

APPENDIX 1. LAND USE DATA

APPENDIX 1. Land Use Data

Table A-1 General Land Use Potential

SOIL TYPE	Central				North	North-East	South	W.KINGDOM	
	total	UCR	EAST	WEST					BMR
UNIT : 1,000 Rai									
AREA WITH SOILS SUITED FOR UPLAND CROPS IN LOW RAINFALL ZONE									
1	4,634.7	613.8	134.0	3,442.1	444.9	5,119	623	0	10,377.3
2	15.6	0.0	0.0	15.6		339	13	0	367.9
3	2,915.9	250.5	1,619.2	1,046.3		3,388	3,015	0	9,319.7
4	6,377.1	116.5	3,053.6	3,207.0		9,561	25,669	0	41,607.0
5	2,774.1	1,669.9	574.7	529.5		1,628	1,374	0	5,776.2
sub-total	16,717.5	2,650.7	5,381.5	8,240.5	444.9	20,036.3	30,694.3	0.0	67,448.2
AREA WITH SOILS SUITED FOR PADDY (WET LAND) RICE									
6	9,664.9	4,884.5	1,036.9	819.2	2,924.3	11,539	7,645	1,923	30,772.6
7	1,727.1	302.2	1,397.4	27.5		3,315	2,289	2,784	10,115.8
8	96.1	0.0	0.0	95.1		143	466	128	833.2
9	5,246.5	673.6	1,068.0	2,397.7	1,107.2	0	0	123	5,369.4
10	3,706.2	514.1	3,009.6	182.6		1,437	28,653	1,604	35,401.0
11	234.1	0.0	0.0	234.1		0	1,467	0	1,700.8
sub-total	20,674.9	6,374.3	6,511.8	3,757.2	4,031.5	16,434.5	40,520.6	6,562.7	84,192.8
AREA WITH SOILS SUITED FOR TREECROPS IN HIGH RAINFALL ZONE									
12	831.6	0.0	831.6	0.0		0	0	2,973	3,805.0
13	822.5	0.0	128.8	693.7		0	0	11,761	12,583.0
sub-total	1,654.1	0.0	960.4	693.7	0.0	0.0	0.0	14,734.0	16,388.1
AREA WITH SOILS GENERALLY UNSUITED FOR CULTIVATED CROPS									
14	5,558.0	310.3	3,075.0	2,172.7		14,152	17,155	0	36,865.3
15	1,683.5	0.0	1,507.0	176.5		0	0	4,170	5,853.4
16	1,378.2	0.0	509.1	262.9	606.1	0	0	2,270	3,648.1
17	33.5	0.0	33.5	0.0		0	0	472	505.2
18	1,588.8	47.4	930.5	610.9		572	4,095	303	6,558.8
19	52.6	0.0	52.6	0.0		0	0	461	513.9
20	15,326.2	942.1	3,768.8	10,615.3		54,241	12,092	14,584	96,244.0
sub-total	25,620.8	1,299.8	9,876.6	13,833.3	606.1	68,965.9	33,342.7	22,259.4	150,188.7
WATER AREA									
	271.0	46.1	83.8	114.3	26.8	551	976	641	2,479.1
TOTAL AREA									
	64,938.3	10,370.9	22,814.1	26,644.0	5,109.3	106,027.7	105,534.0	44,197.0	320,696.9

SOURCE: GENERAL POTENTIAL LAND USE MAP; Land Development Department, Ministry of Agriculture
NOTE: Total Area is adjusted in accordance with the area listed on "AGRICULTURAL STATISTICS OF THAILAND CROP YEAR 1986/87".

Table A-2 Land Use 1986 (Unit : 1,000 Rai)

Region and Area Name	Total	Forest	Farm Holding Land							Unclassified	
			Housing Area	Paddy	Field Crop	Fruit	Veget. & Flower	Grass	Idle Land		Other Land
CHAI NAT	1,543.6	5.4	28.3	908.6	125.0	35.1	1.1	1.3	0.9	1.0	436.9
SING BURI	514.0	0.0	11.6	397.5	9.1	19.9	0.7	0.1	0.3	1.3	73.4
ANG THON	605.2	0.0	20.3	457.3	6.5	17.8	2.8	0.0	3.7	1.2	95.7
AUTHAYA	1,597.9	0.0	41.5	1,237.8	14.3	34.4	4.6	0.2	0.9	4.7	259.4
LOPBURI	3,874.8	171.9	42.7	1,146.0	1,580.6	42.4	4.1	24.2	7.6	6.0	849.2
SARABURI	2,235.3	56.3	38.2	721.4	612.9	44.6	1.3	51.8	1.6	6.2	701.0
UCR	10,370.9	233.7	182.6	4,868.6	2,348.5	194.2	14.5	77.6	14.9	20.6	2,415.7
EASTERN	22,814.1	4,991.9	234.5	4,625.6	3,797.6	1,491.6	24.4	47.0	293.4	159.5	7,148.5
WESTERN	26,644.0	10,266.0	242.8	3,597.0	3,128.2	705.8	72.4	67.0	164.7	86.4	8,313.6
BMR	5,109.3	12.9	100.2	1,904.5	242.0	476.1	91.8	3.4	22.9	63.2	2,192.4
Central	64,938.3	15,504.4	760.1	14,995.7	9,516.4	2,867.7	203.1	195.0	495.9	329.6	20,070.4
North-Eastern	105,534.0	14,813.4	1,120.3	37,445.0	13,039.1	947.1	161.6	530.6	2,172.0	779.8	34,525.0
Northern	106,027.7	51,849.4	768.9	16,932.0	9,365.7	1,122.1	131.5	80.5	433.3	166.3	25,178.0
Southern	44,197.0	9,487.6	423.9	4,860.8	154.3	6,973.5	41.5	101.0	456.6	274.1	19,423.6
Whole Kingdom	320,696.9	91,654.8	3,073.2	74,233.4	32,075.5	13,910.3	537.9	907.1	3,557.8	1,549.8	99,197.0

SOURCE: AGRICULTURAL STATISTICS OF THAILAND CROP YEAR 1987/88
Center for Agricultural Statistics Office of Agricultural Economics,
Ministry of Agriculture & Co-operatives.

Table A-3 Land Suitability

Code No.	Name of Provinces and Districts	Area Total (1000 Rai)	Paddy	Paddy & Upland Crop	Upland Crop	Not Suitable
1 0 0 CHAI NAT						
101	Muang Chai Nat	148.5	39.7	39.3	62.4	13.1
102	Manorom	135.6	51.0	10.2	56.8	17.6
103	Wat Sing	364.7	230.4	37.1	6.6	90.6
104	Sankhaburi	213.2	71.0	36.3	105.8	0.0
105	Sanphaya	137.2	59.6	29.6	48.0	0.0
106	Hankha	544.4	220.6	219.4	37.1	67.5
Province Total		1,543.6	671.4	358.9	324.8	188.4
2 0 0 SING BURI						
201	Muang Sing Buri	70.2	30.0	10.4	29.9	0.0
202	Tha Chang	21.5	16.2	2.5	2.7	0.0
203	Bang Rachan	119.1	67.7	13.5	37.9	0.0
204	Phrom Buri	51.6	20.8	7.2	23.6	0.0
205	In Buri	196.4	118.7	24.9	52.8	0.0
206	Khai Bang Rachan	55.2	37.3	5.1	12.9	0.0
Province Total		514.0	291.8	63.3	158.9	0.0
3 0 0 ANG THONG						
301	Muang Ang Thong	64.3	44.0	10.7	9.7	0.0
302	Chaiyo	45.8	24.5	7.5	13.8	0.0
303	Pa Mok	51.2	34.0	6.3	10.8	0.0
304	Pho Thong	138.9	99.5	12.2	27.2	0.0
305	Wiset Chai Chan	142.2	97.5	4.7	39.9	0.0
306	Samko	55.0	37.7	0.8	16.6	0.0
307	Sawaengha	115.0	42.0	14.4	58.6	0.0
Province Total		613.2	382.6	57.1	173.4	0.0
4 0 0 PHRANAKHON SI AYUTTHAYA						
401	Phranakhon Si Ayutthaya	80.8	45.2	4.7	31.0	0.0
402	Tha Rua	65.7	55.3	4.9	5.4	0.0
403	Nakhon Luang	123.1	106.6	6.7	9.8	0.0
404	Bang Sai	93.3	93.3	0.0	0.0	0.0
405	Bang Sai	126.3	104.4	0.0	22.0	0.0
406	Bang Ban	55.7	42.5	0.3	12.9	0.0
407	Bang Pahan	75.5	67.4	5.3	2.7	0.0
408	Bang Pa-In	141.8	128.4	0.0	13.4	0.0
409	Ban Phraek	70.5	55.0	0.0	15.4	0.0
410	Phak Hai	117.0	96.9	0.0	20.1	0.0
411	Phachi	52.7	52.3	0.0	0.4	0.0
412	Maha Rat	74.4	59.3	0.4	14.7	0.0
413	Lai Bua Luang	134.8	124.8	0.0	10.0	0.0
414	Wang Noi	135.7	135.7	0.0	0.0	0.0
415	Sena	127.2	126.9	0.0	0.3	0.0
416	Uthai	117.7	113.2	0.0	4.5	0.0
Province Total		1,592.3	1,417.3	20.0	154.9	0.0
5 0 0 LOP BURI						
501	Muang Lop Buri	355.7	137.5	137.0	46.3	34.9
502	Khok Samrong	731.0	192.6	426.0	56.6	55.8
503	Chai Badan	1,069.2	113.5	745.8	16.9	193.0
504	Tha Wung	152.7	122.1	5.5	24.8	0.3
505	Ban Mi	368.4	291.3	72.8	0.7	3.6
506	Phattahana Nikhom	325.2	78.7	210.9	5.1	30.5
507	Tha Luang	314.5	41.0	251.2	1.9	20.3
508	Sa Boal	558.2	144.7	260.3	39.4	113.8
Province Total		3,874.8	1,147.6	2,089.5	192.8	444.9
6 0 0 SARA BURI						
601	Muang Sara Buri	314.9	189.1	32.4	14.8	78.6
602	Kaeng Khoi	544.4	47.2	191.0	50.1	256.1
603	Ban Mo	174.4	159.3	15.1	0.0	0.0
604	Phra Phulthabat	202.9	56.3	72.6	36.0	38.1
605	Muak Lek	470.3	8.8	241.9	12.2	207.5
606	Wihan Daeng	143.0	115.0	9.8	0.0	18.2
607	Sao hai	78.2	73.1	1.5	3.6	0.0
608	Nong Khae	183.6	174.6	0.6	0.0	8.4
609	Nong Saeng	60.9	60.9	0.0	0.0	0.0
610	Nong Don	21.6	6.9	1.8	12.9	0.0
611	Don Phut	41.0	41.0	0.0	0.0	0.0
Province Total		2,235.3	932.2	566.7	129.5	606.9
Upper Central Region Total		10,373.2	4,843.1	3,155.6	1,134.3	1,240.2

Source : STUDY TEAM

NOTE : Data to be used are "DETAILED RECONNAISSANCE SOIL MAP OF CHAINAT, SING BURI, ANG THONG, PHRA NAKHON SI AYUTTHAYA, SARA BURI and LOP BURI".

Table A-4 Water Saturation Period of Soil

Code No.	Name of Provinces and Districts (1000 Rai)	AREA TOTAL				
		>6 months	6-3 months	3-1 month	<1 month	
100 CHAI NAT						
101	Muang Chai Nat	148.5	4.8	101.0	13.6	29.1
102	Manorom	135.6	0.0	104.0	9.9	21.7
103	Wat Sing	364.7	0.0	249.2	0.0	115.5
104	Sankhaburi	213.2	26.2	148.4	14.6	23.9
105	Sanphaya	137.2	23.5	96.3	16.2	1.1
106	Hankha	544.4	5.5	231.7	0.0	307.3
Province Total		1543.6	64.9	942.8	58.7	477.1
200 SING BURI						
201	Muang Sing Buri	70.2	11.1	48.5	10.6	0.0
202	Tha Chang	21.5	6.2	12.2	3.1	0.0
203	Bang Rachan	119.1	10.5	95.9	9.2	3.6
204	Phrom Buri	51.6	4.8	36.7	10.1	0.0
205	In Buri	196.4	13.8	154.7	27.3	0.6
206	Khai Bang Rachan	55.2	5.2	43.8	2.4	3.9
Province Total		514.0	53.0	390.3	62.4	8.3
300 ANG THONG						
301	Muang Ang Thong	64.3	10.4	33.1	13.3	7.5
302	Chaiyo	45.8	1.2	35.0	7.9	1.7
303	Pa Mok	51.2	17.8	24.9	7.5	1.1
304	Pho Thong	138.9	42.9	82.9	10.1	2.9
305	Wiset Chai Chan	142.2	99.3	36.2	3.1	3.7
306	Samko	55.0	15.5	39.5	0.0	0.0
307	Sawaengha	115.0	14.7	87.2	1.3	11.8
Province Total		613.2	210.2	328.1	45.4	29.5
400 PHRANAKHON SI AYUTTHAYA						
401	Phranakhon Si Ayutthaya	80.8	43.3	35.1	2.4	0.0
402	Tha Rua	65.7	0.0	62.7	3.1	0.0
403	Nakhon Luang	123.1	30.7	83.7	8.3	0.4
404	Bang Sai	93.3	93.3	0.0	0.0	0.0
405	Bang Shai	126.3	114.2	12.1	0.0	0.0
406	Bang Ban	55.7	42.0	13.6	0.2	0.0
407	Bang Pahan	75.5	34.0	24.4	13.3	3.8
408	Bang Pa-In	141.8	133.8	8.0	0.0	0.0
409	Ban Phraek	70.5	7.9	50.3	0.0	12.3
410	Phak Hai	117.0	103.1	13.4	0.1	0.4
411	Phachi	52.7	5.7	47.0	0.0	0.0
412	Maha Rat	74.4	32.4	27.5	10.8	3.7
413	Lat Bua Luang	134.8	119.0	15.8	0.0	0.0
414	Wang Noi	135.7	134.8	0.0	0.0	0.9
415	Sena	127.2	127.2	0.1	0.0	0.0
416	Uthai	117.7	98.7	15.6	0.0	3.4
Province Total		1592.3	1173.9	363.4	35.8	19.1
500 LOP BURI						
501	Muang Lop Buri	355.7	74.0	45.3	0.0	236.5
502	Khok Samrong	731.0	0.0	137.8	0.0	593.2
503	Chai Badan	1069.2	37.1	54.3	0.0	977.9
504	Tha Wung	152.7	141.0	6.0	0.7	4.9
505	Ban Mi	368.4	73.5	208.4	0.0	86.5
506	Phattahana Nikhom	325.2	3.8	17.2	0.0	304.1
507	Tha Luang	314.5	5.0	12.0	0.0	297.5
508	Sa Boat	558.2	0.0	37.5	0.0	520.7
Province Total		3874.8	350.5	537.6	0.7	2986.0
600 SARA BURI						
601	Muang Sara Buri	314.9	0.7	172.4	0.0	141.8
602	Kaeng Khoi	544.4	0.0	107.5	14.3	422.7
603	Ban Mo	174.4	0.0	174.4	0.0	0.0
604	Phra Phutthabat	202.9	0.0	80.5	0.0	122.4
605	Muak Lek	470.3	0.0	21.4	0.0	448.9
606	Wihan Daeng	143.0	43.5	71.8	0.0	27.7
607	Sao hai	78.2	0.0	75.5	0.0	2.7
608	Nong Khae	183.6	18.0	156.1	0.0	9.6
609	Nong Saeng	60.9	0.0	60.9	0.0	0.0
610	Nong Don	21.6	0.0	21.5	0.0	0.1
611	Don Phut	41.0	1.2	39.8	0.0	0.0
Province Total		2235.3	62.6	897.4	14.3	1261.0
Upper Central Region Total		10,373.2	1,915.1	3,459.7	217.4	4,781.0

Source : STUDY TEAM

NOTE : Data to be used are *DETAILED RECONNAISSANCE SOIL MAP OF CHAINAT, SING BURI, ANG THONG, PHRANAKHON SI AYUTTHAYA, SARA BURI and LOP BURI.

Table A-5 Erosion Area

Code No.	Name of Provinces and Districts	Area (1000Ral)	Potential Errosion Area area(1000ral)	percentage
500	LOP BURI			
501	Muang Lop Buri	355.7	2.9	0.8%
502	Khok Samrong	731.0	21.4	2.9%
503	Chai Badan	1,069.2	140.3	13.1%
504	Tha Wung	152.7	0.0	0.0%
505	Ban Mi	368.4	0.0	0.0%
506	Phattahana Nikhom	325.2	23.4	7.2%
507	Tha Luang	314.5	13.5	4.3%
508	Sa Boat	558.2	21.8	3.9%
	Province Total	3,874.8	223.3	5.8%
600	SARA BURI			
601	Muang Sara Buri	314.9	6.3	2.0%
602	Kaeng Khoi	544.4	57.9	10.6%
603	Ban Mo	174.4	0.0	0.0%
604	Phra Phutthabat	202.9	0.0	0.0%
605	Muak Lek	470.3	73.6	15.7%
606	Wihan Daeng	143.0	9.2	6.4%
607	Sao hai	78.2	0.0	0.0%
608	Nong Khae	183.6	0.0	0.0%
609	Nong Saeng	60.9	0.0	0.0%
610	Nong Don	21.6	0.0	0.0%
611	Don Phut	41.0	0.0	0.0%
	Province Total	2,235.3	147.0	6.6%
	Potential Errosion Area Total		370.3	

Source :

- 1) "STATISTICAL REPORTS OF CHANGWAT",
National Statistical Office , of the Prime Minister,1981
- 2) "Detailed soil reconnaissance soil map of Lopburi and Saraburi"
Soil survey division, LDD

Adjusted by Total area of Changwat shown in Statistical Report in1985

Table A-6 Soil Types and Recommended Land Use

Type of Soil	General Description of Soils	Recommended Land Use	Major Management Required
AREAS WITH SOILS SUITED FOR UPLAND CROPS IN LOW RAINFALL ZONE			
1.	Deep nearly level to gently sloping, moderately well to well drained, medium to fine textured soils with moderate fertility.	Permanent agricultural land : very suitable for a variety of upland crops, vegetables and fruit trees ; suggested crops and maize, sorghum, cotton, tobacco, beans, nuts, sugar cane and castor bean.	Need ordinary management practices to maintain soil fertility and structure ; irrigation is required for continuous cultivation of various upland, crops.
2.	Deep gently sloping, moderately well to well drained, fine textured soil with moderate to high fertility and consisting mainly of montmorillonite clay.	Permanent agricultural land generally suitable for upland crops and fruit trees but choice of crops may be limited due to unfavorable surface texture (very sticky clay); suggested crops are corn, cotton, sorghum and beans.	Need proper cultivation and suitable fertilizer application; application of trace element may be required for some crops such as beans.
3.	Deep gently sloping to strongly sloping well to moderately well drained, fine textured soils with low or moderately low fertility.	Permanent agricultural land; suitable for large variety of upland crops and fruit trees; suggested crops are corn, sorghum, cotton, castor bean, sugar cane and beans.	Require proper fertilizer application and conservation practices such as contour tillage planting and terracing; (drought may occur during period of little rainfall in the rainfed area).
4.	Deep, gently sloping to strongly sloping, well to moderately well drained, medium to coarse textured soils with low fertility.	Permanent agricultural land; generally suitable for upland crops and fruit trees but choice of crops may be limited suggested crops are kenaf beans, nuts, cassava, water melon, sugar cane and pine apple.	In addition to proper fertilization and good management measures to maintain soil fertility and structure, one or more special conservation practices such as contour tillage planting and terracing are required; (drought commonly occurs during periods of little rainfall in growing season of rainfed area).
5.	Shallow to moderately deep, gently sloping to moderately sloping, well to moderately well drained fine or medium textured soils with moderate fertility and high organic matter content in the surface.	Suitable for growing cultivated crops but choice of crops may be limited; suggested crops are maize, sorghum, cotton and beans.	Need ordinary management including fertilizer application to maintain soil fertility and structure; proper conservation practices are required on moderately sloping soils.
AREAS WITH SOILS SUITED FOR PADDY (WET LAND) RICE			
6.	Deep, level, poorly drained, clayey soils with moderate to high fertility.	Best suited for wet land rice in the rainy season; with irrigation multiple crops of rice, vegetables or other upland crops can be grown.	Ordinary fertilizer application and irrigation to maintain productivity, irrigation suitable variety of rice.
7.	Deep, level, poorly drained clayey low to moderately to low fertility	Well suited for wet-land rice in the rainy season with irrigation multiple crops of rice vegetables or other upland crops can be grown.	Proper fertilizer application irrigation and improved variety of rice.
8.	Shallow to moderately deep, level, poorly drained, gravelly soils that include areas with lateritic outcrops.	Can be used for growing wet-land rice in the rainy season under suitable management.	Require intensive work and high investment to cultivated land; proper fertilizer application is necessary.
9.	Deep level poorly drained, extremely acid clayey soils.	Wet-land rice under proper management is suggested.	Proper fertilizer application especially N and P with lime, irrigation, improved variety of rice.
10.	Deep, level to nearly level, poorly drained, medium textured or loamy soil with low to moderate fertility.	Well suited for wet land rice in the rainy season; with irrigation multiple crops of rice, vegetables or other upland crops can be grown.	Suitable fertilizer application; irrigation improved variety of rice (drought may occur during period of little rainfall in the rainfed area).
11.	Deep level to nearly level, poorly drained, medium textured or loamy soils of high salt content.	Generally suited for wet-land rice in the rainy season but may be risky due to high concentration of salt in soil during period of insufficient water supply.	Adequate irrigation system to supply enough water in the growing season; proper fertilizer application.
AREAS WITH SOILS SUITED FOR TREE CROPS IN HIGH RAINFALL ZONE			
12.	Deep, gently sloping to strongly sloping moderately well to well drained, fine textured or clayey soils with low to moderately low fertility and of the humid zone.	Best suited for various kinds of fruit trees (durian, rambutan langsat, orange, mangosteen etc.) beverage crops (coffee) industrial oil crops (oil palm coconut) and rubber	Fertilizer application to maintain soils fertility; erosion control on sloping soils such as cover crops, terracing contour cropping, etc.
13.	Deep, to moderately deep gently sloping to strongly sloping, moderately well to well drained soils with low fertility and of humid zone.	Well suited for many kinds of fruit trees, beverage crops, industrial oil crops and rubber.	Proper fertilizer application; use of erosion control practices such as cover crops, terracing contour cropping, etc.
AREAS WITH SOILS GENERALLY UNSUITED FOR CULTIVATED CROPS			
14.	Shallow to very shallow, moderately sloping to steep, well to moderately well drained gravelly soils including areas with laterite or bedrock near the surface.	Generally not suited for cultivated crops with ordinary management practices; best suited for pasture and woodland.	Special conservation practices are required on sloping soils; fertilizer application and proper cultivation practices are required.

Table A-6 Soil Types and Recommended Land Use (Cont'd)

Type of Soil	General Description of Soils	Recommended Land Use	Major Management Required
15.	Shallow, gently sloping to steep, moderately well to well drained; gravelly soils of the humid zone including areas with bedrock, laterite or stone near the surface.	Generally suited for rubber and pasture best suited for woodland.	Proper fertilizer application, well prepared growing pit; use of erosion control practices such as cover crops, terracing, contour cropping etc.
16.	Muddy soils on tidal flat prolonged deep flooding, regular flooding by sea water.	Not suited for any commercial crops, better maintained for woodland (mangrove) production or construction of shrimp and fish ponds in local areas.	Extensive improvement if being converted into cultivated land.
17.	Peat and muck soils, prolonged deep flooding.	Not suited for any crops; although reclamation has been made, choice of crops is limited.	Reclamation entails costly inputs especially for drainage control and fertilizer application.
18.	Deep, gently sloping, excessively drained sandy soils on beach or sandy terrace.	Not suited for cultivated crops except for pasture; but where water supply is adequate, water melon and other vegetables can be produced; on beach area coconut is well adapted.	Proper fertilizer application; irrigation or water conservation.
19.	Deep, gently sloping, excessively drained sandy soils with spodic horizon that occurs within 100 cm. from the soils surface; usually forming on beach ridges or sand bars.	Generally not suited for any crops due to limitation caused by spodic horizon except for pasture, but water melon, pine apple and cashew nut may be grown if adequate water supply is available.	Proper fertilizer application; water conservation is required if attempts to grow crops are made.
20.	Shallow to deep, well to excessively drained, rolling to very steep soils of the hills and mountains.	Not suited for any commercial crops, suited for woodland or establishment of watershed protective vegetation.	Not recommended to convert into cultivated land because it required very high input which will impact the environment.

Table A-7 Regional Breakdown of Land Rights (1980)

Type of Land Right	UNIT : thousand rai				
	Northeast	North	Central	South	Total
(1) Total Agricultural land	60,325	33,950	35,440	18,317	148,032
(2) Occupied forest reserve land % of forest land inclusion	11,560 19%	8,227 24%	5,951 17%	5,057 28%	30,795
(3) Bai Jong (N.S.2)	3,789	1,766	1,435	729	7,719
(4) Nor Sor 3 (N.S.3)	30,583	14,349	9,917	9,188	64,037
(5) Title Deed (N.S.4)	1,396	2,862	13,190	561	18,009
(6) (3)+(4)+(5) % of regal agricultural land	35,768 59%	18,977 56%	24,542 69%	10,478 57%	89,765 61%
(7) (1)-(3)-(4)-(5) % of iregal agricultural land	24,557 41%	14,973 44%	10,898 31%	7,839 43%	58,267 39%
(8) (7)-(2) % of Forest in iregal Ag. land	12,997 47%	6,746 55%	4,947 55%	2,782 65%	27,472 53%
% of Forest in total Ag. land	22%	20%	14%	15%	19%

Source : Land tenure Security and Agricultural Development of Thailand, Kasetsart University, Staff Paper No.54, Aug. 1984

Table A-8 Land Tenure in the UCR

No.	Amphc Name	Unit : Number of Villages			Total Villages
		Most Villagers have land title of :	Temporary right	certificate of use	
CHAINAT					
101	Muang Chai Nat	7	14	34	55
102	Manorom	5	11	20	36
103	Wat Sing	7	56	1	64
104	Sankhaburi	9	23	37	69
105	Sanphaya	7	6	29	42
106	Hankha	15	68	4	87
Total		50	178	125	353
SINOBURI					
201	Muang Sing Buri	2	1	49	52
202	Tha Chang	0	1	9	10
203	Bang Rachan	0	12	25	37
204	Phrom Buri	2	0	26	28
205	In Buri	11	21	69	101
206	Khai Bang Rachan	1	8	40	49
Total		16	43	218	277
ANGTHONG					
301	Muang Ang Thong	3	1	77	81
302	Chaiyo	2	1	43	46
303	Pa Mok	3	0	43	46
304	Pho Thong	0	1	94	95
305	Wiset Chai Chan	1	9	85	95
306	Samko	1	7	2	10
307	Sawaengha	1	22	29	52
Total		11	41	373	425
AYUTTHAYA					
401	Phranakhon Si Ayutthaya	11	1	96	108
402	Tha Rua	4	1	63	68
403	Nakhon Luang	5	1	55	61
404	Bang Sai	2	0	31	33
405	Bans Shai	3	4	107	114
406	Bang Ban	8	8	65	81
407	Bang Pahan	3	0	84	87
408	Bang Pa-In	16	0	104	120
409	Ban Phrack	0	0	23	23
410	Phak Hai	4	2	68	74
411	Phachi	3	0	59	62
412	Maha Rat	0	0	52	52
413	Lat Bua Luang	3	0	50	53
414	Wang Noi	1	2	48	51
415	Scna	10	2	79	91
416	Uthai	4	2	85	91
Total		77	23	1069	1169
LOPBURI					
501	Muang Lop Buri	32	28	137	197
502	Khok Samrong	28	176	6	210
503	Chai Badan	80	53	1	134
504	Tha Wung	1	4	112	117
505	Ban Mi	5	37	109	151
506	Phettahana Nikhon	18	27	32	77
507	Tha Luang	38	4	0	42
508	Sa Boat	4	39	1	44
Total		206	368	398	972
SARABURI					
601	Muang Sara Buri	9	25	76	110
602	Kaeng Khoi	5	66	23	94
603	Ban Mo	11	17	35	63
604	Phra Phutthabat	3	28	34	65
605	Muak Lek	58	22	1	81
606	Wihan Daeng	7	25	16	48
607	Sao Hai	11	5	72	88
608	Nong Khac	7	6	154	167
609	Nong Saeng	0	0	65	65
610	Nong Don	2	4	22	28
611	Don Phut	1	0	22	23
Total		114	198	520	832

Source : Rural Data Base 1987.

A-9 Land Use Zoning In the UCR

Zone Name	UNIT : 1000 Rai						UCR Total
	CHAI NAT	SING BURI	ANG THONG	AYUTTHAYA	LOP BURI	SARA BURI	
Preservation Area							
Forest Preservation	188 (12%)	0 (0%)	0 (0%)	0 (0%)	445 (11%)	607 (27%)	1,240 (12%)
Conservation Area							
Delta Area	65 (4%)	53 (10%)	210 (34%)	1174 (74%)	351 (9%)	63 (3%)	1,916 (18%)
Upland Area	0 (0%)	0 (0%)	0 (0%)	0 (0%)	223 (6%)	147 (7%)	370 (4%)
Development Area							
Delta Area	1,115 (72%)	461 (90%)	403 (66%)	418 (26%)	122 (3%)	290 (13%)	2,809 (27%)
Upland Area	175 (11%)	0 (0%)	0 (0%)	0 (0%)	2,734 (71%)	1,128 (50%)	4,037 (39%)
Total	1,544 (100%)	514 (100%)	613 (100%)	1,592 (100%)	3,875 (100%)	2,235 (100%)	10,373 (100%)

Source : The Study Team

Table A-10 Land Consolidation Procedures (at Present)

1. Planning of land consolidation programme in various localities as well as setting up plan of execution.
2. Holding the meeting among the landowners, investigation the willingness of landowners, making records of their agreements and disagreements.
3. Publish in the government gazette declaring the locality to be surveyed on the area of land consolidation programme.
4. Conduct the necessary surveys, such as
 1. Aerial survey
 2. Rectification
 3. Spot-height and geographical mapping
 4. Cadastral survey and cadastral mapping
 5. Land classification surveys and soil mapping
 6. Economical and social surveys
5. Design
 1. Preliminary planning for the irrigation and drainage system of on-farm and reallocation the plot of land.
 2. Hearing with farmers
 3. Final planning
6. Publish in the Royal Decree prescribe land area in any locality as the area of land consolidation programme. Together with the Royal Decree there should be a list of names of rightful owners or possessors and map showing the area of land consolidation programme.
7. Promulgation of the Royal Decree.
8. Assessment of the value of the land and property.
9. Construction
 1. Staking out of center line
 2. Land clearing
 3. Construction of farm roads, drain and ditches
 4. Land levelling
 5. Construction of related structures
10. Issuing new title deeds
 1. Collection of the old title deeds in order to issue the new ones.
 2. Issuance of a new title deeds.
11. Pay or receive the difference in compensation under the principle and conditions prescribed by the Land Consolidation Committee.
12. Establishment of the water users' groups for the operation and maintenance purposes.
13. Promote and support the agricultural aspects:
 1. Promoting the agricultural extension
 2. Promoting the co-operatives
 3. Promoting the Fisheries
 4. Providing credit
14. Follow-up, monitoring and evaluating
15. Collect expenses of land consolidation project from farmers according to the principles and conditions determined by the Central Land Consolidation Committee.

Table A-11 Estimation of the Future Land Utilization

Proposed Land Utilization in the year of 2010 is estimated based on the following data and information to be compiled. Land use intensity, population density, irrigable area in field crop area and land use conversion ratio are assumed based on the existing land use and production data.

Area Name	CHAI NAT	SING BURI	ANGTHONG	AYUTTHAYA	LOP BURI	SARA BURI	Total
LAND USE POTENTIAL IN THE UCR (Unit : 1000 Rai) Prepared by study team based on the soil data of LDD.							
Paddy	671	292	383	1,417	1,148	932	4,843
Field Crop	359	63	57	20	2,089	567	3,156
Paddy & Field Crop	325	159	173	155	193	129	1,134
Not suitable	188	0	0	0	445	607	1,240
Total	1,544	514	613	1,592	3,875	2,235	10,373
LAND UTILIZATION 1986 (Unit : 1000 Rai) Agricultural statistics year book crop year 1987/1988							
Forest	5	0	0	0	172	56	234
Paddy	909	398	457	1,238	1,146	721	4,869
Field Crop	125	9	7	14	1,581	613	2,348
Fruit	35	20	18	34	42	45	194
Veg. & Flower	1	1	3	5	4	1	15
Grass	1	0	0	0	24	52	78
Idle Land	1	0	4	1	8	2	15
Other Land	1	1	1	5	6	6	21
Housing Area	28	12	20	41	43	38	183
Unclassified	437	73	96	259	849	701	2,416
Total	1,544	514	605	1,598	3,875	2,235	10,371
Potential erosion area and existing deteriorated field crop areas area measured as shown below.							
Erosion Area	0	0	0	0	223	147	370
(Unit : 1000 Rai)							
Flood areas are estimated based on the soil data & LANDSAT images							
Potential Flood Area	65	53	210	1,174	351	63	1,916
(Unit : 1000 Rai)							
Potential Paddy areas in the Chao Phraya Project are measured on the map. Areas area shown below.							
Paddy in C.P. Project	335	292	383	1,417	403	354	3,183
(Unit : 1000 Rai)							
Total Land Area	(1,180)	(514)	(613)	(1,592)	(473)	(353)	(4,725)
in the Chao Phraya Project							
Other than C.P. Project	337	0	0	0	745	578	1,660
Floating rice cultivation areas are estimated based upon the LANDSAT image analysis							
Floating Rice Area	0	56	89	473	105	19	742
(Unit : 1000 Rai)							
Urban population in the UCR is forecasted as shown below.							
Urban Population 2010	35	89	86	378	184	301	1,072
(Unit : 1000 persons)							
LAND USE ZONING							
Preservation Area							
Forest Preservation	188	0	0	0	445	607	1,240
(land to be classified as Not Suitable in Land Use Potential)							
Conservation Area							
Delta Area	65	53	210	1174	351	63	1,916
(Potentially Flooded Area)							
Upland Area	0	0	0	0	223	147	370
(Erosion Area)							
Development Area							
Delta Area	1,115	461	403	418	122	290	2,809
(Land Area in the C.P. Project - Conservation Area in the Delta)							
Upland Area	175	0	0	0	2,734	1,128	4,037
(Areas other than above)							

AGRICULTURAL LAND USE ESTIMATION

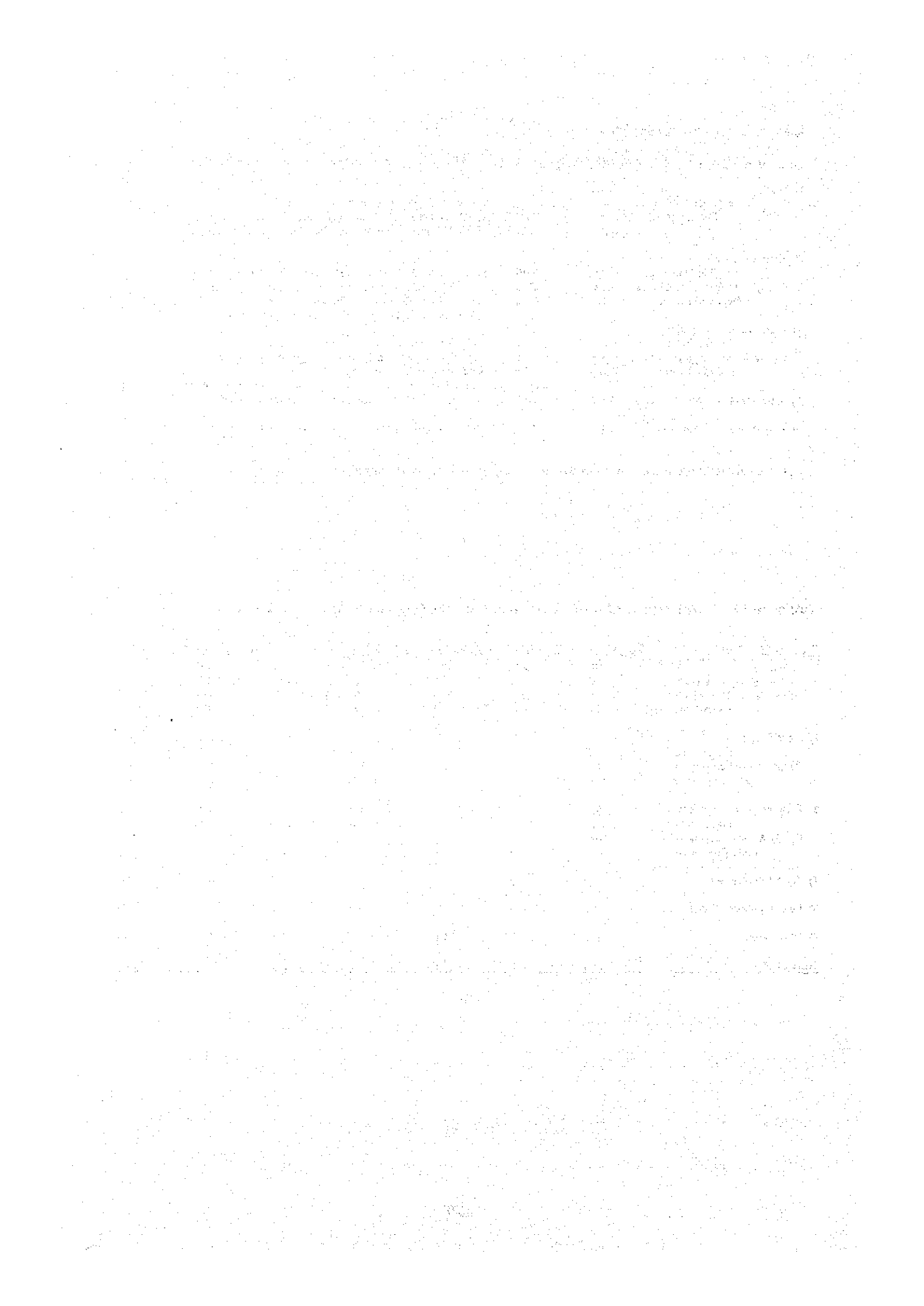
Land Use Intensity : land use intensity by type of crops and land use potential are assumed as followings

	INDEX	INTENSITY	
1) Paddy			
Floating rice area :	0.85	0.85	100 % of potential area can be cultivated
Paddy area :	0.80	0.80	100 % of potential area in the Chao Phraya Project area
	0.24	0.80	30 % of potential area other than Chao Phraya Project
2) Field Crops			
Paddy area :	0.36	0.80	50% of potential area to be diversified to the field crops
Paddy & Field crop area :	0.34	0.75	50 % of potential area use for field crops cultivation
Field Crop Area :	0.63	0.70	100 % of potential area to be used (10 % of Field Crop Area will be treecrop/wind breaker)
3) Tree crops & vegetable			
Paddy area :	0.20	0.80	20 % of potential area diversity to the tree crops ***
Paddy & Field crop area :	0.41	0.75	50 % of potential area use for tree crop cultivation **
Field Crop Area :	0.07	0.70	wind breaker in field crop area (* other than C.P.Project area) (** wind breaker is included)
4) Agro-forestry area :	0.80	0.80	80 % of potentialy erosion area shall be used
5) Forest preservation area :	1.00	1.00	100 % of land not suited for development shall be preserved

Based upon the above mentioned assumption, followings are Futur Land Utilization Plan

Table A-12 Land Utilization in 2010 (Actual Planted Area, Unit : 1,000 Rai)

Area Name	CHAI NAT	SING BURI	ANG THONG	AYUTTHAYA	LOP BURI	SARA BURI	Total
1) Paddy	365	248	325	1,205	521	440	3,104
Floating rice area :	0	48	76	402	89	16	631
Pady area (C. P. Project) :	284	200	250	803	253	285	2,075
Paddy area :	81	0	0	0	179	139	398
2) Field Crops	457	94	95	65	1,649	609	2,968
Paddy area :	121	0	0	0	268	208	598
Paddy & Field crop area :	110	54	59	52	65	44	383
Field Crop Area :	226	40	36	13	1,316	357	1,988
3) Tree crops & vegetable	226	70	76	65	375	209	1,021
Paddy area :	67	0	0	0	149	116	332
Paddy & Field crop area :	134	66	72	64	80	53	468
Field Crop Area :	25	4	4	1	146	40	221
4) Agro-forestry area :	0	0	0	0	179	118	296
5) Forest preservation area :	188	0	0	0	445	607	1,240
6) Other area	306	102	118	257	706	254	1,743
Total UCR	1,544	514	613	1,592	3,875	2,235	10,373



**APPENDIX 2. NATIONAL WATER RESOURCES
COMMITTEE (NWRC)**

APPENDIX 2. National Water Resources Committee (NWRC)

1. Committee members :
 - 1.1 Deputy Prime Minister Chairman
(General Thianchai Sirisamphan)
 - 1.2 Minister of Agriculture and Cooperative Member
 - 1.3 Minister of Defence Member
 - 1.4 Minister of Interior Member
 - 1.5 Minister of Science, Technology & Energy Member
 - 1.6 Minister of Industry Member
 - 1.7 Minister of Public Health Member
 - 1.8 Minister of Attach to Prime Minister Office
(Mr. Korn Taprangsi)
 - 1.9 Minister of Attach to Prime Minister Office
(Dr. Anuwat Wattanapongsiri)
 - 1.10 Supreme Commander
 - 1.11 Commander in Chief of Army
 - 1.12 Secretary General NESDB
 - 1.13 Permanent Secretary Min. of Interior
 - 1.14 Permanent Secretary MOAC
 - 1.15 Permanent Secretary Min. of Science, Tech. & Energy
 - 1.16 Permanent Secretary Min. of Industry
 - 1.17 Permanent Secretary Min. of Public Health
 - 1.18 Permanent Secretary Min. of Communication
 - 1.19 Secretary General to Prime Minister Secretary
 - 1.20 Director NWRC Office Asst. secretary
 - 1.21 Assistant Governor, EGAT Asst. secretary
 - 1.22 Project Planning Expert, RID Asst. secretary
 - 1.23 Director, Rural Development Coordination
Division, NESDB Asst. secretary

2. Duty & Authority

As specified in point 7 of Prime Minister Office Regulation for National Water Resources Administration, AD 1989

Appointed by Prime Minister on 10 Jan. 1990

Pasak River Basin Working Group

- | | | |
|-----|--|-----------------|
| 1. | Inspector General, Prime Minister Office | Chairman |
| 2. | Governor, Lopburi Province | Deputy chairman |
| 3. | Permanent secretary, Petchaboon Province | Member |
| 4. | Permanent secretary, Loei | Member |
| 5. | Permanent secretary, Saraburi | Member |
| 6. | Permanent secretary, Ayutthaya | Member |
| 7. | Representative, NWRC Office | |
| 8. | Representative, NESDB | |
| 9. | Representative, ARD | |
| 10. | Representative, NEA | |
| 11. | Representative, EGAT | |
| 12. | Representative, Provincial Water Works Authority | |
| 13. | Director, RID Regional 8 | Secretary |
| 14. | Representative, RID Regional 8 | Asst. secretary |

Appointed by Chairman, NWRC

Dated February 22, 1990

APPENDIX 3. LIST OF STUDY REPORTS AND PAPERS

APPENDIX 3. LIST OF STUDY REPORTS AND PAPERS

1. REPORTS

Design for the Study

Inception Report

Inception Report: Amendment

Progress Report

Interim Report

Executive Summary

Master Plan Report

Technical Reports

- Vol. 1 Spatial Framework for Development
- Vol. 2 Environmental Management
- Vol. 3 Land Use and Agricultural Development
- Vol. 4 Industrial Development
- Vol. 5 Distribution
- Vol. 6 Water Resources Management
- Vol. 7 Transportation
- Vol. 8 Economic Environment
- Vol. 9 Local Government Finance
- Vol. 10 Energy
- Vol. 11 Landsat Analysis

Draft Final Report

Executive Summary

Master Plan Report

Sector Reports

- Vol. 1 Spatial Framework and Network for Development
- Vol. 2 Urban Management
- Vol. 3 Environmental Management
- Vol. 4 Water Resource Management, Agricultural Development and Land Use Management
- Vol. 5 Industrial Development
- Vol. 6 Distribution and Marketing
- Vol. 7 Energy
- Vol. 8 Social Development in Rural Economies
- Vol. 9 International and National Economic Environment
- Vol. 10 Human Resource Development
- Vol. 11 Landsat Analysis

Final Report

Executive Summary

Master Plan Report

Sector Reports

- Vol. 1 Spatial Framework and Network for Development
- Vol. 2 Urban Management
- Vol. 3 Environmental Management

- Vol. 4 Water Resource Management, Agricultural Development and Land Use Management
- Vol. 5 Industrial Development
- Vol. 6 Distribution and Marketing
- Vol. 7 Energy
- Vol. 8 Social Development in Rural Economies
- Vol. 9 International and National Economic Environment
- Vol. 10 Human Resource Development
- Vol. 11 Landsat Analysis

2. PAPERS

Papers for Seminar, Sara Buri, November 2-3, 1989

1. Development Framework, Strategies, and Production
2. Urban, Land Use and Infrastructure Development
3. Critical Issues for Development Management

Papers for Seminar, Pattaya, July 28-29, 1990

1. Agriculture and Water Resources: Policies and Programs
2. Industry and Energy: Policies and Programs
3. Urbanization and Infrastructure Facilities: Policies and Programs
4. Development Administration and Environmental Management: Policies and Programs

APPENDIX 4. STAFF INPUT

APPENDIX 4. STAFF INPUT

Members of UCR Study Project Staff of NESDB

1. Mr. Vithya Siripongse Deputy Secretary-General and Project Director
2. Dr. Utis Kaothien Director of Urban Development Coordination Division and Projector Advisor
3. Mr. Manu Sattayateva Director of Central Region Development Center and Project Manager
4. Mr. Weera Sritaranondha CRDC Official and Counterpart Team Member
5. Mr. Teerapat Kaiyarit - do -
6. Mr. Numthip Pattanaskul - do -
7. Mrs. Somsiri Protitikul - do -
8. Mr. Sumeth Srisangthaisuk - do -
9. Mr. Kiattikul Lueangwattana UDCD Official and Counterpart Team Member
10. Ms. Piyachat Sonkom CRDC Official and Counterpart Team Member
11. Mr. Poolwit Bua-on - do -
12. Mr. Mana Ligkachai - do -
13. Mr. Sumitra Pooltong - do -
14. Mr. Chokdee Srisomboon - do -

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1. Mr. Koichiro Katsurai Chairman of the Committee, Institute for International Cooperation, JICA
2. Mr. Koichi Nonaka Member of the Committee, Institute of Developing Economies
3. Mr. Koji Taniguchi Member of the Committee, IDE
4. Dr. Kunitoshi Sakurai Member of the Committee, IFIC, JICA

5. Mr. Atsushi Matsumoto Member of the Committee and Officer in Charge, JICA

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2. Dr. Masahiko Honjo Advisor, Regional Development, IDCJ
3. Mr. Yoshinobu Nomura Deputy Leader, Regional Development, PCI
4. Dr. Masahiro Nakashima Water Resource and Environmental Management, IDCJ
5. Mr. Tadashi Kume Land Use and Environmental Management, PCI
6. Mr. Toru Ishibashi Industrial Development, ECFA
7. Dr. Michiaki Hosono Agricultural Development, PCI
8. Mr. Katsuhide Nagayama Spatial Framework for Development, Urban and Environmental Management, PCI
9. Mr. Atsushi Saito Distributional Marketing, PCI
10. Dr. Charit Tingsabadh National Economic Environment, CUSRI
11. Mr. James M. McBride Transportation Development, PCI
12. Dr. Masayuki Doi Transportation Development, IDCJ
13. Ms. Abha Sirivongs Na Ayuthaya Water Management Institution, CUSRI
14. Mr. Masamichi Ogawa Industrial Development, IDCJ

- | | | |
|-----|---------------------|---|
| 15. | Mr. Masahiro Hamano | Local Authority Finance,
SOMC |
| 16. | Mr. Masumi Ishida | Energy and Regional Economy,
IDCJ |
| 17. | Mr. Kazuto Yamada | Environmental Management,
PCI |
| 18. | Mr. Kenji Domoto | International and National
Economic Environment,
IDCJ |
| 19. | Mr. Toshiyuki Imai | Private Investment and Industrial
Development,
IDCJ |

CUSRI:	Chulalong Korn University Social Research Institute
ECFA:	Engineering Consulting Firm Association
IDCJ:	International Development Center of Japan
PCI:	Pacific Consultants International
SOMC:	Shinko Overseas Management Consultant

CO-EXPERTS

- | | | |
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| 2. | Dr. Chamnien Boonma | Agricultural Economy,
Kasetsart University |
| 3. | Dr. Kamol Sudaprasert | Human Resource Development,
Nonformal Education Department |
| 4. | Dr. Jacques Amoyot | Social Development in Rural Economies,
Chulalong Korn University |
| 5. | Dr. Wisoot Wiseschinda | Social Development in Rural
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| 6. | Mr. Suvit Vibulsresth | Landsat Analysis,
Thailand Remote Sensing Center |
| 7. | Mr. Satoshi Machida | Landsat Analysis,
Pacific Consultants Co. Ltd. |
| 8. | Dr. Krai Tungsonga | Survey of Industry, Distribution and
Marketing,
Asian Engineering Consultants |

9. Dr. Kraiyudht
Dhiratayakinant
Local Government Financing,
Chulalong Korn University
10. Dr. Jesada Kaewkulaya
Water Management,
Kasarsart University
11. Dr. Daranee Thavinpipatkul
Urban and Human Settlement Analysis,
Chulalong Korn University
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Tourism Authority of Thailand

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General Manager, Planning Division,
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2. Mr. Tsuneo Sakano
Resident Representative,
PCI Bangkok

JICA