?	×	?	×	×	×
<b>2. Natural Aspects</b>						
Topography	-/△	?	-/△	?	×	×
Hydrology	×	+/-○	×	+/-○	×	×
Coastal area	×	×	×	×	×	×
Water quality	-/△	-/△	-/△	-/△	×	×
Flora, fauna, and ecology	-/△	?	?	?	×	×
Landscape	-/○	+/-○	-/○	+/-○	-/△	-/△

<sup>1/</sup>: Major components of the Master Plan to be examined.

<sup>2/</sup>: Each applicable item is marked with the following classifications.

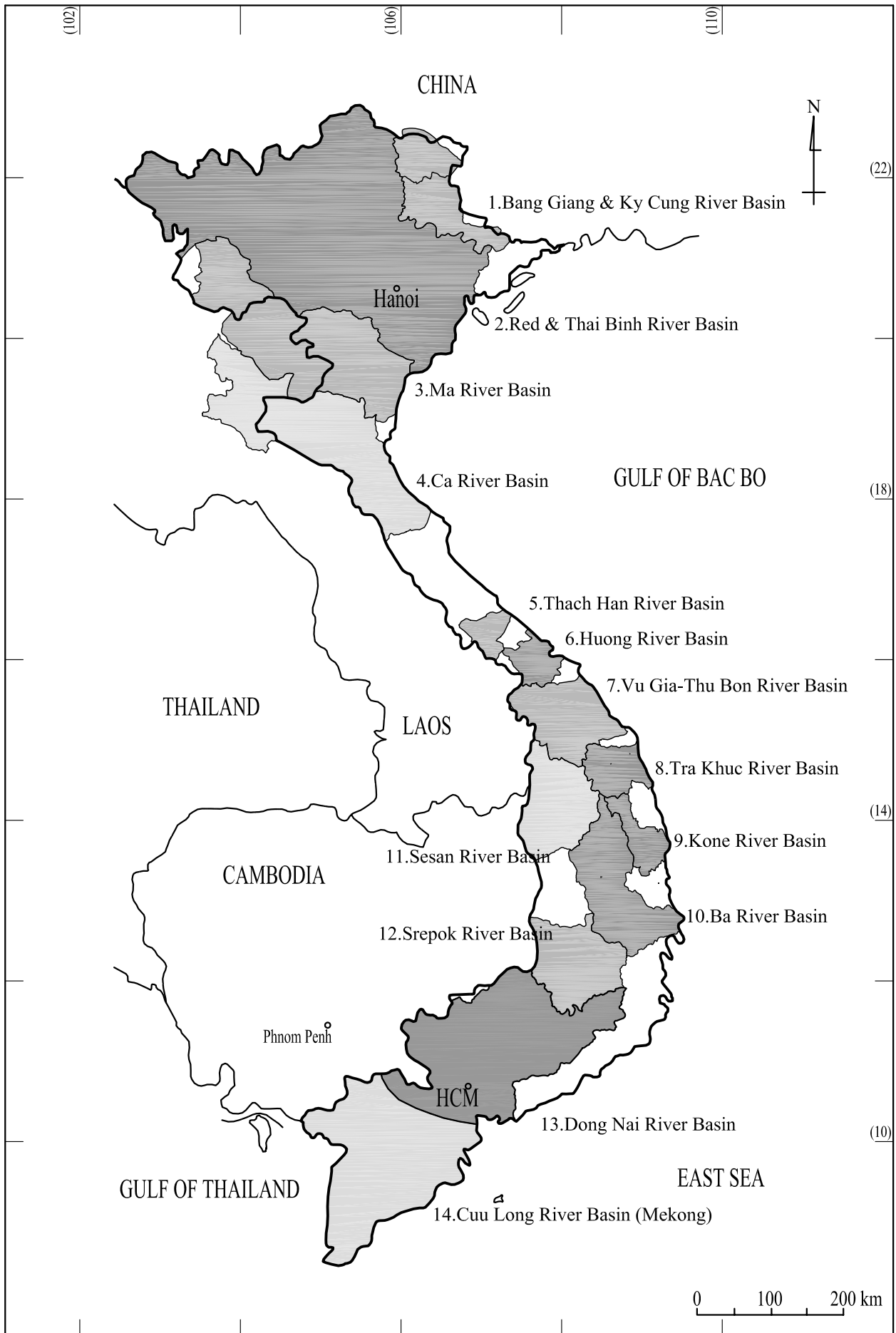
+/-○: Upper part shows the direction of impacts and lower part shows the magnitude of impacts.

○: Major    △: Minor    ×: None    ? : Not Clear

+: Positive    -: Negative    +/-: Neutral

<sup>3/</sup>: Environmental Elements were selected based on JICA Environmental Consideration Guideline

# Figures

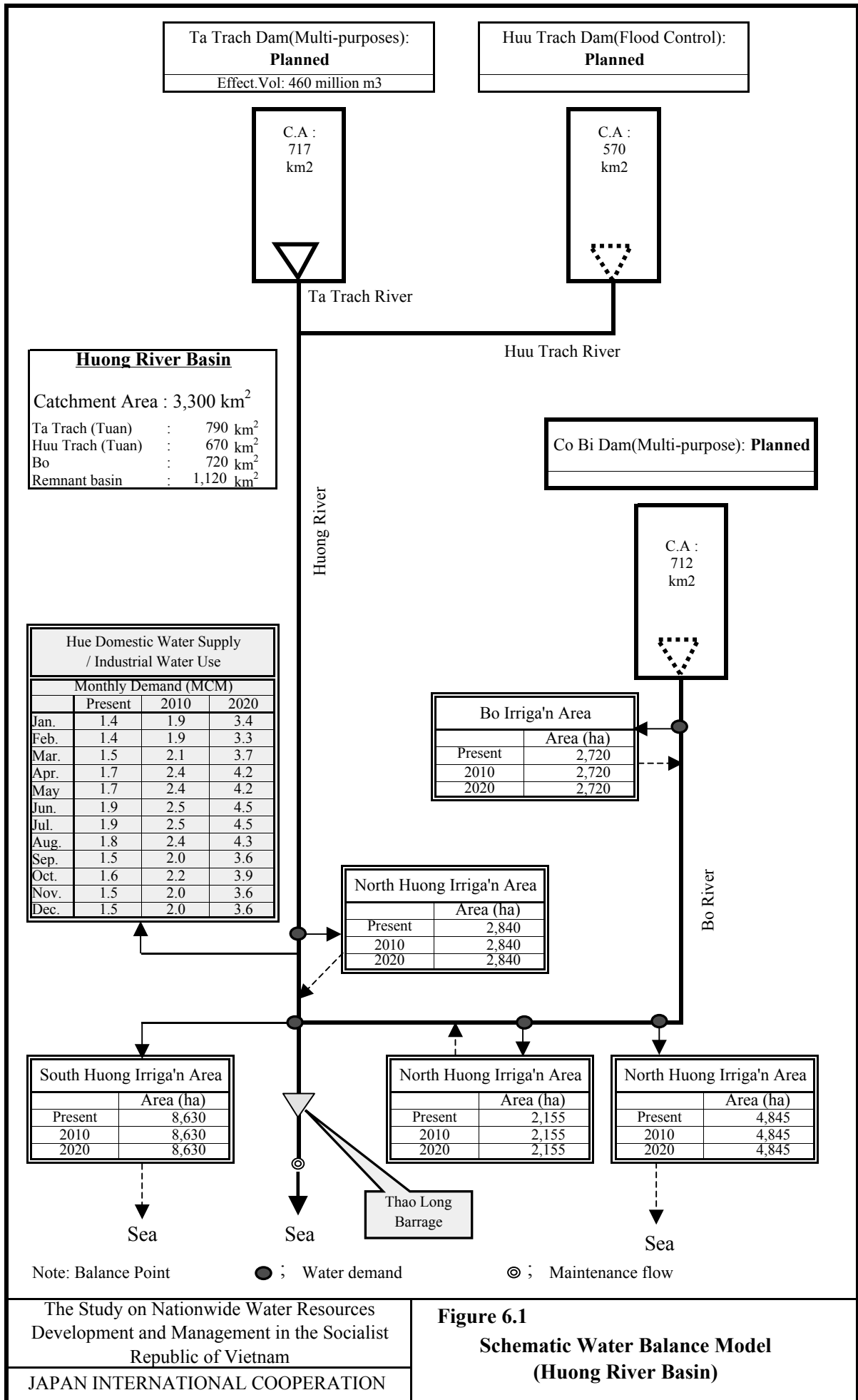


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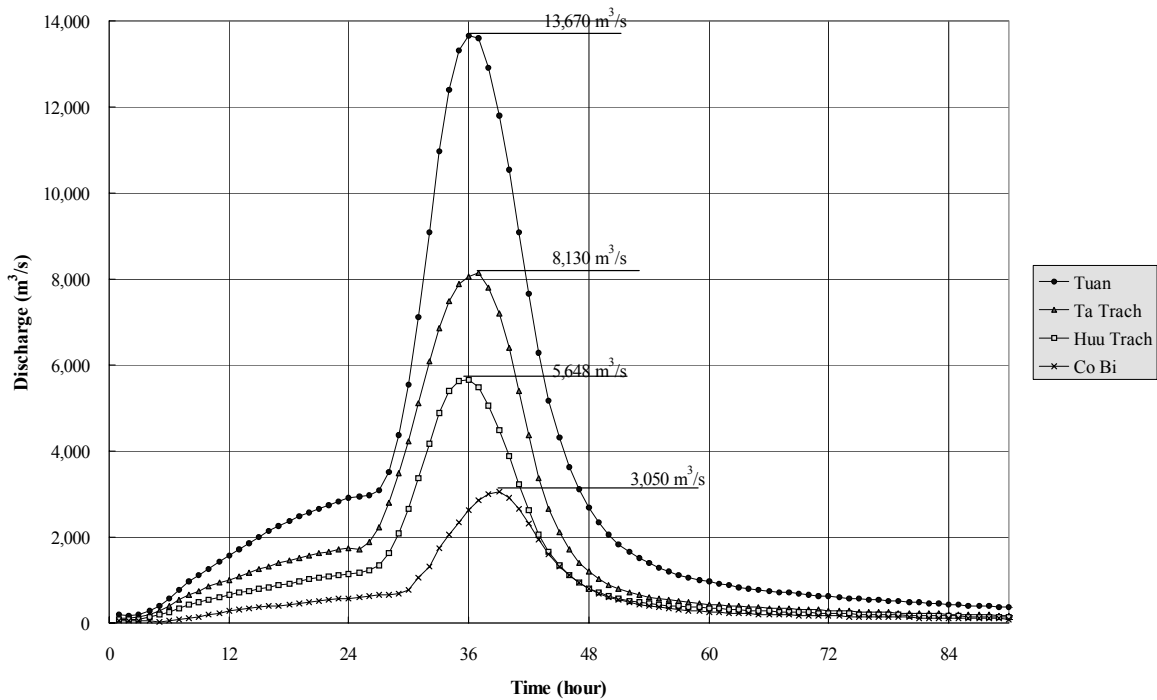
**Figure 1.1**  
**Location Map of 14 River Basins**





**Figure 6.1**  
**Schematic Water Balance Model**  
**(Huong River Basin)**

**(1) Major Flood in 1999**



**(2) 10-year Provable Early Flood**

