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Appendix 1

Table A-1 Five Year Plan for System Improvement

Item		Annual Budget (baht)				
		1998	1999	2000	2001	2002
1	improvement of canals	27,670,000	28,790,000	27,974,000	420,000	1,110,000
2	improvement of water control facility	4,832,000	9,333,000	473,000	693,000	330,000
3	improvement of drainage system	7,285,000	285,000	35,000	35,000	100,000
4	construction of bridges	45,090,000	29,520,000	25,900,000	20,300,000	6,300,000
5	construction of ditches	1,050,000	750,000	750,000	850,000	900,000
6	improvement of ditches	7,100,000	7,150,000	7,500,000	6,900,000	7,200,000
7	installment of drainage capstan	366,000	112,000			
8	installment of electricity gear and motor	2,700,000	4,800,000	5,700,000	7,200,000	3,300,000
9	installment of electricity system	450,000	520,000			
10	construction of work house and others	896,000	896,000			
11	roads and signs	175,000				
12	construction of accommodation	10,969,000	6,041,000	6,275,000	2,191,000	
total		108,583,000	88,197,000	74,607,000	38,589,000	19,240,000

Source: RID Regional Office 4

Table A-2 Primary, Secondary and Farm Level System Improvement Cost

Item	Annual Budget for Operation and Maintenance (baht)				
	1998	1999	2000	2001	2002
1 improvement of canals	27,670,000	28,790,000	27,974,000	420,000	1,110,000
2 improvement of water control facility	4,832,000	9,333,000	473,000	693,000	330,000
3 improvement of drainage system	7,285,000	285,000	35,000	35,000	100,000
4 construction of ditches	1,050,000	750,000	750,000	850,000	900,000
5 improvement of ditches	7,100,000	7,150,000	7,500,000	6,900,000	7,200,000
6 installment of drainage capstan	366,000	112,000			
7 installment of electricity gear and motor	2,700,000	4,800,000	5,700,000	7,200,000	3,300,000
8 installment of electricity system	450,000	520,000			
total	51,453,000	51,740,000	42,432,000	16,098,000	12,940,000

	2003	2004	2005	2006	2007
1 improvement of canals					
2 improvement of water control facility					
3 improvement of drainage system					
4 construction of ditches	800,000	780,000	760,000	740,000	720,000
5 improvement of ditches	7,155,000	7,150,000	7,145,000	7,140,000	7,135,000
6 installment of drainage capstan					
7 installment of electricity gear and motor					
8 installment of electricity system					
total	7,955,000	7,930,000	7,905,000	7,880,000	7,855,000

Source: RID Regional Office 4 (1998-2002), Projection (2003-2005)

Table A-3 Farm Level System Improvement Cost

Item		Annual Budget for Operation and Maintenance (baht)				
		1998	1999	2000	2001	2002
1	Construction of ditches	1,050,000	750,000	750,000	850,000	900,000
2	Improvement of ditches	7,100,000	7,150,000	7,500,000	6,900,000	7,200,000
total		8,150,000	7,900,000	8,250,000	7,750,000	8,100,000

		2003	2004	2005
1	construction of ditches	800,000	780,000	760,000
2	improvement of ditches	7,155,000	7,150,000	7,145,000
total		7,955,000	7,930,000	7,905,000

Source: RID Regional Office 4 (1998-2002), Projection (2003-2005)

Table A-4 Operation and Maintenance Cost for 1989-1998

Activities		Annual Budget (bahit)				
		1989	1990	1991	1992	1993
1	management	1,846,236	1,896,300	2,055,600	2,157,700	2,342,300
2	maintenance	10,696,900	12,263,375	6,251,700	14,252,300	24,530,000
3	rehabilitation	11,948,458	5,242,300	1,352,900	9,399,700	9,761,800
4	others	128,600		1,191,365	1,718,640	2,073,565
5	MIP	10,781,500	13,756,100	16,091,200	6,975,900	
total		35,401,694	33,158,075	26,942,765	34,504,240	38,707,665

Activities						
		1994	1995	1996	1997	1998
1	management	2,372,300	2,463,300	2,763,000	2,454,750	2,322,470
2	maintenance	22,901,200	22,826,300	24,152,200	29,525,100	18,118,600
3	rehabilitation	17,810,900	12,115,400	31,438,264	14,145,700	4,840,500
4	others	446,000	677,000	3,163,700	5,140,000	1,909,200
5	MIP					
total		43,530,400	38,082,000	61,517,164	51,265,550	27,190,770

Source: RID Regional Office 4

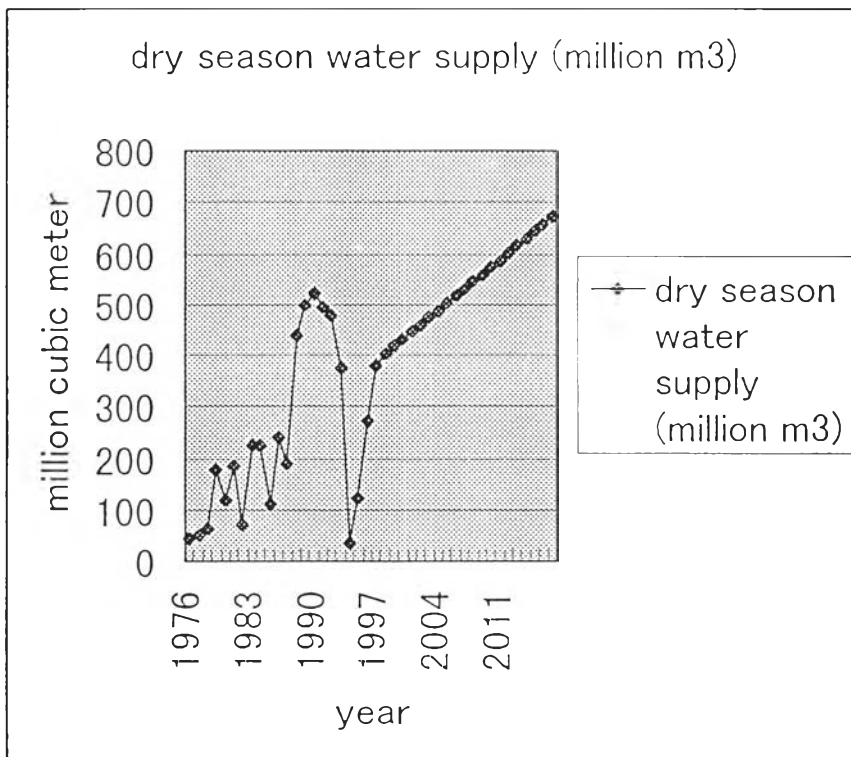
Table A-5 Annual Water Delivery of Nong Wai Irrigation Project

year	rainy season water delivery (million m ³)	dry season water delivery (million m ³)	total water delivery (million m ³)
1976	251.812	43.307	295.119
1977	234.492	51.311	285.803
1978	44.662	63.445	108.107
1979	225.216	177.346	402.562
1980	147.114	119.985	267.099
1981	296.987	184.645	481.632
1982	237.924	69.961	307.885
1983	303.813	226.089	529.902
1984	103.548	225.67	329.218
1985	344.522	112.334	456.856
1986	459.100	241.435	700.535
1987	384.394	188.278	572.672
1988	527.746	440.960	968.706
1989	514.472	499.815	1014.287
1990	481.726	521.355	1003.081
1991	457.832	495.656	953.488
1992	521.868	478.637	1000.505
1993	346.155	377.222	723.377
1994	253.300	35.000	288.3
1995	317.000	120.811	437.811
1996	433.824	275.015	708.839
1997	486.009	381.324	867.333
1998	494.7171169	404.3865455	899.1036623
1999	508.5916646	418.4849763	927.0766409
2000	522.4662123	432.5834071	955.0496194
2001	536.34076	446.6818379	983.022598
2002	550.2153077	460.7802688	1010.995577
2003	564.0898554	474.8786996	1038.968555
2004	577.9644032	488.9771304	1066.941534
2005	591.8389509	503.0755613	1094.914512

Source: 1997 Annual Report of Nong Wai Irrigation Project,
RID Nong Wai Project Office

Table A-6 Water Delivery Projection (Dry Season)

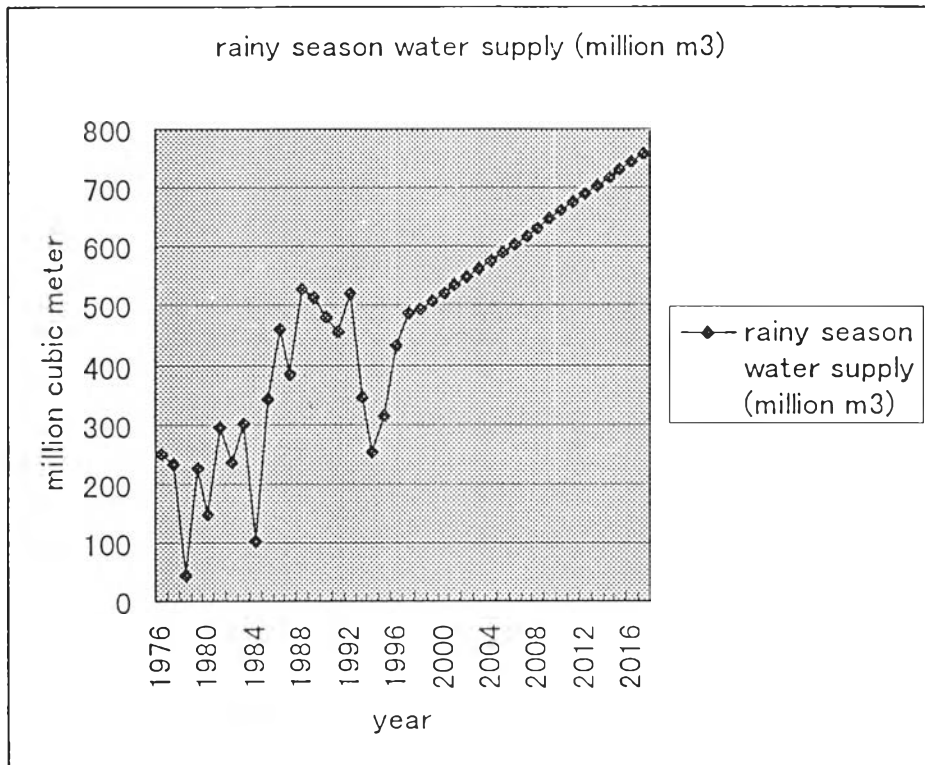
year	dry season water supply (million m3)
1998	404.3865455
1999	418.4849763
2000	432.5834071
2001	446.6818379
2002	460.7802688
2003	474.8786996
2004	488.9771304
2005	503.0755613



Source: 1997 Annual report of Nong Wai Irrigation Project,
RID Nong Wai Project Office (1976-1997), Projection (1998-2005)

Table A-6 Water Delivery Projection (Rainy Season)

year	rainy season water supply (million m ³)
1998	494.7171169
1999	508.5916646
2000	522.4662123
2001	536.34076
2002	550.2153077
2003	564.0898554
2004	577.9644032
2005	591.8389509



Source: 1997 Annual report of Nong Wai Irrigation Project,
RID Nong Wai Project Office (1976-1997), Projection (1998-2005)

Table A-7 Incremental Quantity of Water Delivery

year	rainy season water supply (million m3)	incremental water supply (million m3)	dry season water supply (million m3)	incremental water supply (million m3)
1997	486.009		381.324	
1998	494.717	8.708	404.387	23.063
1999	508.592	22.583	418.485	37.161
2000	522.466	36.457	432.583	51.259
2001	536.341	50.332	446.682	65.358
2002	550.215	64.206	460.780	79.456
2003	564.090	78.081	474.879	93.555
2004	577.964	91.955	488.977	107.653
2005	591.839	105.830	503.076	121.752

Source: projection based on water delivery record

In 1997 Annual Report of Nong Wai Irrigation Project,
RID Nong Wai Project Office

Table A-8 Average Crop Water Yield for Khon Kaen Province

crop	Crop Life (day)	Period Requiring Water (day)	Daily Requirement of Water (mm)	Life Time Water Requirement	
				mm	m ³ / rai
Rice K.C.	100	88	9.17	788.62	1261.79
Jasmine Rice 105	100	86	8.23	707.44	1131.90
Sweet Corn	75	68	4.66	316.95	507.12
Soy Bean	100	86	5.02	431.29	690.06
Peanut	105	91	4.72	429.52	687.24
Mung Bean	70	63	3.95	249.04	398.46
Sesame	90	76	4.48	340.78	545.25
Watermelon	85	78	6.20	463.21	773.14
Cotton	160	130	4.19	544.57	871.31
Sugarcane	300	270	4.19	1131.03	1809.65
Taro	170	158	8.73	1362.19	2825.39

Note: In calculation of irrigation water requirement, irrigation efficiency needs to be set around 35-50% for the rainy season, and 60-75% for the dry season.

Source: Royal Irrigation Department

Appendix 2

QUESTIONNAIRE

Address Village

Age Sex Male Female Education

No. of household members.....

Household annual cash income / sources of income

Cropping area rai-x-x Type of land rights

How many rai do you grow rice in rainy/dry season?

Rainy season rai Dry season Rai

Are you satisfied with the current irrigation service? If not, what do you think should be improved?.....

In order to make the improvement you mentioned, who do you think should bear the costs?

(e.g. RID, TAOs, farmers, etc.)

In the future, government might become short of financial resources to operate and improve irrigation systems. If you are asked to pay irrigation water fees to support O&M of Nong Wai irrigation, would you be willing to pay 40 baht per rai of paddy cropping for rainy season?

Yes >>> go to (a) No >>> go to (b)

(a) If the water fee was 80 per rai, would you be willing to pay?

Yes >>> go to (b) No >>> Why?

(b) What is the most you could afford to pay for irrigation water fee per rai of paddy cropping for rainy season? baht

Would you be willing to pay 60 baht per rai of paddy cropping for dry season?

Yes >>> go to (c) No >>> go to (d)

(c) If the water fee was 120 per rai, would you be willing to pay?

Yes >>> go to (b)

No

>>>

why?

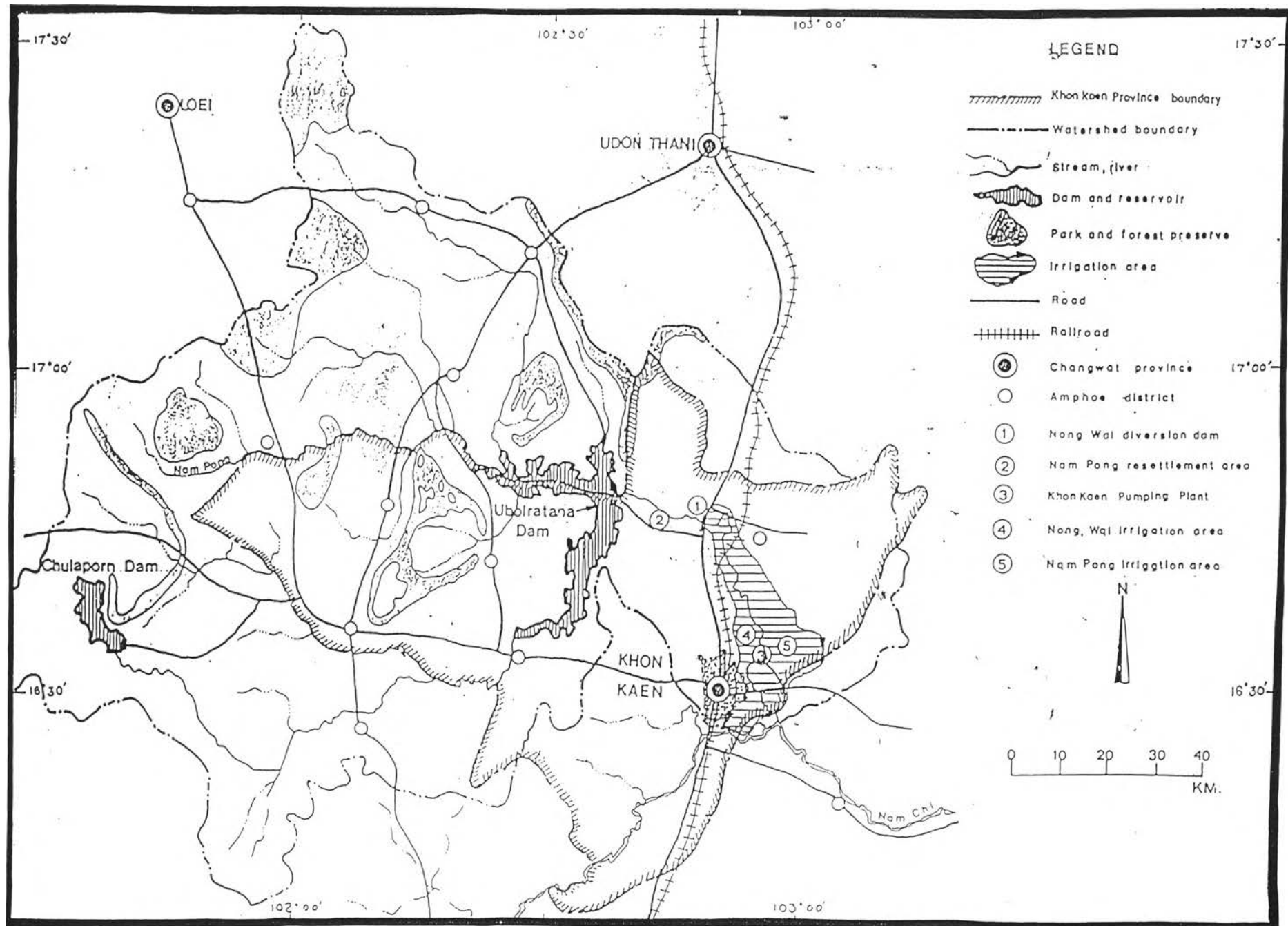
.....

(d) What is the most you could afford to pay for irrigation water fee per rai of paddy cropping for dry season? baht

Suppose some water fees were going to be collected (regardless of the amount of fees), what do you think is a good way to collect fees?

- In what form the payment should be made ? (e.g. in cash, in rice, etc.)
- How should water fees be collected? By who? (e.g. RID, water users groups, TAOs, agricultural cooperatives, etc.) and when? (e.g. after rice harvest, etc.)
- Who should use the collected money to manage irrigation at main canals / secondary canals / farm ditches levels? (e.g. RID, agricultural cooperatives, TAOs, etc.)
- Other suggestions?

Appendix 3



Biography

Mikayo Yamazaki was born in Tokyo, Japan in 1971. She received her BA in Sociology from the International Christian University, Tokyo in 1994. She continued her study at the University of Hawaii at Manoa, and received the Master's degree in Urban and Regional Planning in 1996. She Joined the United Nations Development Programme in 1997, and was assigned to the UNDP Bangkok Office. She was accepted to the Master's Programme in Environmental and Natural Resource Economics at the Chulalongkorn University in 1998.

