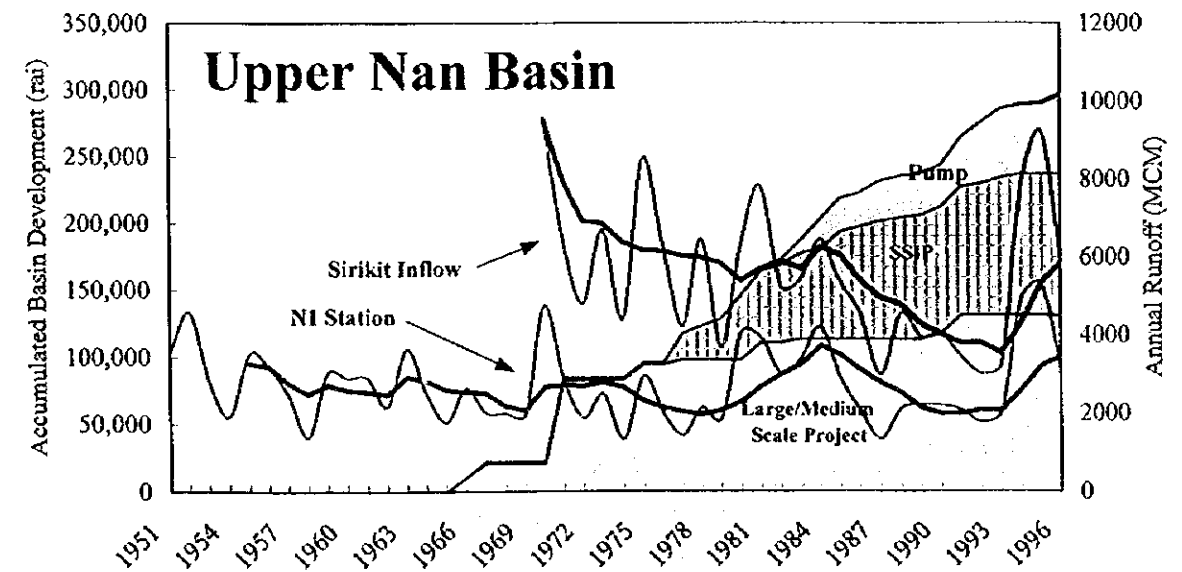
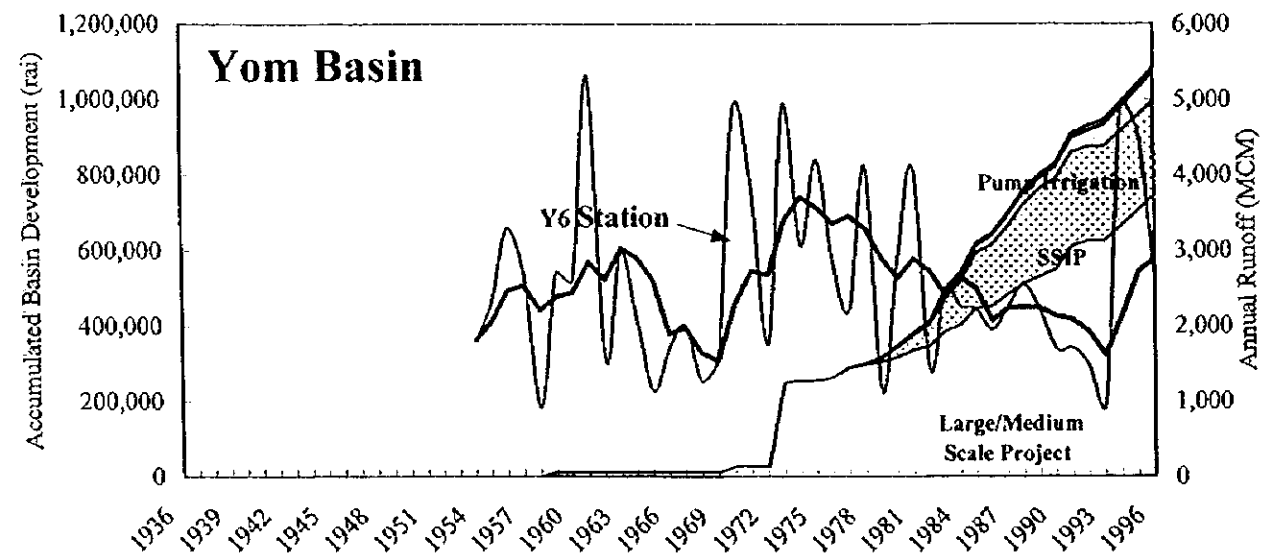
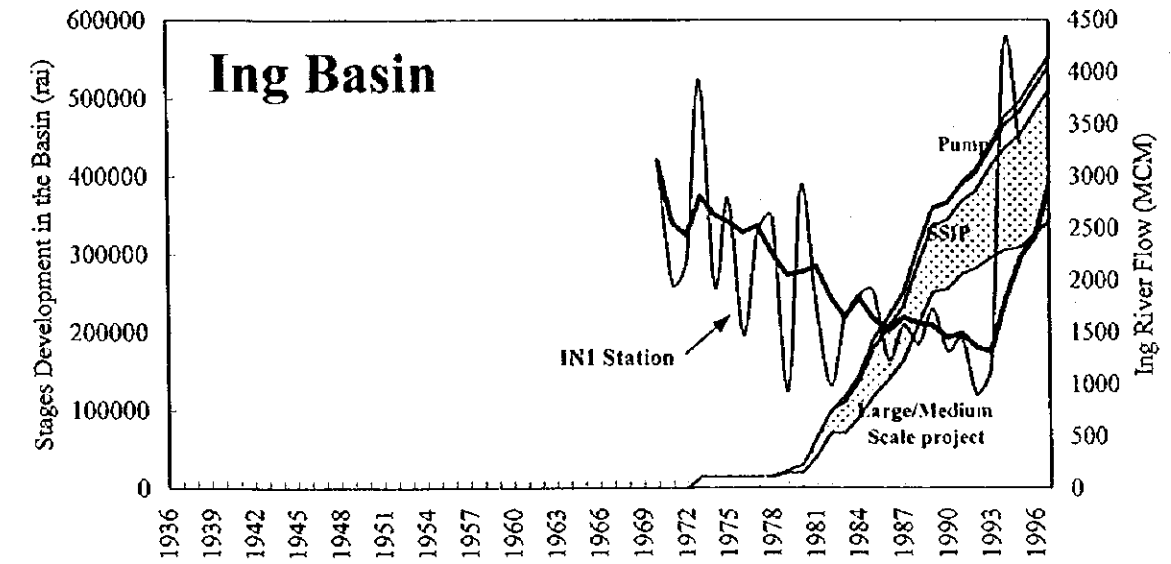
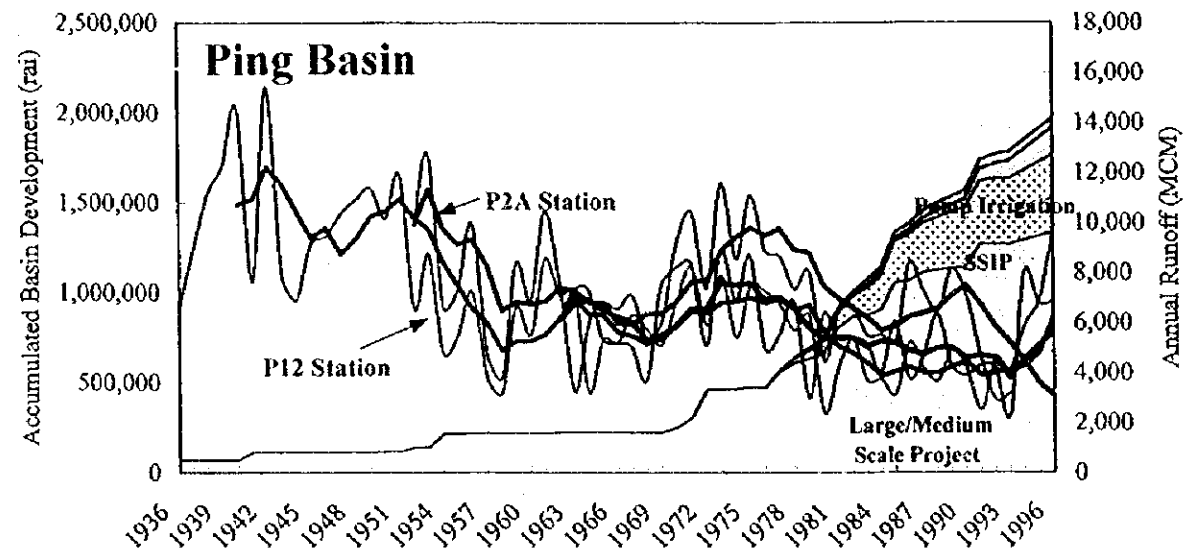
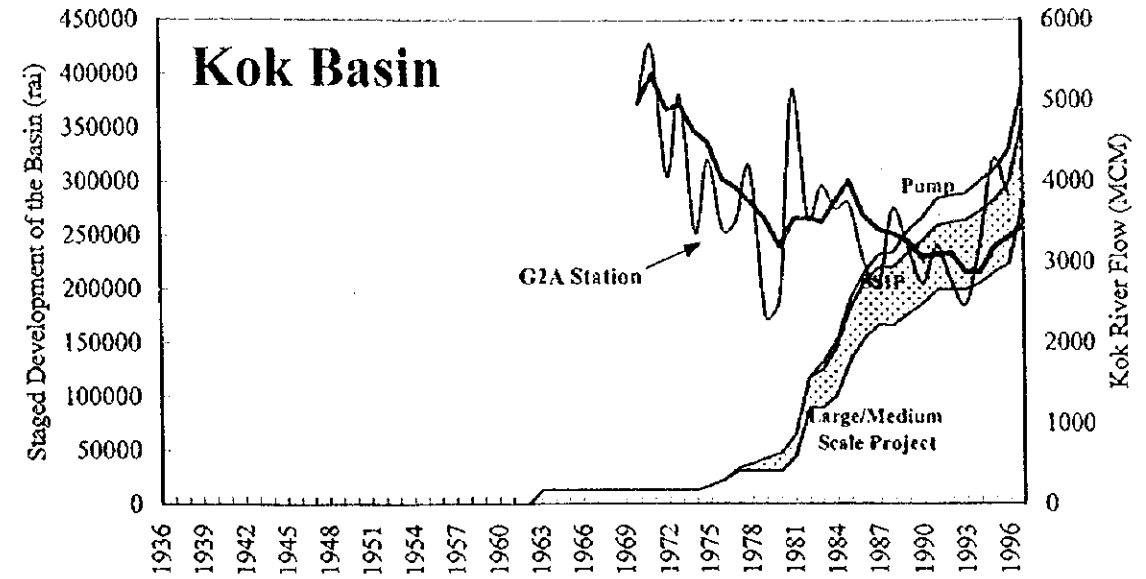
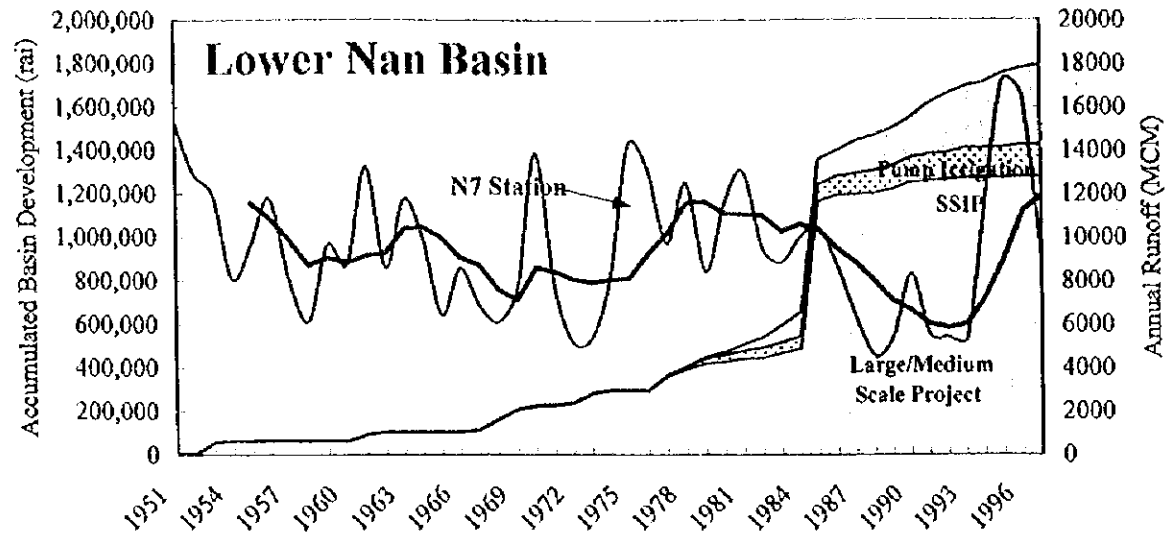


PART III	WATER RESOURCES DEVELOPMENT
III-1	Decreasing River Runoffs and Basin Development
III-2	Decreasing Chao Phraya River Runoffs and Basin Development at Nakhon Sawan
III-3	Provinces and Irrigation Project Areas in the Chao Phraya Delta
III-4	Salinity Conditions of Groundwater Aquifer in the Chao Phraya Delta
III-5	Necessity of Overall Water Management
III-6	Alternative Water Diversion Plans
III-7	Schematic Diagram of the Kok and Ing Basins
III-8	Schematic Diagram of the Upper Nan Basin
III-9	Inundation Conditions in the Lower Kok and Ing Basins
III-10	Existing Land Use Map of the Kok Basin
III-11	Existing Land Use Map of the Ing Basin
III-12	Existing Land Use Map of the Upper Nan Basin
III-13	Land Use Suitability Map of the Kok Basin
III-14	Land Use Suitability Map of the Ing Basin
III-15	Land Use Suitability Map of the Upper Nan Basin
III-16	Present and Proposed Cropping Pattern



THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT	
DECREASING RIVER RUNOFF AND BASIN DEVELOPMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Map & Drawing No.
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	III-1

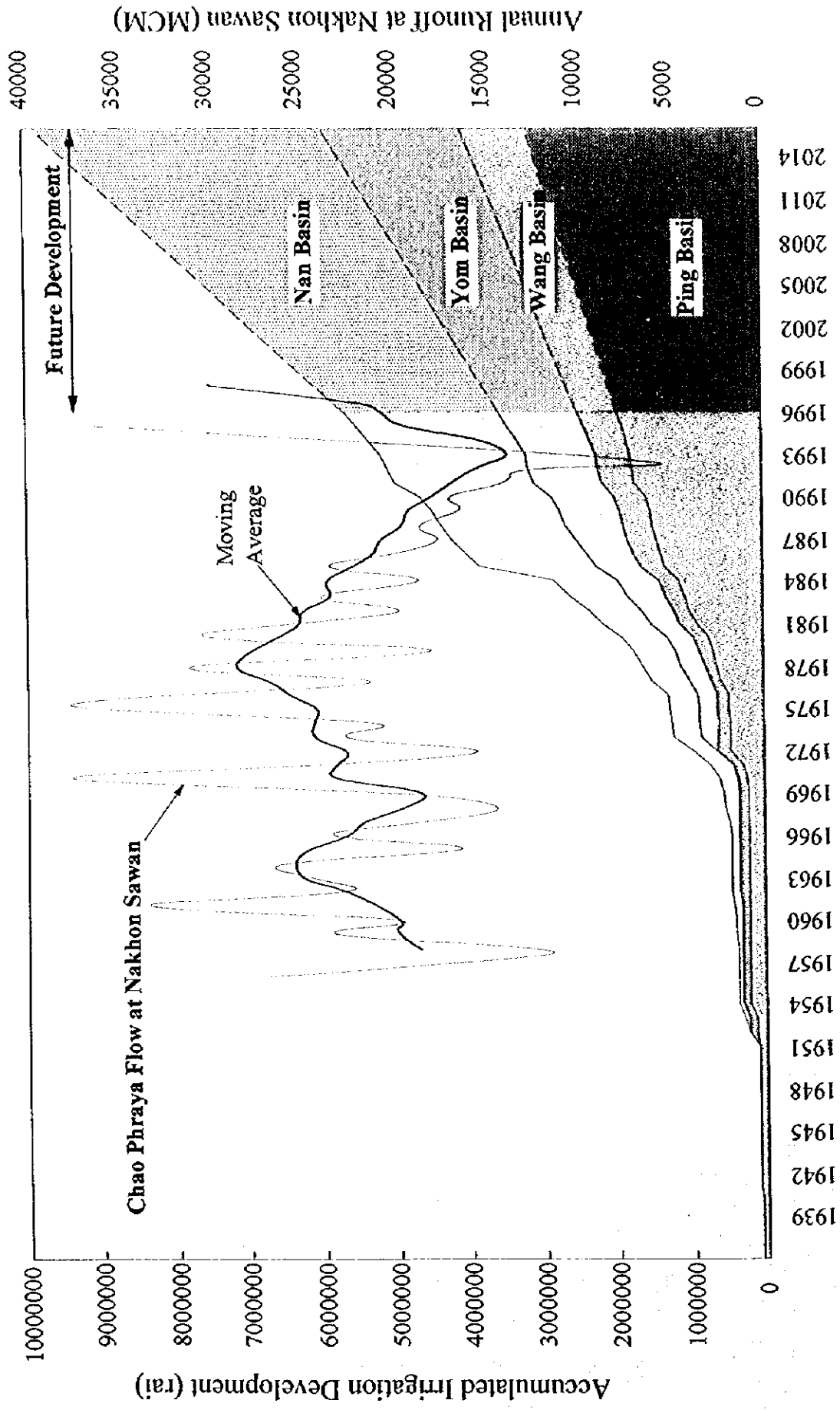
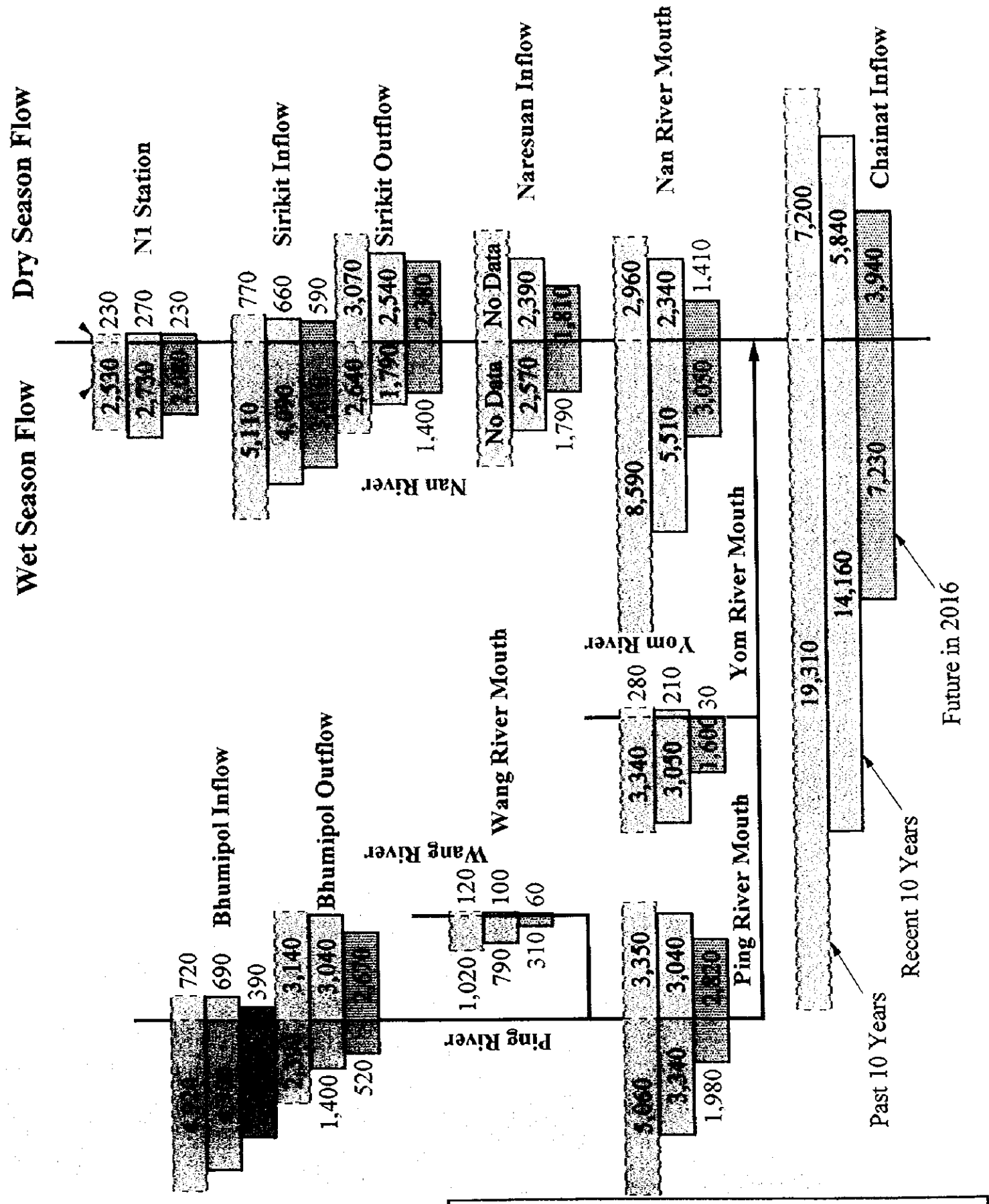


Figure 6.1.2 Past, Recent and Future Flow of Chao Phraya River at Major Stations



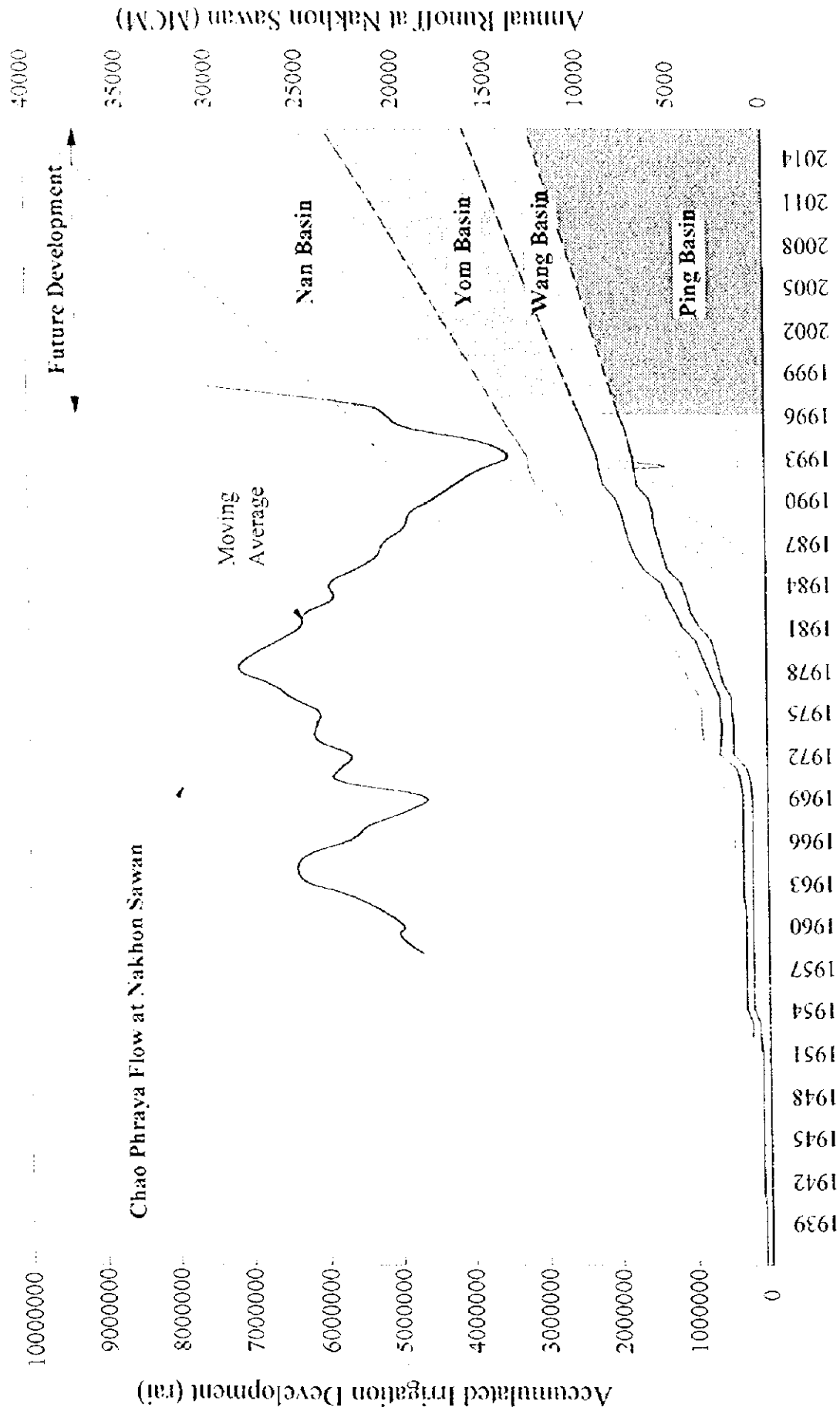
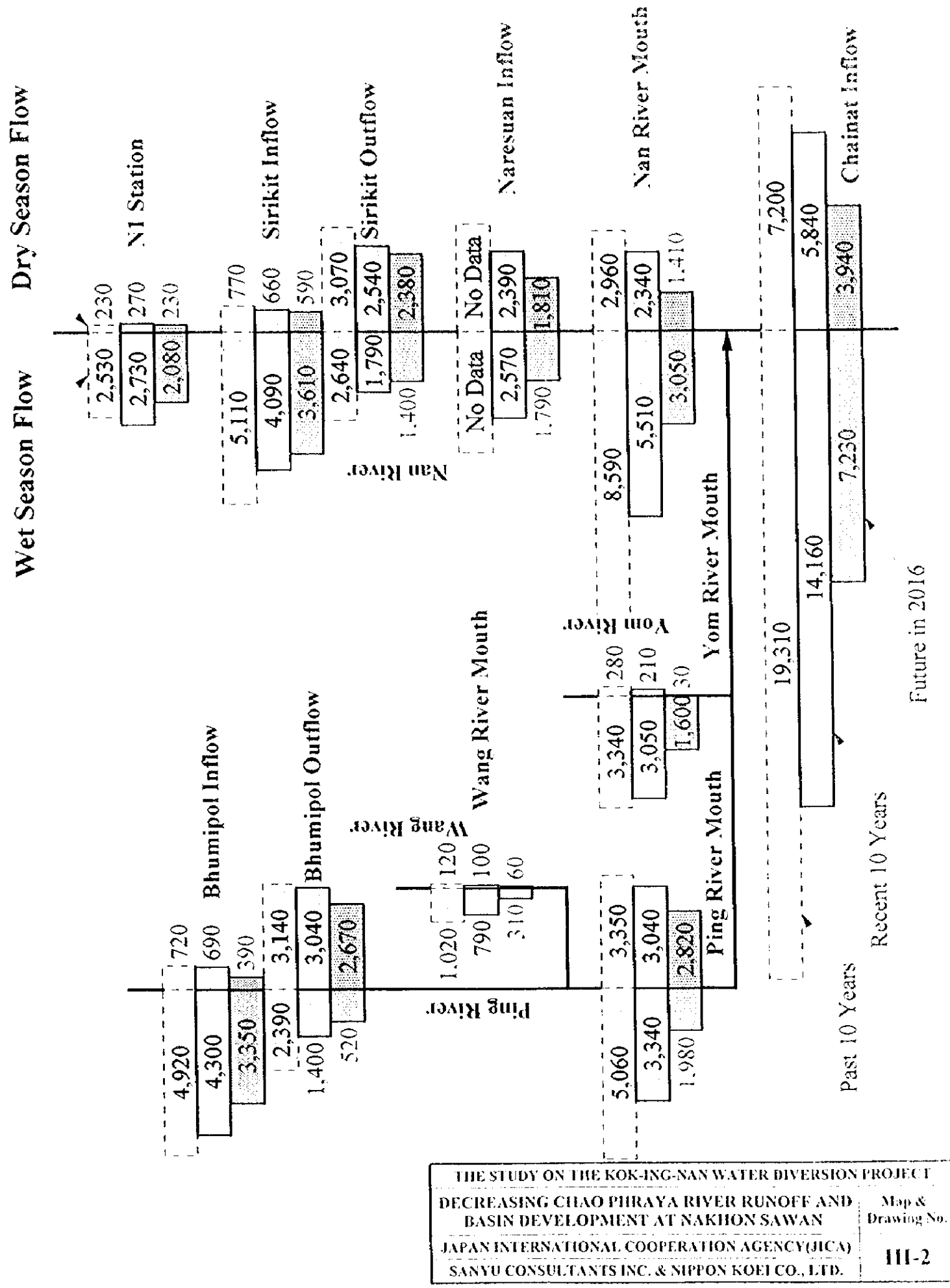
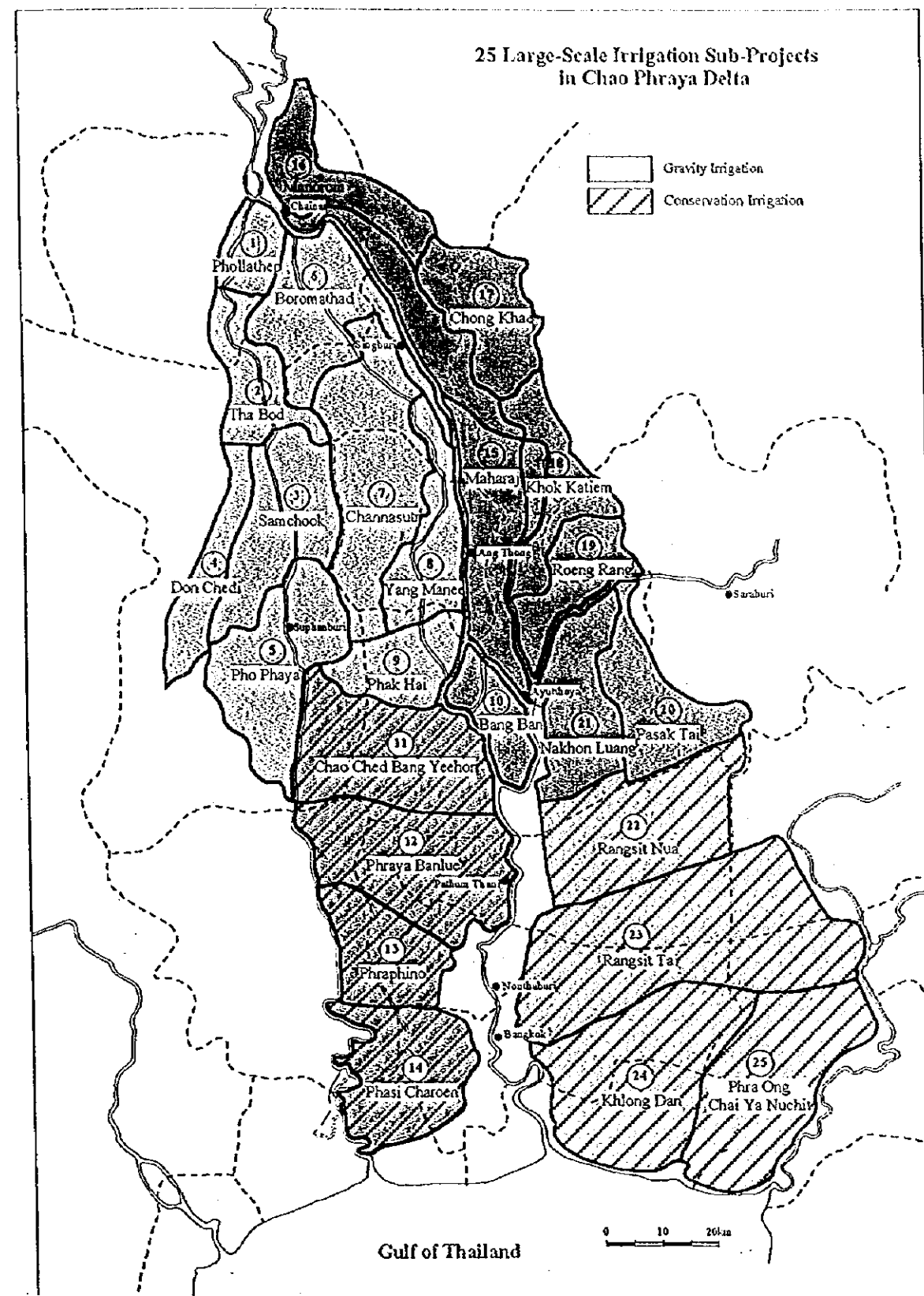
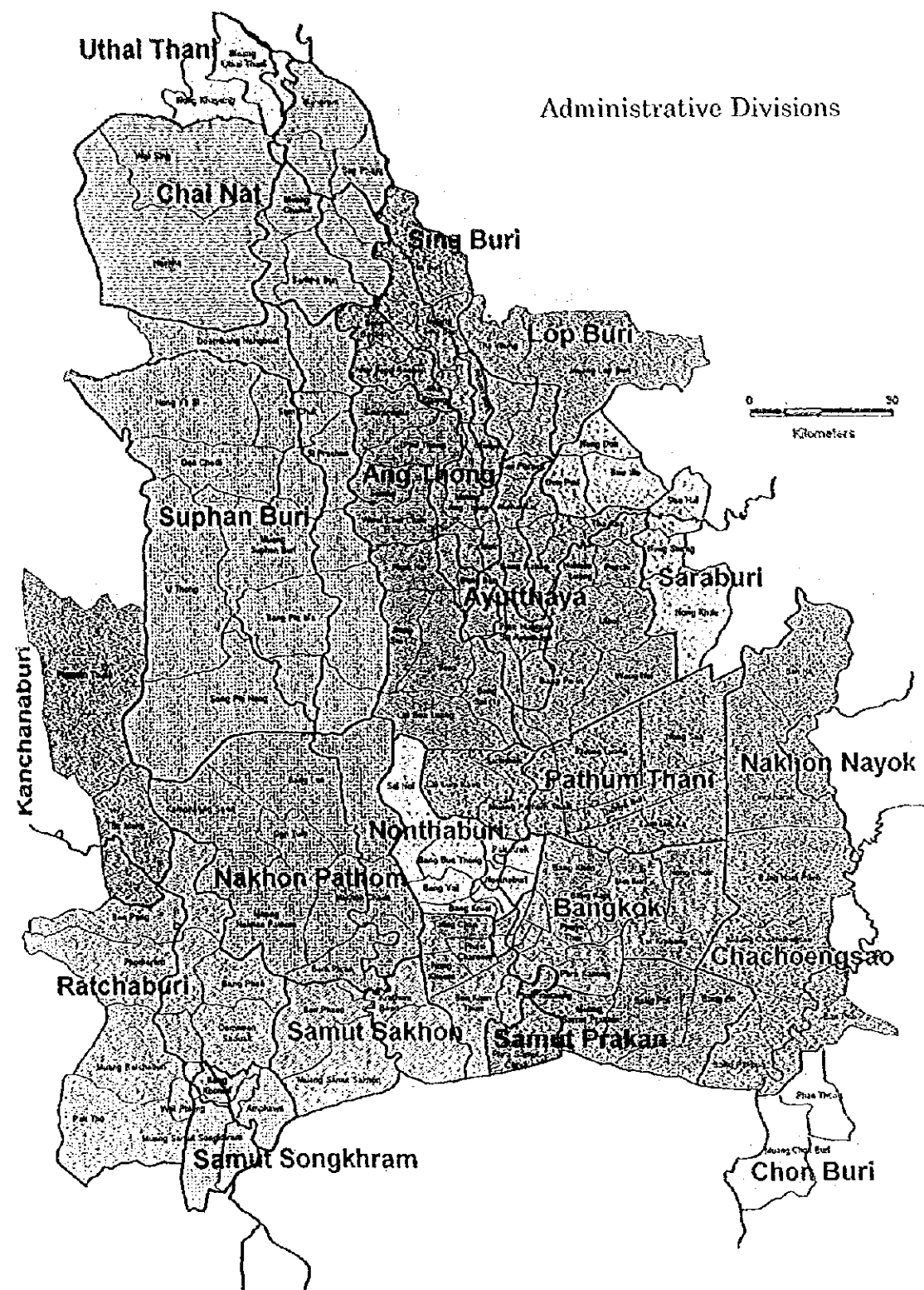
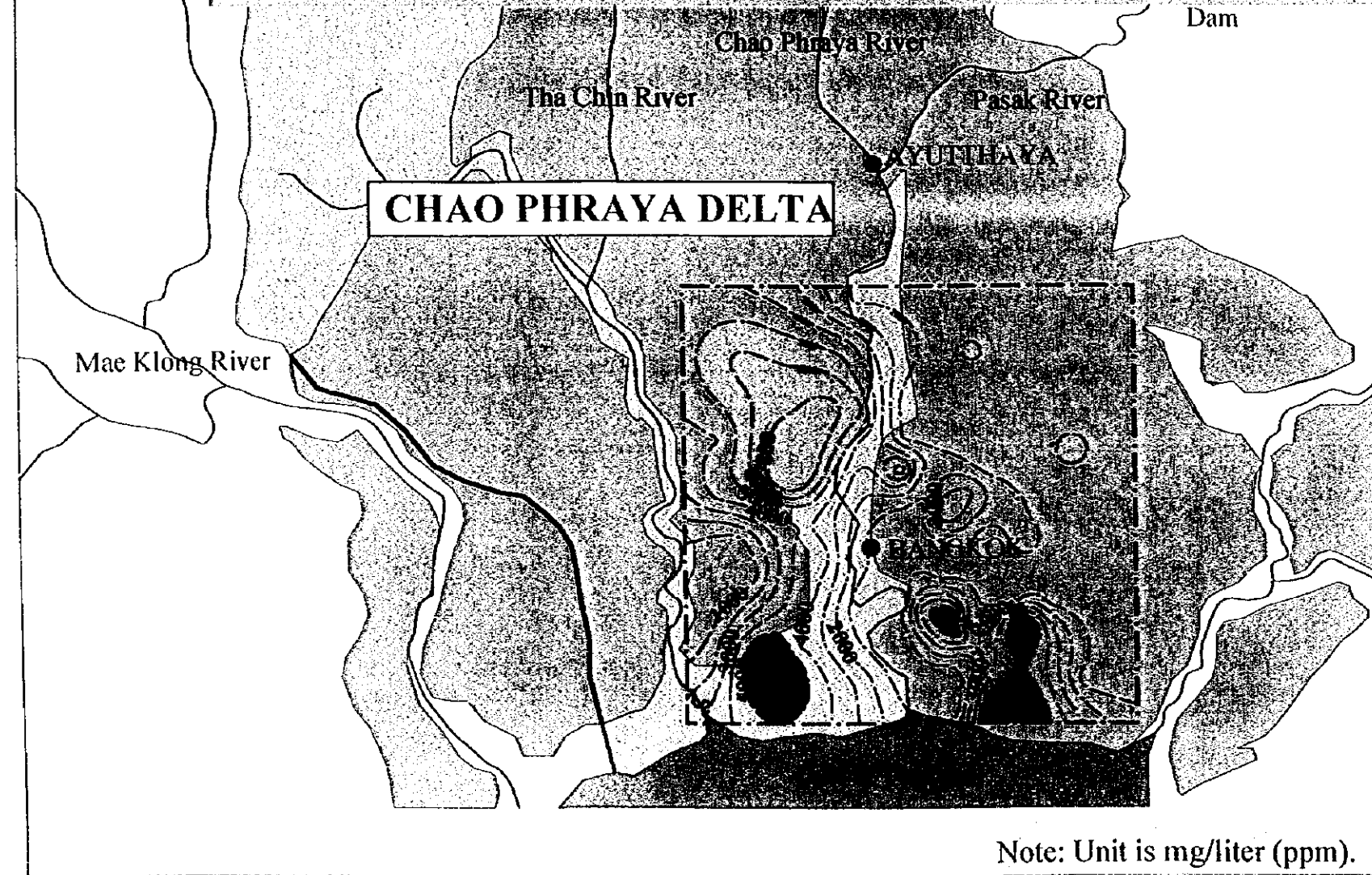
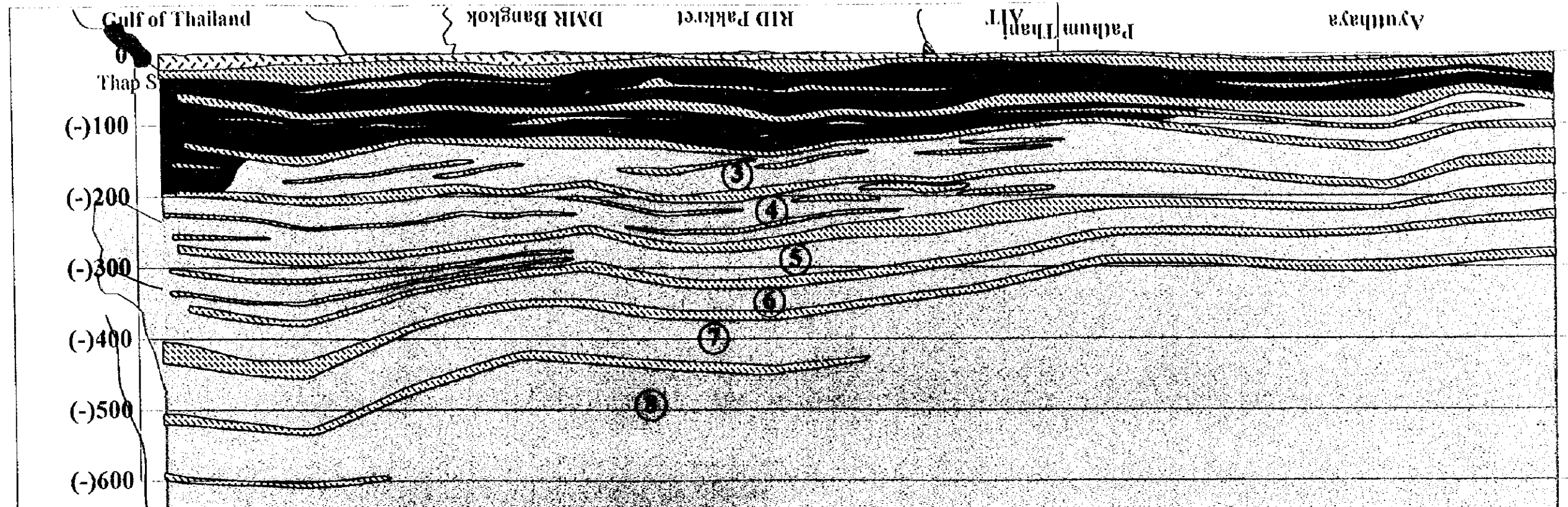


Figure 6.1.2 Past, Recent and Future Flow of Chao Phraya River at Major Stations





THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT	
PROVINCES AND IRRIGATION PROJECT AREAS IN THE CHAO PHRAYA DELTA	Map & Drawing No.
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	III-3
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	

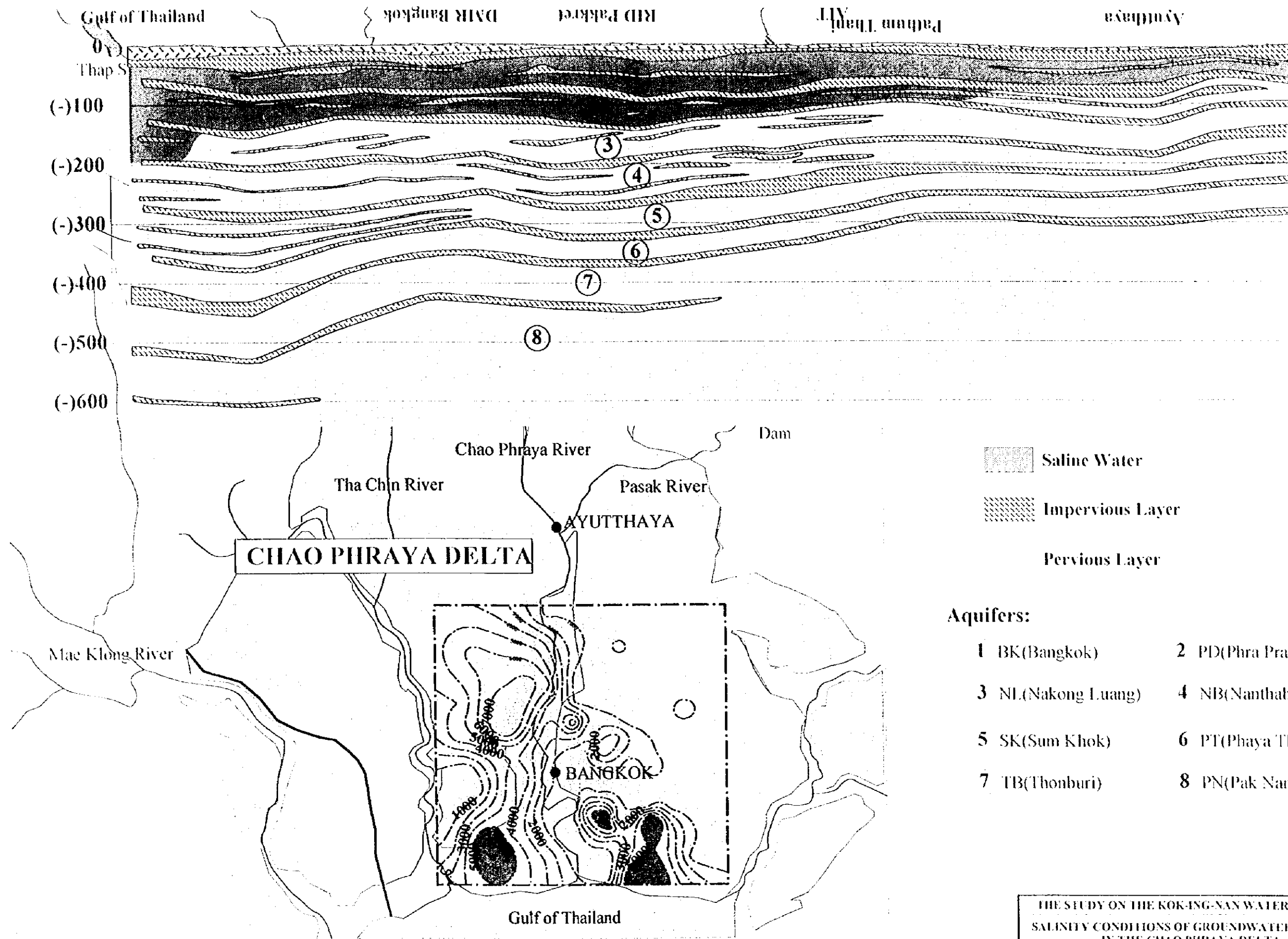


- Saline Water
- Impervious Layer
- Pervious Layer

- Aquifers:**
- ① BK(Bangkok)
 - ② PD(Phra Pradaeng)
 - ③ NI(Nakong Luang)
 - ④ NB(Nanthaburi)
 - ⑤ SK(Sum Khok)
 - ⑥ PT(Phaya Thai)
 - ⑦ TB(Thonburi)
 - ⑧ PN(Pak Nam)

Note: Unit is mg/liter (ppm).

THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT	
SALINITY CONDITIONS OF GROUNDWATER AQUIFER IN THE CHAO PHRAYA DELTA	Map & Drawing No.
JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)	
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	
III-4	



Note: Unit is mg/liter (ppm).

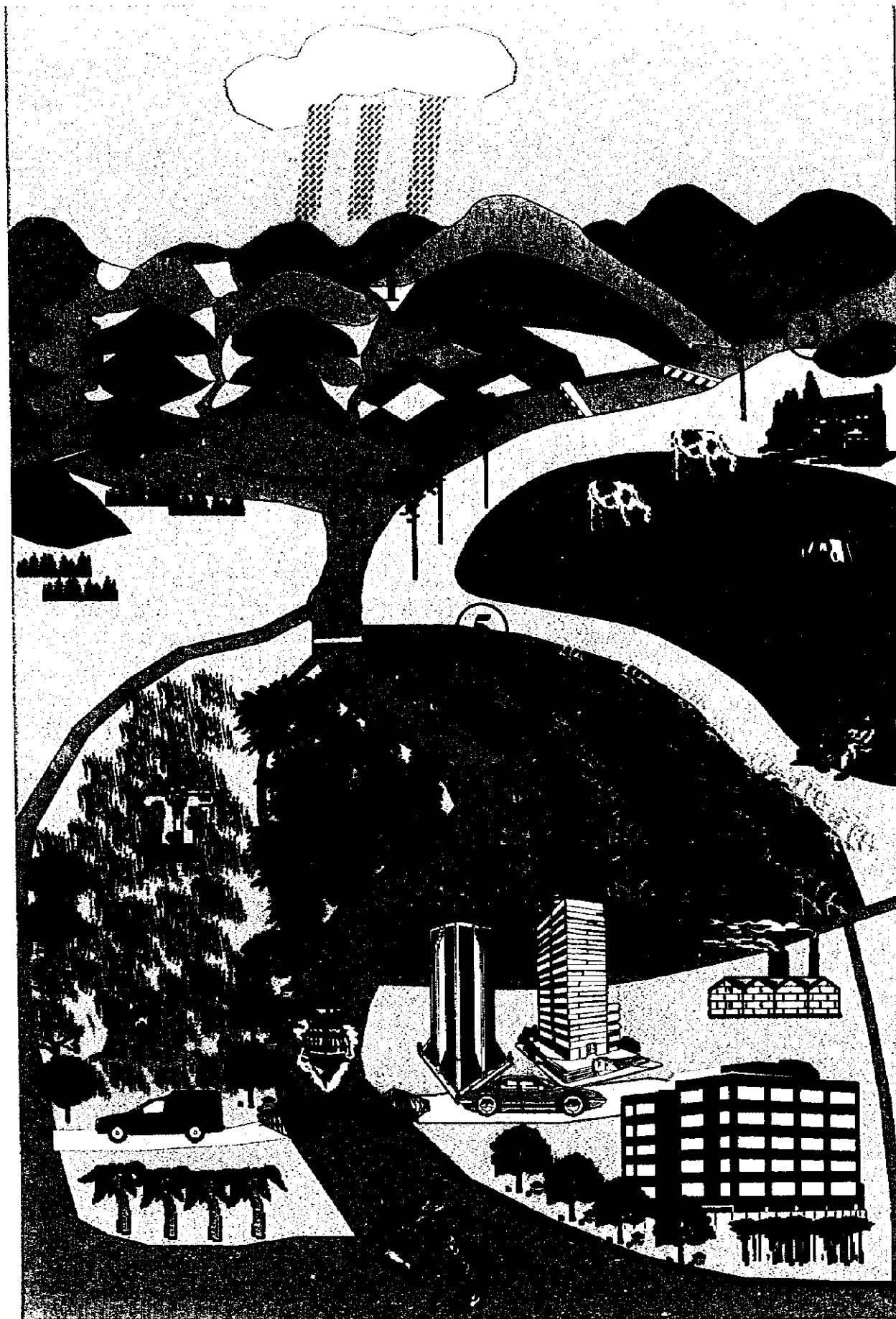
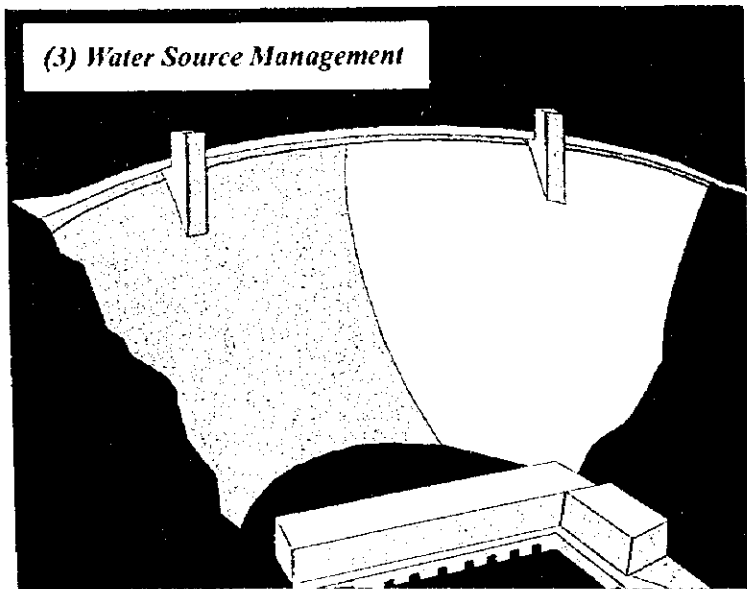
(1) Watershed Management



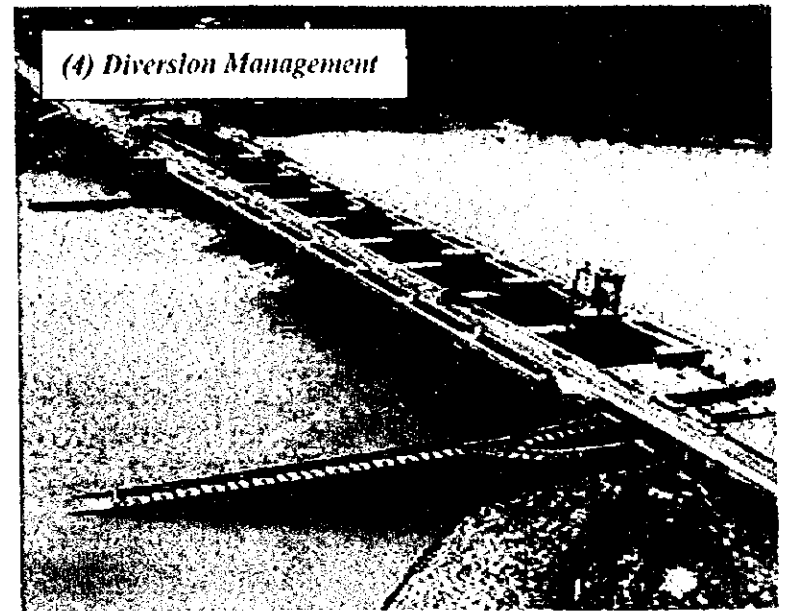
(2) River Management



(3) Water Source Management



(4) Diversion Management

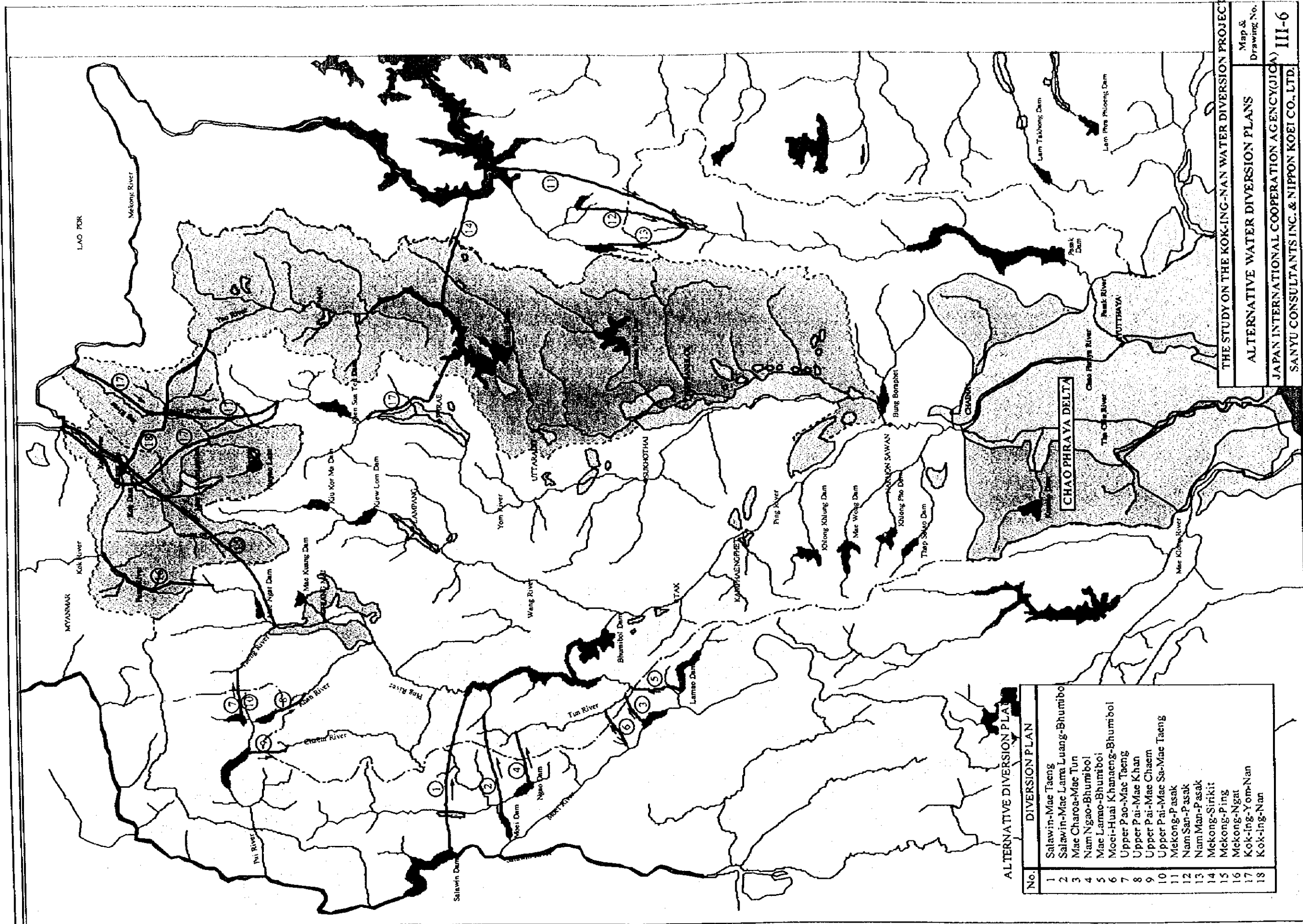


(5) Distribution Management



(6) On-farm Management

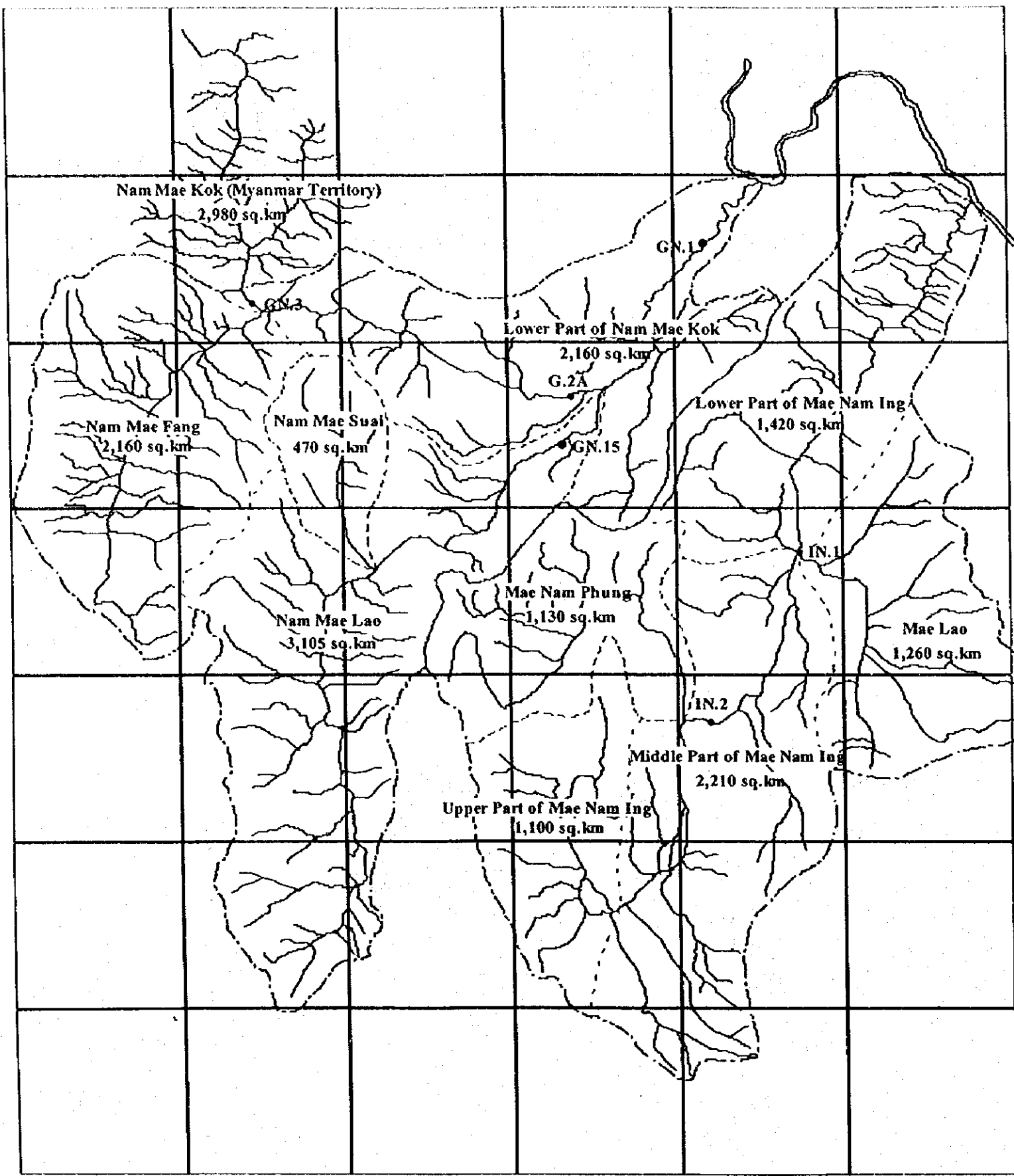




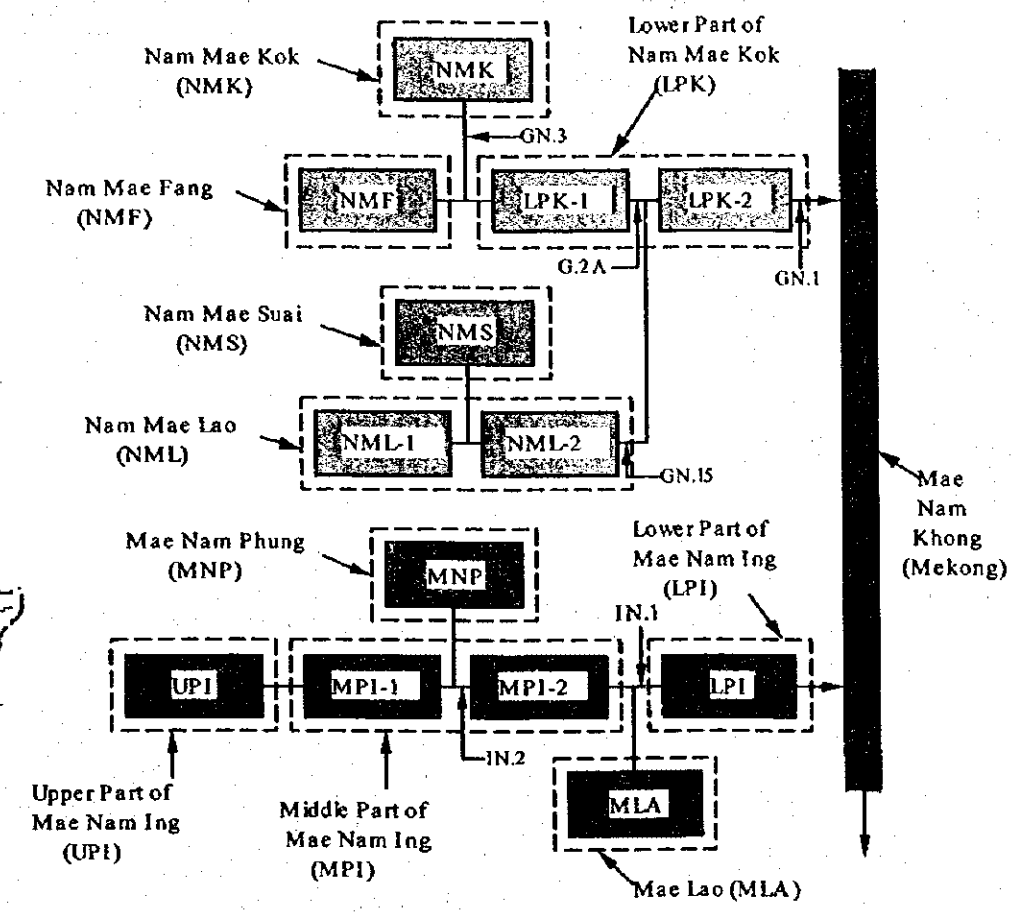
ALTERNATIVE DIVERSION PLAN

No.	DIVERSION PLAN
1	Salawin-Mae Taeng
2	Salawin-Mae Larra-Luang-Bhumibol
3	Mae Charoat-Mae Tun
4	Nam Ngao-Bhumibol
5	Mae Lamao-Bhumibol
6	Moc-i-Huai-Khanaeng-Bhumibol
7	Upper Pao-Mae Taeng
8	Upper Pai-Mae Khan
9	Upper Pai-Mae Chaem
10	Upper Pai-Mae Sa-Mae Taeng
11	Mekong-Pasak
12	Nam San-Pasak
13	Nam Man-Pasak
14	Mekong-Sirikit
15	Mekong-Ping
16	Mekong-Ngat
17	Kok-Ing-Yom-Nan
18	Kok-Ing-Nan

THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT
 ALTERNATIVE WATER DIVERSION PLANS
 Map & Drawing No. III-6
 JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
 SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.

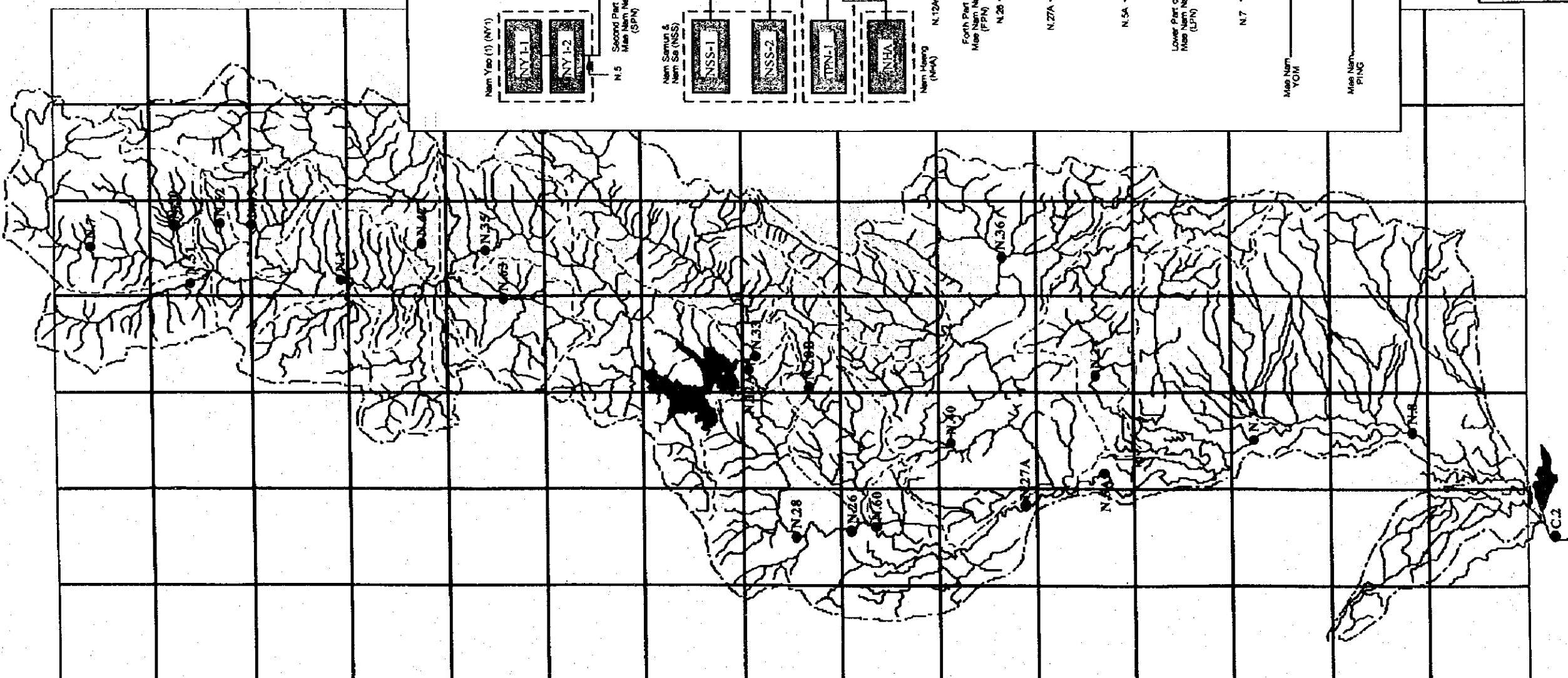


Kok and Ing River System Configuration



LEGEND

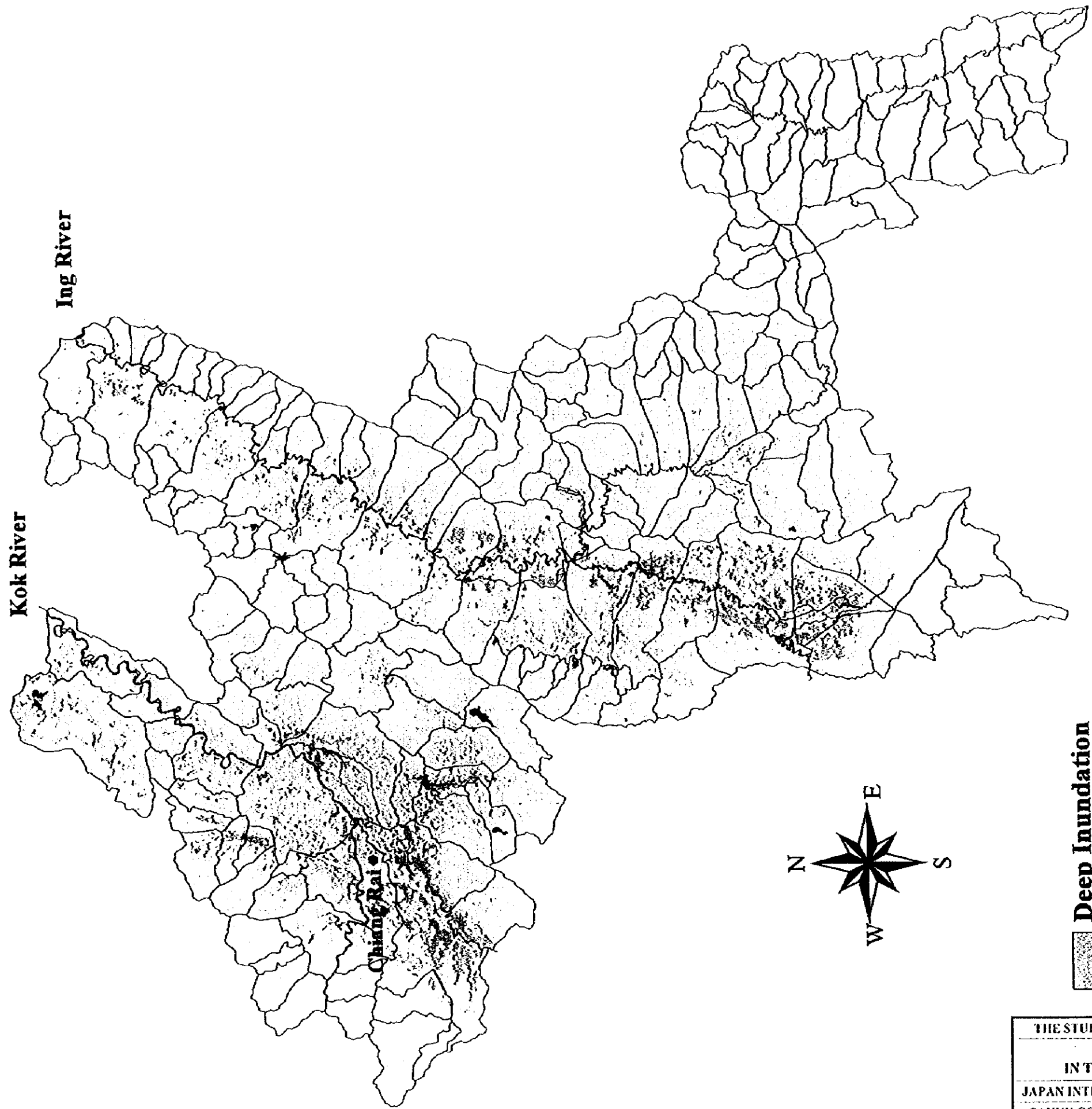
--- Sub-basin used for the 25 Basin Study









Nan River System Configuration

LEGEND	
(---)	Sub-basins used for the 25 Basin Study

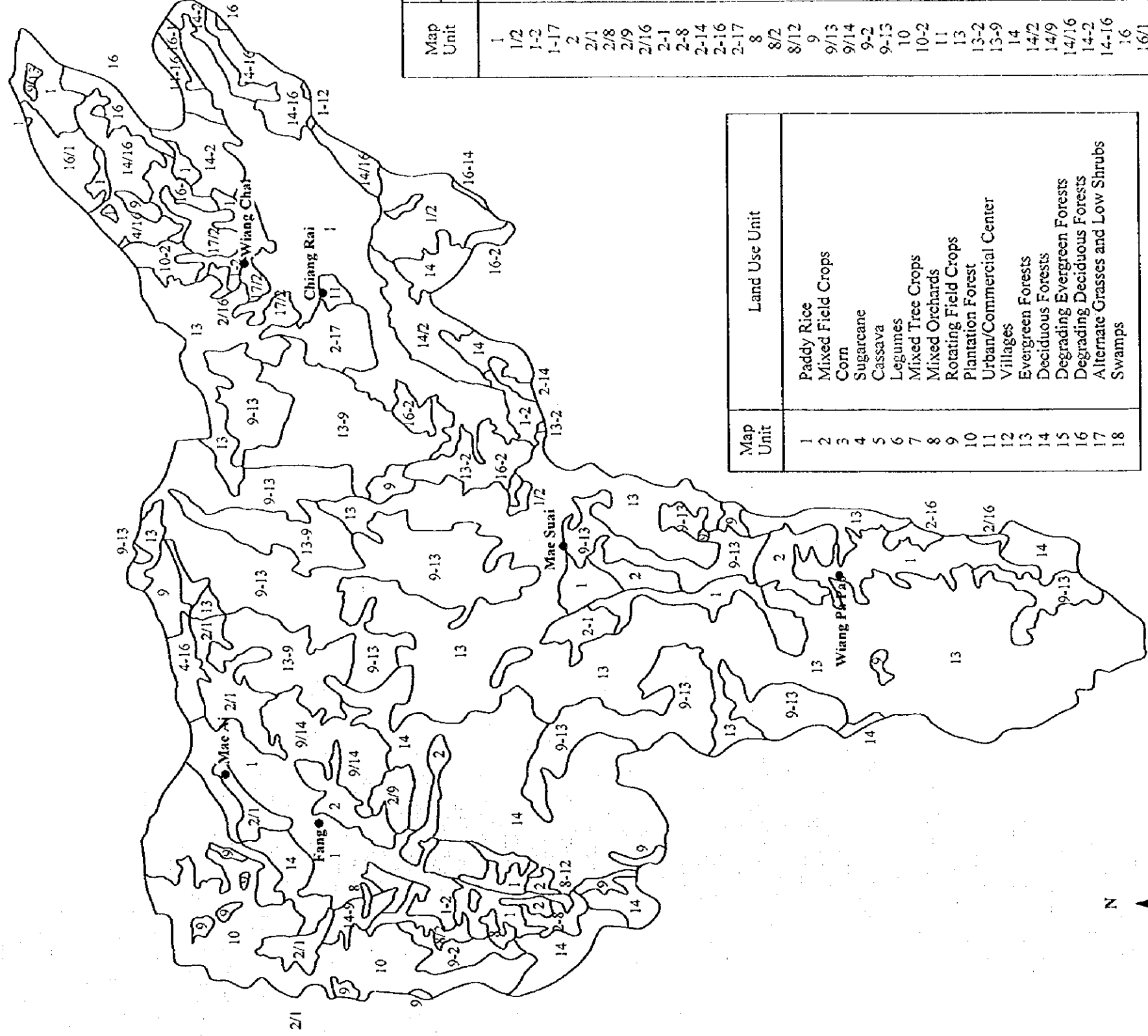
THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT
Map & Drawing No.
SCHEMATIC DIAGRAM OF UPPER NAN BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC. & NIPPON KOGI CO., LTD. III-8



-  Deep Inundation
-  Shallow Inundation
-  Rivers
-  Reservoir / Lake
-  No Inundation
-  No data



THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT	
INUNDATION CONDITIONS IN THE LOWER KOK AND ING BASINS	
JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	Map & Drawing No. III-9

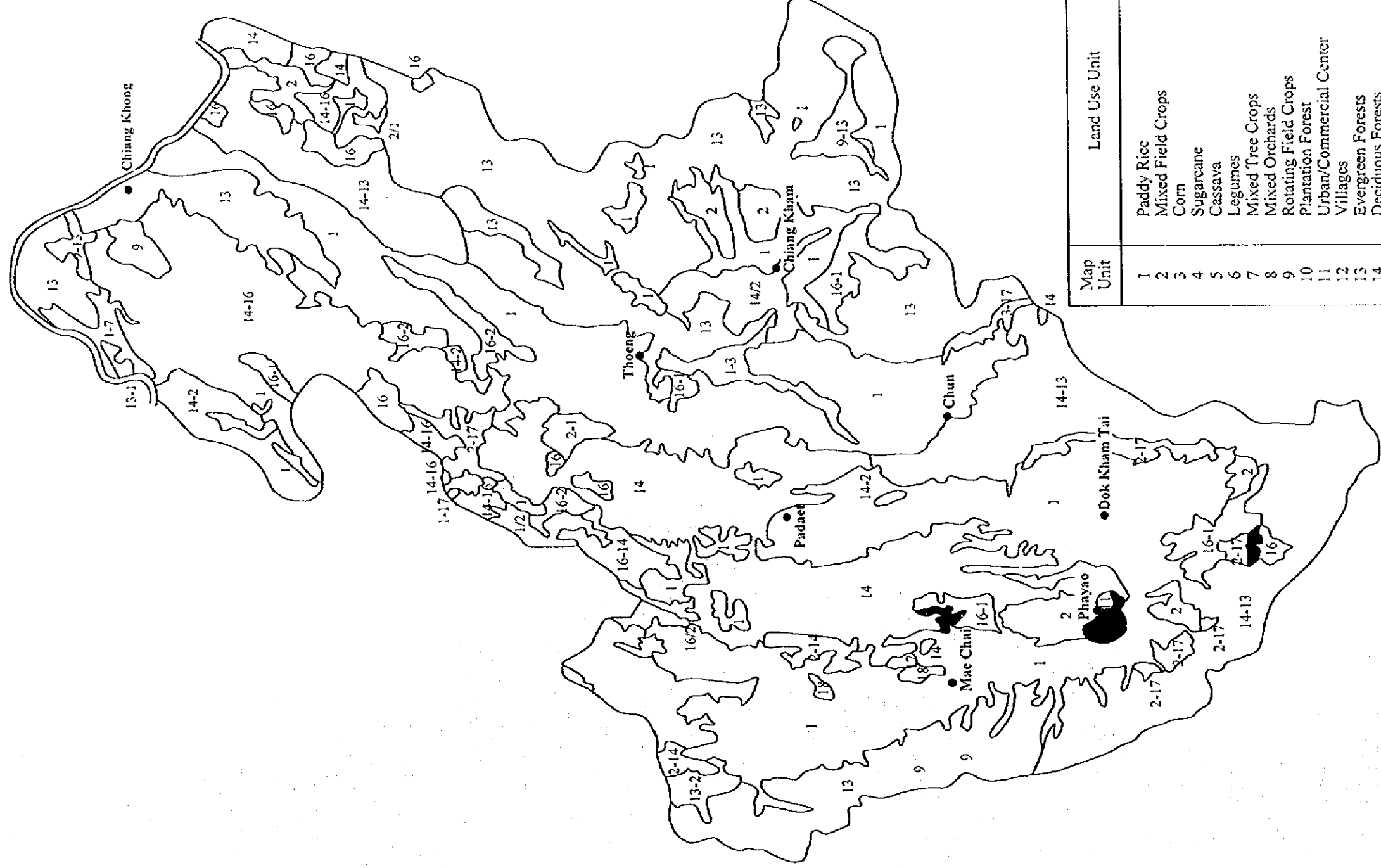


Map Unit	Area Extent	
	%	Ha
1	13.79	108,879
1/2	1.44	11,407
1-2	0.51	4,022
1-17	0.03	219
2	2.57	20,255
2/1	1.84	14,551
2/8	0.23	1,828
2/9	0.42	3,291
2/16	0.15	1,023
2-1	0.61	4,826
2-8	0.30	2,340
2-14	0.15	1,170
2-16	0.24	1,901
2-17	0.91	7,239
8	0.20	1,536
8/2	0.41	3,217
8/12	0.08	658
9	1.81	14,259
9/13	0.07	585
9/14	1.60	12,650
9-2	0.69	5,411
9-13	15.81	109,025
10	4.39	34,660
10-2	0.45	3,546
11	0.23	1,828
13	23.14	182,805
13-2	1.01	7,970
13-9	7.74	61,130
14	11.56	89,648
14/2	1.16	9,140
14/9	0.36	2,998
14/16	1.77	13,966
14-2	1.42	11,188
14-16	1.30	10,310
16	0.06	439
16/1	1.03	8,117
16-1	0.40	3,144
16-2	0.45	3,546
16-14	0.04	293
17/2	1.07	8,487
18	0.63	4,972
Water	0.15	1,022
Total	100.0	789,500

Map Unit	Land Use Unit
1	Paddy Rice
2	Mixed Field Crops
3	Corn
4	Sugarcane
5	Cassava
6	Legumes
7	Mixed Tree Crops
8	Mixed Orchards
9	Rotating Field Crops
10	Plantation Forest
11	Urban/Commercial Center
12	Villages
13	Evergreen Forests
14	Deciduous Forests
15	Degrading Evergreen Forests
16	Degrading Deciduous Forests
17	Alternate Grasses and Low Shrubs
18	Swamps

LEGEND	
1/2	1=50%, 2=50%
1-2	1=70%, 2=30%





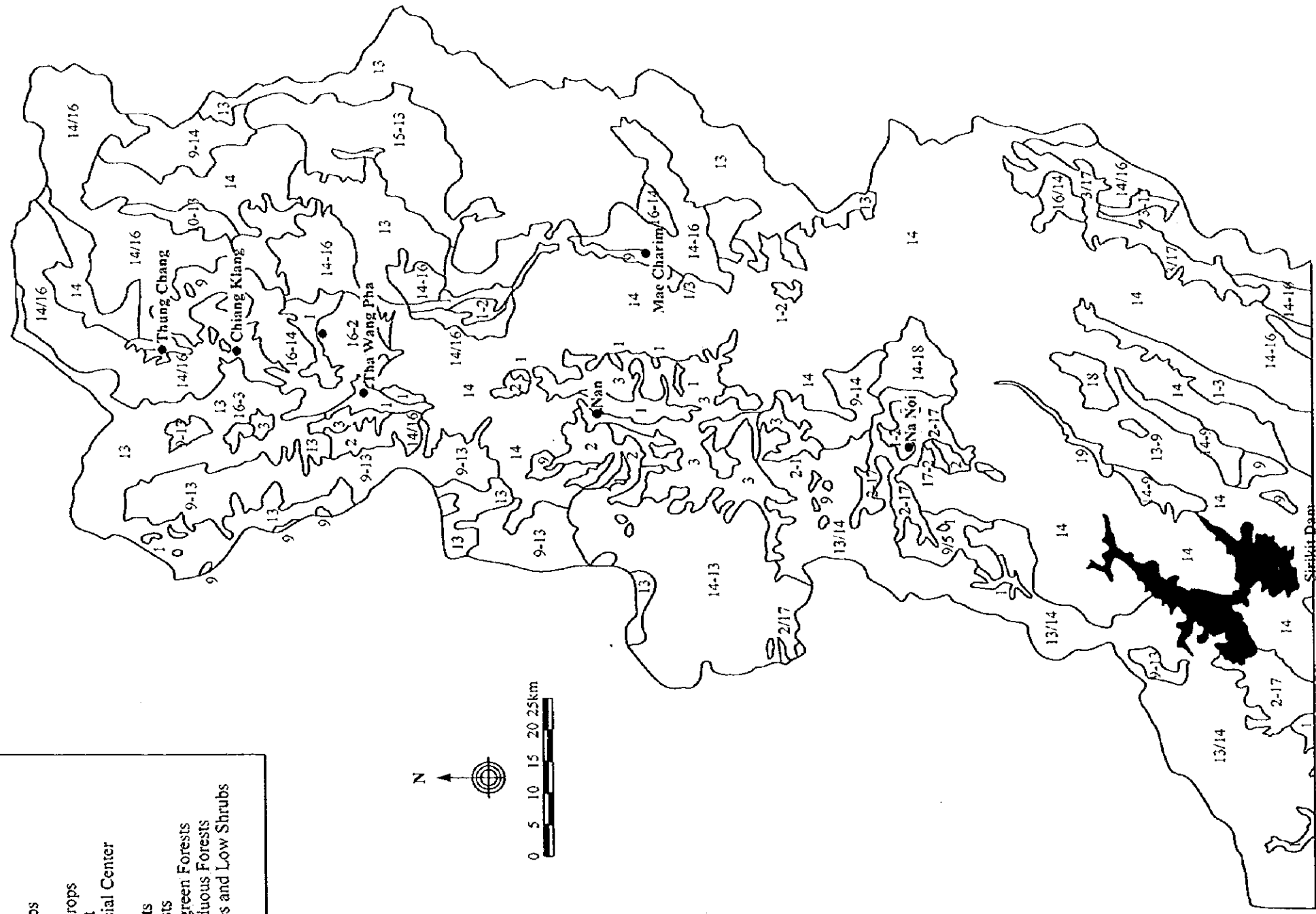
LEGEND	
1/2	1=50%, 2=50%
1-2	1=70%, 2=30%

Map Unit	Land Use Unit
1	Paddy Rice
2	Mixed Field Crops
3	Corn
4	Sugarcane
5	Cassava
6	Legumes
7	Mixed Tree Crops
8	Mixed Orchards
9	Rotating Field Crops
10	Plantation Forest
11	Urban/Commercial Center
12	Villages
13	Evergreen Forests
14	Deciduous Forests
15	Degrading Evergreen Forests
16	Degrading Deciduous Forests
17	Alternate Grasses and Low Shrubs
18	Swamps

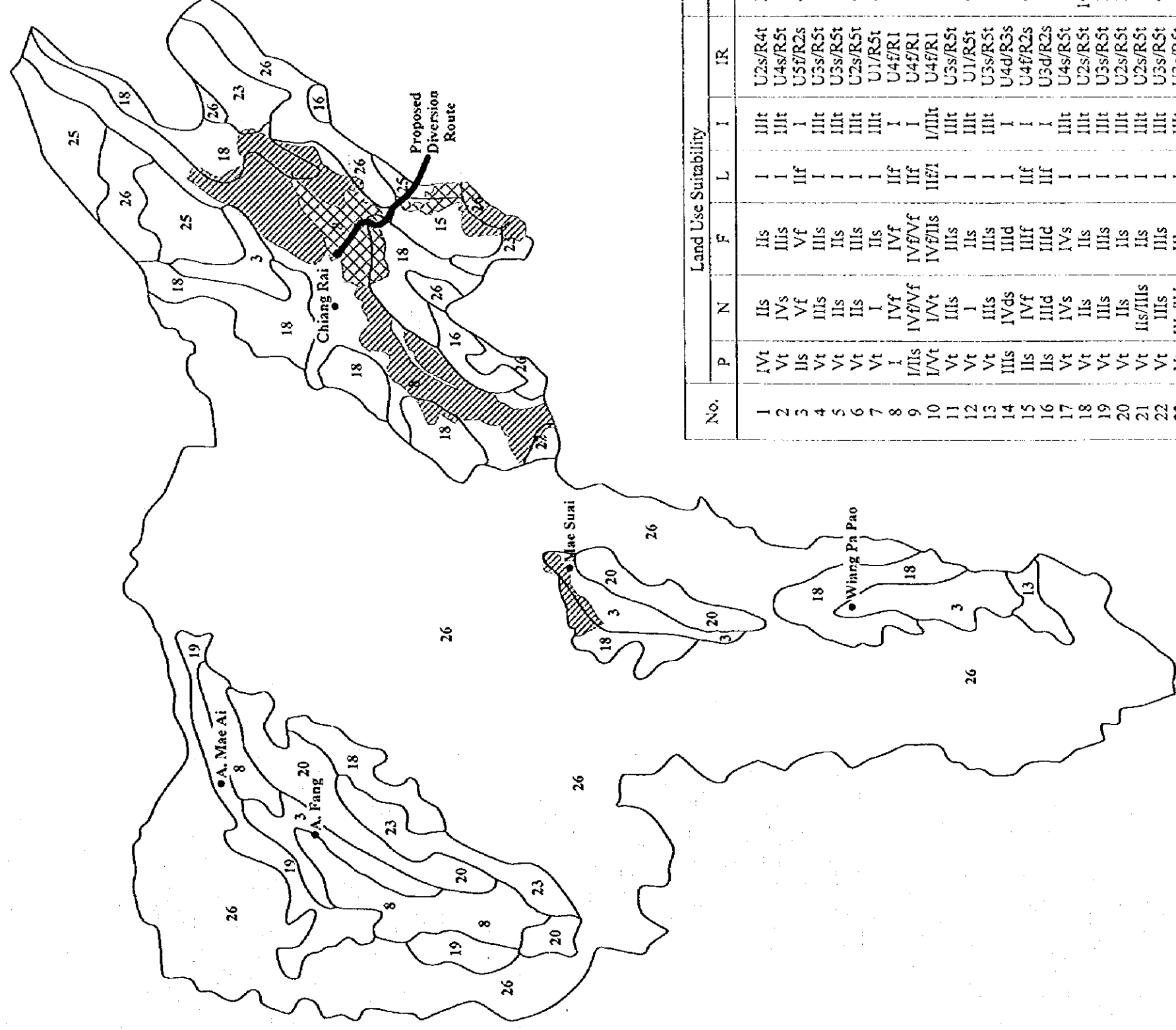
Map Unit	Area Extent	
	%	Ha
1	26.41	195,112
1/2	0.47	3,458
1-3	0.18	1,328
1-7	0.50	3,665
1-17	0.09	634
2	2.54	18,752
2/1	0.08	584
2-1	0.50	3,665
2-14	0.38	2,815
2-17	1.40	10,359
7/2	0.12	850
9	0.45	3,293
9-13	0.60	6,003
11	0.07	478
13	18.50	136,679
13-2	0.35	2,550
14	10.80	79,893
14/2	1.58	11,687
14/16	0.32	2,390
14-1	0.10	797
14-2	1.20	8,818
14-3	41.40	84,196
14-16	7.26	53,652
15	0.76	5,631
15-1	0.10	794
16	1.30	9,668
16/2	0.14	1,009
16-1	2.24	16,520
16-2	0.60	4,409
16-14	5.90	43,559
18	1.80	13,280
18-1	0.86	6,374
18-2	0.43	3,187
Water	0.37	2,709
Total	100.0	738,800

Map Unit	Land Use Unit
1	Paddy Rice
2	Mixed Field Crops
3	Corn
4	Sugarcane
5	Cassava
6	Legumes
7	Mixed Tree Crops
8	Mixed Orchards
9	Rotating Field Crops
10	Plantation Forest
11	Urban/Commercial Center
12	Villages
13	Evergreen Forests
14	Deciduous Forests
15	Degrading Evergreen Forests
16	Degrading Deciduous Forests
17	Alternate Grasses and Low Shrubs
18	Swamps

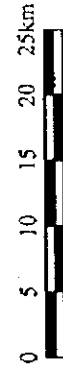
Map Unit	Area Extent	
	%	Ha
1	17.47	599,697
1/2	0.03	943
1/3	0.91	31,258
1/4	0.51	17,381
1/18	0.23	7,949
1-2	0.21	7,141
1-3	0.79	27,149
1-8	0.10	3,503
2	3.53	121,260
2-1	0.05	1,549
2-17	1.81	62,247
3	2.67	91,686
3/1	0.69	23,646
3/8	0.16	5,457
3/16	0.39	13,541
3/17	0.63	21,557
3/18	0.02	651
3-5	0.38	13,203
3-9	0.31	10,509
4	1.43	49,043
4/5	0.28	9,768
5-17	1.54	53,017
6-4	2.59	88,858
7	0.01	202
8	0.04	1,482
8-1	0.10	3,503
9	0.68	23,444
9/3	0.25	8,556
9-2	0.16	5,591
9-13	1.72	59,013
9-14	1.58	54,095
10	0.30	10,307
11	0.05	1,549
13	11.84	406,355
13/14	4.74	162,758
13-9	0.02	651
13-14	0.41	14,181
13-15	1.40	48,167
14	22.79	782,463
14/13	2.60	89,328
14/16	4.59	157,570
14-9	0.34	11,789
14-13	2.10	71,948
14-16	2.01	68,916
15	0.12	4,177
16	0.47	16,033
16/14	0.26	8,825
16-2	0.60	20,547
16-3	1.30	44,529
16-13	0.14	4,918
17	0.41	13,861
17/2	0.99	33,885
17-2	0.02	649
18	0.08	2,829
Water	0.90	30,989
Total	100.0	3,433,000



LEGEND	
1/2	1=50%, 2=50%
1-2	1=70%, 2=30%



No.	Land Use Suitability							Area Extent	
	P	N	F	L	I	IR	%	Ha	
1	IVt	IIs	IIs	I	IIIIt	U2s/R4t	5.08	24,286	
2	Vt	IVs	IIIIs	I	IIIIt	U4s/R5t	-	-	
3	IIs	Vf	Vf	IIIIf	I	U5t/R2s	4.08	32,234	
4	Vt	IIIIs	IIIIs	I	IIIIt	U3s/R5t	-	-	
5	Vt	IIs	IIs	I	IIIIt	U3s/R5t	-	-	
6	Vt	IIs	IIIIs	I	IIIIt	U2s/R5t	0.42	3,298	
7	Vt	I	IIs	I	IIIIt	U1/R5t	6.71	53,044	
8	I	IVf	IVf	IIIIf	I	U4f/R1	-	-	
9	I/IIIs	IVf/Vf	IVf/Vf	IIIIf	I	U4f/R1	-	-	
10	I/Vt	I/Vt	IVf/IIIs	IIIIf	I/IIIIt	U4f/R1	-	-	
11	Vt	IIIIs	IIIIs	I	IIIIt	U3s/R5t	-	-	
12	Vt	I	IIs	I	IIIIt	U1/R5t	0.42	3,298	
13	Vt	IIIIs	IIIIs	I	IIIIt	U3s/R5t	-	-	
14	IIIIs	IVds	IIIId	I	IIIIt	U3s/R5t	-	-	
15	IIs	IVf	IIIIf	I	I	U4d/R3s	1.04	8,171	
16	IIs	IIIId	IIIId	IIIIf	I	U4f/R2s	0.56	4,423	
17	Vt	IVs	IVs	IIIIf	I	U3d/R2s	-	-	
18	Vt	IIs	IIs	I	IIIIt	U4s/R5t	-	-	
19	Vt	IIIIs	IIIIs	I	IIIIt	U2s/R5t	10.51	82,983	
20	Vt	IIs	IIIIs	I	IIIIt	U3s/R5t	2.54	20,015	
21	Vt	IIs/IIIIs	IIs	I	IIIIt	U2s/R5t	3.18	25,114	
22	Vt	IIIIs	IIIIs	I	IIIIt	U3s/R5t	-	-	
23	Vt	IIIIs/IVs	IIIIs	I	IIIIt	U3s/R5t	0.14	1,124	
24	Vt	IIs	IIIIs	I	I	U3s/R5t	3.07	24,213	
25	Vt	IIs	IIs	I	IIIIt	U2s/R5t	-	-	
26	Vt	Vt	Vt	IIIIt	III	U6t/R5t	1.56	10,720	
27	Urban and Commercial Centers							0.23	1,828
-	Water Areas							0.13	1,024
Total							100.0	789,500	



THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT

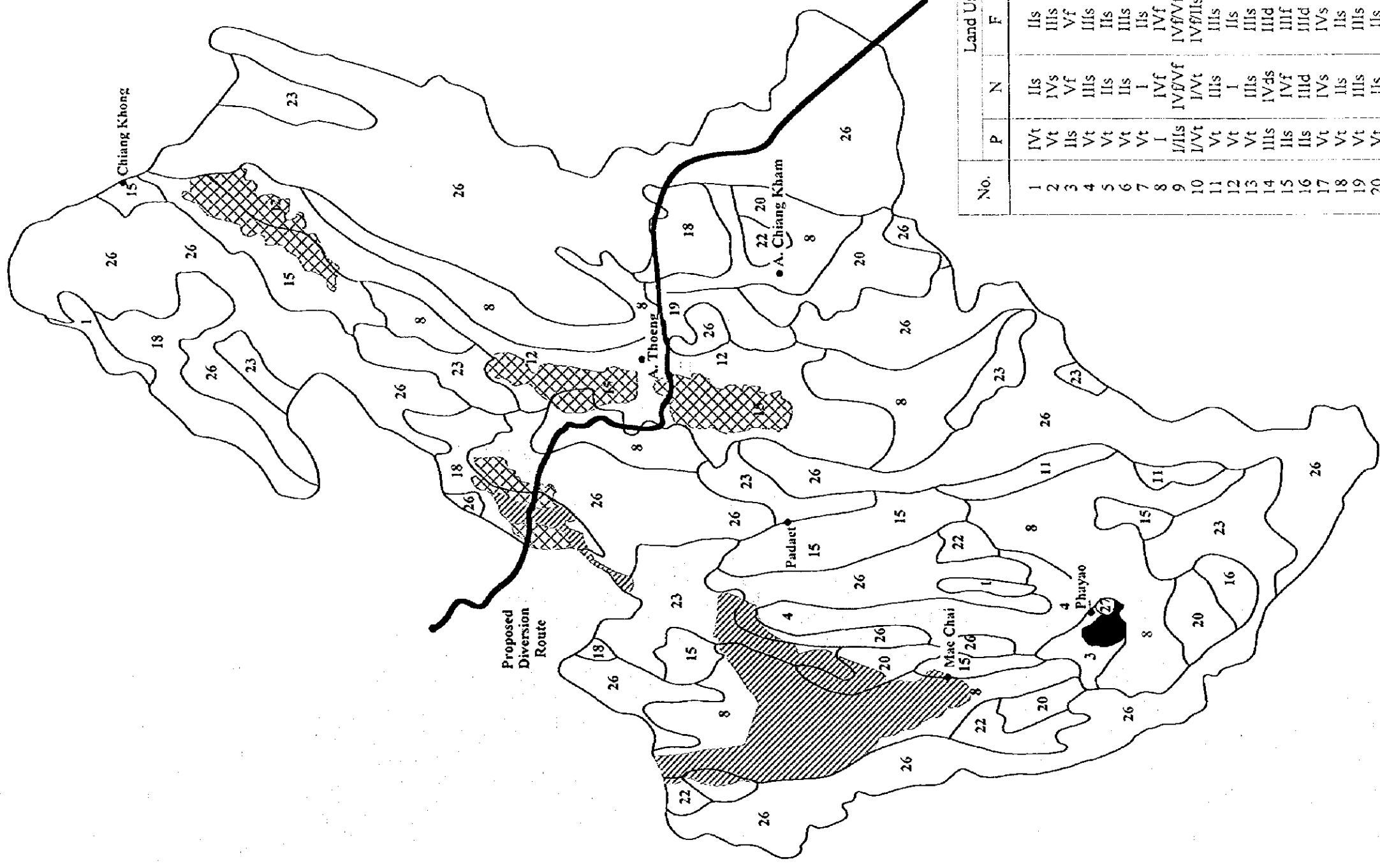
LAND USE SUITABILITY MAP OF KOK BASIN

Map & Drawing No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

III-13

SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.



No.	Land Use Suitability							Area Extent	
	P	N	F	L	I	IR	%	Ha	
1	IVt	IIIs	IIIs	I	III	U2s/R4t	0.88	6,469	
2	Vt	IVs	IIIIs	I	III	U4s/R5t	-	-	
3	IIIs	Vf	Vf	III	I	U5f/R2s	0.38	2,844	
4	Vt	IIIIs	IIIs	I	III	U3s/R5t	1.96	14,454	
5	Vt	IIIs	IIIs	I	III	U3s/R5t	-	-	
6	Vt	IIIs	IIIIs	I	III	U2s/R5t	-	-	
7	Vt	I	IIIs	I	III	U1/R5t	-	-	
8	I	IVf	IVf	III	I	U4f/R1	17.21	127,174	
9	I/IIIs	IV/Vf	IV/Vf	III	I	U4f/R1	-	-	
10	IVt	IVt	IV/IIIs	III	I/III	U4f/R1	-	-	
11	Vt	IIIs	IIIs	I	III	U3s/R5t	0.86	6,469	
12	Vt	I	IIIs	I	III	U1/R5t	3.41	25,178	
13	Vt	IIIIs	IIIIs	I	III	U3s/R5t	-	-	
14	IIIIs	IVds	III	I	I	U4d/R3s	-	-	
15	IIIs	IVf	III	III	I	U4f/R2s	9.49	70,115	
16	IIIs	III	III	III	I	U5d/R2s	0.45	3,206	
17	Vt	IVs	IVs	I	III	U4s/R5t	-	-	
18	Vt	IIIs	IIIs	I	III	U2s/R5t	4.78	35,319	
19	Vt	IIIIs	IIIIs	I	III	U3s/R5t	0.97	7,169	
20	Vt	IIIs	IIIs	I	III	U2s/R5t	3.69	27,277	
21	Vt	IIIs/IIIIs	IIIs	I	III	U2s/R5t	-	-	
22	Vt	IIIIs	IIIIs	I	III	U3s/R5t	2.46	18,298	
23	Vt	IIIIs/IVs	IIIIs	I	III	U3s/R5t	8.95	65,977	
24	Vt	IIIs	IIIIs	I	III	U3s/R5t	-	-	
25	Vt	IIIs	IIIs	I	III	U2s/R5t	-	-	
26	Vt	Vt	Vt	III	III	U6r/R5t	44.06	325,659	
27	Urban and Commercial Centers							0.07	478
-	Water Areas							0.56	2,709
Total							100.00	758,800	

THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT

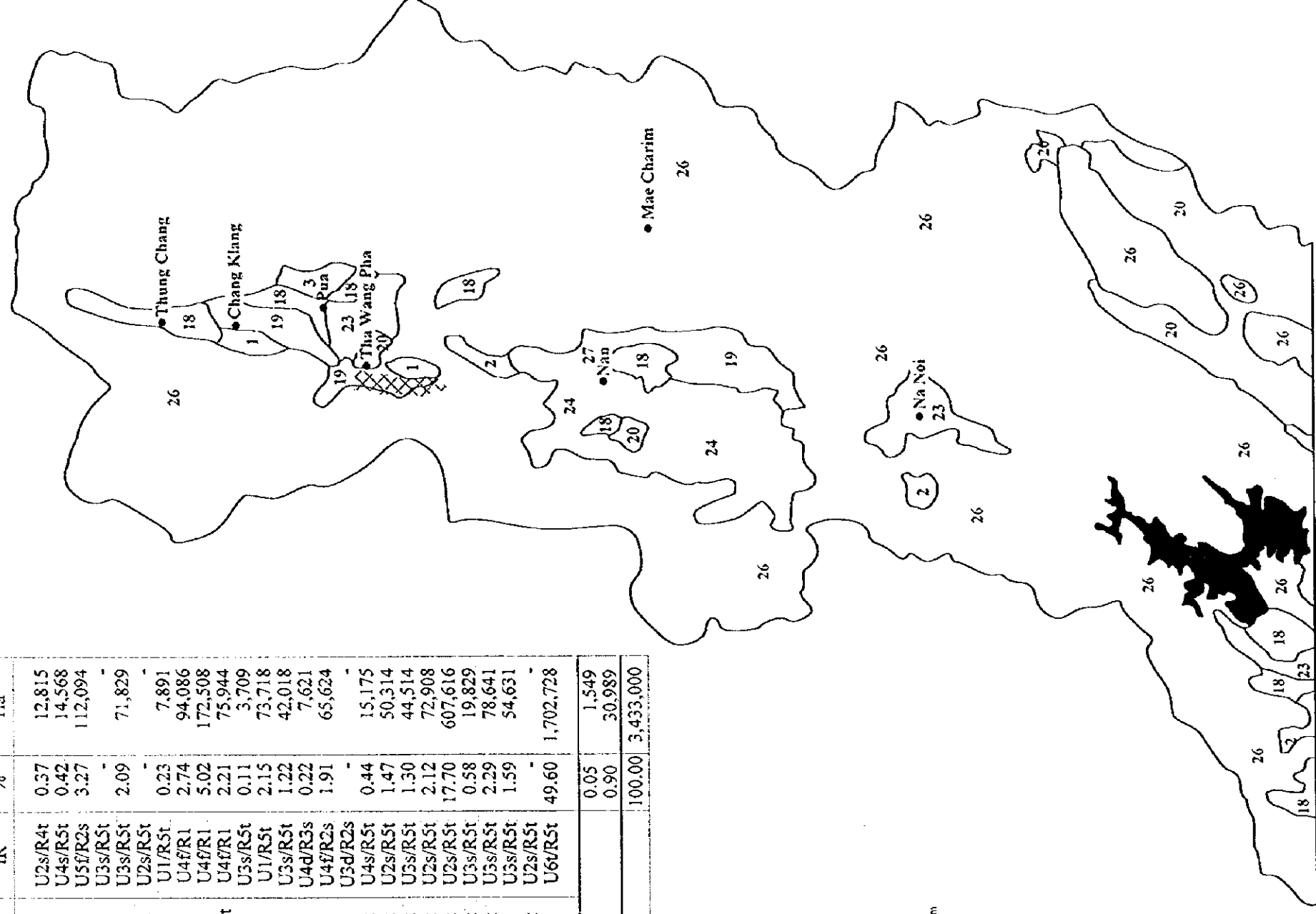
LAND USE SUITABILITY MAP OF ING BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.

Map & Drawing No. III-14

No.	Land Use Suitability						Area Extent		
	P	N	F	L	I	IR	%	Ha	
1	IVt	IIs	IIs	I	IIIc	U2s/R4t	0.37	12,815	
2	Vt	IVs	IIIc	I	IIIc	U4s/R5t	0.42	14,568	
3	IIc	Vf	Vf	IIIc	I	U5f/R2s	3.27	112,094	
4	Vt	IIIc	IIIc	I	IIIc	U3s/R5t	-	-	
5	Vt	IIc	IIc	I	IIIc	U3s/R5t	2.09	71,829	
6	Vt	IIc	IIIc	I	IIIc	U2s/R5t	-	-	
7	Vt	I	IIc	I	IIIc	U1/R5t	0.23	7,891	
8	I	IVf	IVf	IIIc	I	U4f/R1	2.74	94,086	
9	IIc	IVf/Vf	IVf/Vf	IIIc	I	U4f/R1	5.02	172,508	
10	IVt	I/Vt	IVf/IIc	IIIc	I/IIIc	U4f/R1	2.21	75,944	
11	Vt	IIIc	IIIc	I	IIIc	U3s/R5t	0.11	3,709	
12	Vt	I	IIc	I	IIIc	U1/R5t	2.15	73,718	
13	Vt	IIIc	IIIc	I	IIIc	U3s/R5t	1.22	42,018	
14	IIIc	IVds	IIIc	I	IIIc	U4d/R3s	0.22	7,621	
15	IIc	IVf	IIIc	I	I	U4f/R2s	1.91	65,624	
16	IIc	IIIc	IIIc	I	I	U3d/R2s	-	-	
17	Vt	IVs	IVs	I	IIIc	U4s/R5t	0.44	15,175	
18	Vt	IIc	IIc	I	IIIc	U2s/R5t	1.47	50,314	
19	Vt	IIIc	IIIc	I	IIIc	U3s/R5t	1.30	44,514	
20	Vt	IIc	IIc	I	IIIc	U2s/R5t	2.12	72,908	
21	Vt	IIc/IIIc	IIc	I	IIIc	U2s/R5t	17.70	607,616	
22	Vt	IIIc	IIIc	I	IIIc	U3s/R5t	0.58	19,829	
23	Vt	IIIc/IVs	IIIc	I	IIIc	U3s/R5t	2.29	78,641	
24	Vt	IIc	IIc	I	I	U3s/R5t	1.59	54,631	
25	Vt	IIc	IIc	I	IIIc	U2s/R5t	-	-	
26	Vt	Vt	Vt	IIIc	III	U6f/R5t	49.60	1,702,728	
27	Urban and Commercial Centers							0.05	1,549
-	Water Areas							0.90	30,989
	Total							100.00	3,433,000



Present Cropping Pattern in Kok, Ing and Nan River Basins

Crops	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Inside and Outside Irrigated Area (Lowland)												
Wet Season Rice												
Dry Season Rice												
Field Crops (Soybean, Mungbean, Peanut, Corn etc)												
Vegetables (Shallot, Garlic, Common Ginger etc)												
Rainfed Agricultural Land (Upland)												
Corn, Soybean, Peanut												
Mungbean												
Cotton												
Common Ginger												
Cassava												
Sugarcane												
Vegetables												
Fruit Trees and Perennial Crops												

Proposed Cropping Pattern In Irrigation Area

Crops	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Kok River Basin												
Lowland (60%)												
Rice - Field Crops												
Rice - Vegetables												
Cropping Intensity=150%												
Upland (40%)												
Field Crops - Field Crops												
Fruit Trees/Perennial Crops												
Cropping Intensity=160%												
Ing River Basin												
Lowland (68%)												
Rice - Field Crops												
Rice - Vegetables												
Cropping Intensity=150%												
Upland (32%)												
Field Crops - Field Crops												
Fruit Trees/Perennial Crops												
Cropping Intensity=165%												
Upper Nan River Basin												
Lowland (35%)												
Rice - Field Crops												
Rice - Vegetables												
Cropping Intensity=150%												
Upland (65%)												
Field Crops - Field Crops												
Fruit Trees/Perennial Crops												
Cropping Intensity=165%												
Lower Nan River Basin												
Lowland												
Rice - Rice												
Rice - Field Crops												
Rice - Vegetables												
Cropping Intensity=160%												
Upland												
Field Crops - Field Crops												
Fruit Trees/Perennial Crops												
Cropping Intensity=165%												
Upper Chao Phraya Tha Chin												
Wet Season Rice (Native Variety) (25%)												
Areal Extent (%)												
Wet Season Rice (RD Variety) (64%)												
Areal Extent (%)												
Dry Season Rice (RD Variety) (31%)												
Areal Extent (%)												
Lower Chao Phraya Tha Chin												
Wet Season Rice (Native Variety) (18%)												
Areal Extent (%)												
Wet Season Rice (RD Variety) (47%)												
Areal Extent (%)												
Dry Season Rice (RD Variety) (42%)												
Areal Extent (%)												

THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT

PRESENT AND PROPOSED CROPPING PATTERN

Map & Drawing No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.

III-16