Profile No. 1

Soil series name: **Kohong (Kh)**

I. Information on the site.
- a. Date of examination: Nov. 29, 1991
- b. Location: Ban Sai, Tambon Nachaang, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Low terrace
  - ii. Relief and slop: Undulating, 2-3 %
  - iii. Elevation: 13 m
  - iv. Stoniness: None
- d. Land use: Coconut, rubber and shrub same

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic
  b) USDA : Typic Paleudults
- b. Parent material: Old alluvium
- c. Drainage: Well drained
- d. Permeability: Moderate
- e. Run off: Medium
- f. Ground water table: > 150 cm
- g. Moisture condition: Moist between 0-103 cm in depth and wet below that depth.

III. Additional Notes: No flooded

IV. Profile description.

Depth

0-12 cm Grayish brown (7.5YR5/2) sandy loam; no mottles; weak, fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful fine roots; charcoal 2 %; clear wavy boundary; strongly acidic; pH(1:5)=5.3, EC(1:5)=0.04 MS/cm

12-35 cm Dull orange (7.5YR6/4) sandy loam; no mottles; weak, fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; few and coarse roots; clear wavy boundary; strongly acid; pH(1:5)=5.5, EC(1:5)=0.03 MS/cm

35-59 cm Brownish gray (7.5YR4/1) sandy loam; bright brown (7.5YR6/4) 20 %; fine and medium subangular blocky structure; very hard, very friable, non sticky, non plastic; few fine and coarse roots; gradual irregular boundary; very strongly acid; pH(1:5)=5.0, EC(1:5)=0.02 MS/cm

59-103 cm Orange (7.5YR7/6); sandy loam; bright brown (7.5YR5/8) 15 %; fine and medium subangular blocky structure, soft, very friable, non sticky, non plastic; gradual irregular boundary; strongly acid; pH(1:5)=5.3, EC(1:5)=0.03 MS/cm

103-150 cm Dull orange (5YR6/4) sandy loam; bright yellowish brown (10YR6/6) 10%; fine and medium subangular blocky structure, soft, very friable, non sticky, non plastic; moderately acid; pH(1:5)=5.2, EC(1:5)=0.01 MS/cm

Profile No. 2

Soil series name: **Tha Muang (Tm)**

I. Information on the site.
- a. Date of examination: Nov. 28, 1991
- b. Location: Ban Bang Luk, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Recent natural levee
  - ii. Relief and slop: Nearly level, 1-2 %
  - iii. Elevation: 8 m
  - iv. Stoniness: None
- d. Land use: Durian, banana and coconut

II. General information on the soil.
- a. Classification: a) National : Alluvial
  b) USDA : Typic Ustifluvents
- b. Parent material: Recent riverine alluvium
- c. Drainage: Moderately well drained
- d. Permeability: Moderate
- e. Run off: Medium
- f. Ground water table: > 150 cm
- g. Moisture condition: Moist throughout profile

III. Additional Notes: Periodical flooding for short period during flash flood.
No concretion throughout.
Fine some mica.
Few clay contain below 35 cm depth.

IV. Profile description.

Depth

0-13 cm Grayish yellow brown (10YR5/2) silty loam - very fine sandy loam, no mottle; weak, fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; many very fine and common fine roots; charcoal on surface 3 %; clear smooth boundary; near neutral; pH(1:5)=6.6, EC(1:5)=0.14 MS/cm

13-35 cm Dull yellowish brown(10YR5/4) very fine sandy loam; no mottles; weak, fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; many very fine and common fine roots; clear smooth; strongly acid; pH(1:5)=5.4, EC(1:5)=0.05 MS/cm

35-70 cm Dull yellowish brown (10YR4/3) fine sandy loam; weak fine subangular blocky structure; soft, very friable, non sticky, non plastic; many fine, common and coarse roots; some fine mica; clear wavy boundary; very strongly acid;

pH(1:5)=4.8, EC(1:5)=0.05 MS/cm

70-125 cm Brown (10YR4/6); fine sandy loam; weak fine subangular blocky structure; soft, very friable, non sticky, non plastic; few fine, medium fine roots; some fine mica; clear wavy boundary; very strong acid; pH(1:5)=4.9, EC(1:5)=0.07 MS/cm

125-150 cm Brown (7.5YR4/6) sandy loam; weak fine subangular blocky structure, soft, very friable, non sticky, non plastic; few fine medium fine roots; strongly acid; pH(1:5)=5.1, EC(1:5)=0.04 MS/cm

Profile No.3

Soil series name: **Chumphon (Cp)**

I. Information on the site.
- a. Date of examination: Nov. 29, 1991
- b. Location: Ban Sapan Sam, Tambon Hadphumkrai, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Middle terrace
  - ii. Relief and slop: Undulating, 2-3 %
  - iii. Elevation: 25 m
  - iv. Stoniness: None
- d. Land use: Coconut and some shrub

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic
  b) USDA : Typic Paleudults
- b. Parent material: Old alluvium
- c. Drainage: Moderately well drained - well drained
- d. Permeability: Moderate
- e. Run off: Rapid
- f. Ground water table: > 150 cm
- g. Moisture condition: Mois throughout profile

III. Additional Notes: No flood.

IV. Profile description.

Depth

0-20 cm Grayish brown (7.5YR4/2) sandy loam, no mottle; weak fine to medium subangular blocky structure; soft, very friable, non sticky, non plastic; abundant very fine and medium roots; some fine charcoal on surface 2 %; clear smooth boundary; moderately acid; pH(1:5)=5.6, EC(1:5)=0.03 MS/cm

20-57 cm Dull yellowish brown (7.5YR6/4) sandy loam; no mottles; weak fine to medium subangular blocky structure; soft, very friable, non sticky, non plastic; abundant very fine and medium roots; some fine charcoal on surface 2 %; abrupt smooth boundary; strongly acid; pH(1:5)=5.2, EC(1:5)=0.03 MS/cm

57-80 cm Brown (10YR4/4) sandy clay loam; moderate fine to medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine and plentiful medium roots; some fine charcoal 8 %; gradual irregular boundary; strongly acid; pH(1:5)=5.4, EC(1:5)=0.02 MS/cm

80-129 cm Dull yellowish brown (10YR5/4), bright reddish brown (5YR5/8) 10 %; sandy clay loam; moderate fine to medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine and plentiful medium roots; some fine Fe/Mn soft, < 2 %; very strongly acid; pH(1:5)=4.7, EC(1:5)=0.03 MS/cm

129-150 cm Grayish yellow brown (10YR6/2), bright reddish brown (2.5YR5/8) 20 %, yellowish brown (10YR5/6) 10 %; sandy clay loam; moderate fine to medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; few fine and plentiful medium roots; some fine Fe/Mn soft, < 2 %; very strongly acid; pH(1:5)=4.7, EC(1:5)=0.02 MS/cm

Profile No. 4

Soil series name: **Phato/Ranong Association (Pto/Rg)**

I. Information on the site.
- a. Date of examination: Nov. 29, 1991
- b. Location: Ban Khao Lieng, Tambon Hadphumkrai, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Foot slope
  - ii. Relief and slop: Gently rolling, 5-7 %
  - iii. Elevation: 80 m
  - iv. Stoniness: None
- d. Land use: Coconut and grasses

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic
  b) USDA : Typic Paleudults
- b. Parent material: Residuum and local colluvium derived from stone and quartzite
- c. Drainage: Moderately well drained - well drained
- d. Permeability: Rapid

e. Run off: Rapid
f. Ground water table: > 150 cm
g. Moisture condition: Throughout

III. Additional Notes: Laterite at 57-98 cm in depth, bedrock at 98-151 cm in depth,

IV. Profile description.

Depth

0-17 cm Grayish yellow brown (10YR4/2) sandy loam; no mottle; weak fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; abundant and few medium coarse roots; clear smooth boundary; moderately acid; pH(1:5)=5.7, EC(1:5)=0.05 MS/cm

17-30 cm Grayish red (2.5YR6/2) sandy loam; no mottle; weak fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful and medium coarse roots; gradual irregular boundary; strongly acid; pH(1:5)=5.5, EC(1:5)=0.02 MS/cm

30-57 cm Bright yellowish brown (10YR6/6) sandy clay loam; weak fine and medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; plentiful and medium coarse roots; few fine Fe/Mn soft < 2 %; clear boundary; moderately acid; pH(1:5)=5.6, EC(1:5)=0.03 MS/cm

57-98 cm Dull yellowish brown (10YR5/4), reddish brown (5YR4/6) 10 %; laterite + fine sandy clay loam; weak fine and medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; laterite 45-50 % + Fe/Mn 5 %; clear smooth boundary; moderately acid; pH(1:5)=5.6, EC(1:5)=0.02 MS/cm

98-129 cm Grayish red (2.5YR6/2), reddish brown (2.5YR4/8) 25 %, yellowish brown (10YR5/8) 10 %; bed rock + silty clay loam; moderate fine to medium angular blocky structure; extremely hard, firm, slightly sticky, slightly plastic; no roots; bed rock 20-25 %; gradual irregular boundary; strongly acid; pH(1:5)=5.4, EC(1:5)=0.02 MS/cm

129-160 cm Light gray (10YR7/1), yellowish brown (10YR5/8) 30 %, reddish brown (2.5YR4/8) 10 %; bed rock + silty clay loam; moderate fine to medium angular blocky structure; extremely hard, firm, slightly sticky, slightly plastic; no roots; bed rock 20-25 %; moderately acid; pH(1:5)=5.6, EC(1:5)=0.02 MS/cm

Profile No. 5

Soil series name: **Slope complex (SC)**

I. Information on the site.
- a. Date of examination: Nov. 28, 1991
- b. Location: Ban Nuw Yen, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Hill and foot slope
  - ii. Relief and slop: Steep, 35-40 %
  - iii. Elevation: 90 m
  - iv. Stoniness: None
- d. Land use: Rice and some sugar palm

II. General information on the soil.
- a. Classification: a) National :
  b) USDA :
- b. Parent material: Residuum and local colluvium derived from sand stone and quartzite
- c. Drainage: Well drained
- d. Permeability: Rapid
- e. Run off: Rapid
- f. Ground water table: > 150 cm
- g. Moisture condition: moist throughout profile

III. Additional Notes: bedrock below 56 cm in depth 2-35 %, laterite 15 % at 56-72 cm in depth,

IV. Profile description.

Depth

0-21 cm Bright brown (7.5YR5/6) clay loam; no mottle; moderate fine subangular blocky structure; slightly hard, friable, non sticky, non plastic; plentiful fine roots; Fe/Mn soft-hard 2 %; clear smooth boundary; strongly acid; pH(1:5)=5.4, EC(1:5)=0.05 MS/cm

21-56 cm Brown (7.5YR4/6) clay loam; no mottle; moderate-slight fine subangular blocky structure; hard, firm, slightly sticky, non plastic; few very fine roots; some bedrock 2 %; clear wavy boundary; strongly acid; pH(1:5)=5.1, EC(1:5)=0.02 MS/cm

56-72 cm Bright reddish brown (5YR5/6) laterite, clay loam; no mottle; weak-moderate very fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; few very fine roots; some fine laterite 15 %, bedrock 5 %; gradually broken boundary; strongly acid; pH(1:5)=5.3, EC(1:5)=0.03 MS/cm

72-106 cm Bright reddish brown (5YR5/8), clay loam; no mottle; moderately very fine angular blocky structure; hard, firm, slightly sticky, slightly plastic; bedrock 20 % + some Fe/Mn 2 % soft; gradually broken boundary; very strongly acid; pH(1:5)=5.0, EC(1:5)=0.06 MS/cm

106-150 cm Bright brown (7.5YR5/6), yellowish brown (10YR6/6) 10 %, clay loam; moderate medium-coarse angular blocky structure; hard, firm, slightly sticky, slightly plastic; distribute very fine roots; bed rock 30-35 %; very strongly acid; pH(1:5)=5.0, EC(1:5)=0.06 MS/cm

Profile No. 6

Soil series name: **Bangnara (Ba)**

I. Information on the site.
- a. Date of examination: Dec. 01, 1991
- b. Location: Ban Nawan, Tambon Kuring Amphoe Tha Sae,
- c. Land form:
  - i. Physiographic position: Low terrace and fans
  - ii. Relief and slop: Nearly level
  - iii. Elevation: 30 m
  - iv. Stoniness: None
- d. Land use: Paddy field

II. General information on the soil.
- a. Classification: a) National : Hydromorphic Alluvial
  b) USDA : Typic Paleaquults
- b. Parent material: Old alluvium
- c. Drainage: Poorly drained
- d. Permeability: Slow
- e. Run off: Slow
- f. Ground water table: 70 cm
- g. Moisture condition: Wet throughout

III. Additional Notes: Flooded by impounded rain water in rainy season.
Ground water flow is rapid.
Estimated yield is 400 kg/rai

IV. Profile description.
Depth
0-15 cm Brownish gray (10YR5/1), brown (10YR4/6) 10 %, silty clay loam; moderate fine medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; abundant fine roots; some fine strong mica; clear smooth

boundary; slightly acid; pH(1:5)=6.1, EC(1:5)=0.08 MS/cm

15-37 cm Brownish gray (7.5YR5/1), yellowish brown (10YR5/6) silty clay; moderate to strongly fine subangular blocky structure; extremely hard, firm, sticky, plastic; plentiful fine roots; Fe/Mn soft 5 %; clear smooth boundary; moderately alkaline; pH(1:5)=7.0, EC(1:5)=0.04 MS/cm

37-56 cm Brownish gray (10YR6/1) yellowish brown (10YR5/8) 30 %, silty clay; moderate to strongly fine subangular blocky structure; extremely hard, firm, sticky, plastic; few fine roots; Fe/Mn soft 5 %; clear smooth boundary; nearly neutral; pH(1:5)=7.1, EC(1:5)=0.05 MS/cm

56-70 cm Grayish yellow brown (10YR5/2), yellowish brown (10YR5/8) 40 %; silty clay loam; moderate to strongly fine subangular blocky structure; extremely hard, firm, slightly sticky, slightly plastic; no root; Fe/Mn soft 5 %; clear smooth boundary; nearly neutral; pH(1:5)=6.8, EC(1:5)=0.05 MS/cm

70 cm + Ground water flow rapidly and cannot dig more.

Profile No. 7

Soil series name: **Chumphon (Cp)**

I. Information on the site.
- a. Date of examination: Dec. 01, 1991
- b. Location: Ban Yai Thai, Tambon Hong Charaoen, Amphoe Tha Sae
- c. Land form:
  - i. Physiographic position: Middle terrace
  - ii. Relief and slop: Undulating, 3 %
  - iii. Elevation: 60 m
  - iv. Stoniness: None
- d. Land use: Grass, Pineapple is somewhere

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic
  b) USDA : Typic Paleudults
- b. Parent material: Old alluvium
- c. Drainage: Well drained
- d. Permeability: Moderate
- e. Run off: Rapid
- f. Ground water table: > 150 cm
- g. Moisture condition: Below 14 cm depth, (0-14 cm dry)

III. Additional Notes: Laterite 40-45 % below 102 cm in depth

IV. Profile description.

Depth

0-14 cm Grayish yellow brown (10YR4/2) sandy loam; no mottle; weak to moderate fine subangular blocky structure; slightly hard, very friable, non sticky, non plastic; abundant fine + medium roots; clear smooth boundary; slightly acid; pH(1:5)=6.3, EC(1:5)=0.06 MS/cm

14-36 cm Bright brown (7.5YR5/6) sandy loam; no mottle; weak fine medium subangular blocky structure; very hard, friable, non sticky, non plastic; plentiful fine + medium roots; gradual smooth boundary; strongly acid; pH(1:5)=5.2, EC(1:5)=0.03 MS/cm

36-62 cm Bright reddish brown (7.5YR5/8), sandy loam; no mottle; moderate fine medium subangular blocky structure; hard, friable, non sticky, non plastic; plentiful fine + coarse roots; gradually smooth boundary; strongly acid; pH(1:5)=5.1, EC(1:5)=0.03 MS/cm

62-102 cm Bright reddish brown (5YR5/8), sandy loam; no mottle; moderate fine medium subangular blocky structure; hard, firm, non sticky, non plastic; plentiful fine + coarse roots; Fe/Mn hard < 2 %; clear boundary; strongly acidic; pH(1:5)=5.1, EC(1:5)=0.02 MS/cm

102-131 cm Orange (5YR6/8), laterite + sandy loam, no mottle; moderate fine subangular structure; hard, firm, non sticky, non plastic; few fine roots; laterite + Fe/Mn hard 40-45 %; strongly acid; pH(1:5)=5.5, EC(1:5)=0.02 MS/cm

131-150 cm Orange (7.5YR6/6), laterite + sandy loam, no mottle; moderate fine subangular structure; hard, firm, non sticky, non plastic; few fine roots; laterite + Fe/Mn hard 40-45 %; very strong acidic; pH(1:5)=5.4, EC(1:5)=0.02 MS/cm

Profile No. 8

Soil series name: **Slope complex (SC)**

I. Information on the site.

a. Date of examination: Dec. 01, 1991
b. Location: Ban Thamcharern, Tambon Hongchareaoern, Amphoe Tha Sae
c. Land form:
   i. Physiographic position: Hill and foot slope
   ii. Relief and slop: Steep, 35-40 %
   iii. Elevation: 150 m
   iv. Stoniness: None
d. Land use: Banana, Durian

II. General information on the soil.

a. Classification: a) National :
   b) USDA :
b. Parent material: Residuum and local colluvium derived from sand stone and quartzite
c. Drainage: Well drained
d. Permeability: Rapid
e. Run off: Rapid
f. Ground water table: > 150 cm
g. Moisture condition: Moist throughout profile

III. Additional Notes:

IV. Profile description.

Depth

0 - 9 cm Dull brown (7.5YR5/4) sandy loam; no mottle; moderate fine-medium subangular blocky structure; slightly hard, very friable, non sticky, non plastic; abundant fine-medium roots; Fe/Mn soft < 2 %; clear wavy boundary; very strongly acid; pH(1:5)=4.9, EC(1:5)=0.04 MS/cm

9 -38 cm Bright reddish brown (5YR5/8) fine sandy clay loam; no mottle; moderate fine-medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; plentiful fine roots; Fe/Mn soft < 2 %; gradual smooth boundary; moderately acidic; pH(1:5)=4.8, EC(1:5)=0.12 MS/cm

38-82 cm Reddish brown (5YR4/6) fine sandy clay loam; no mottle; moderate fine-medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; Fe/Mn soft < 2 %; gradual smooth boundary; strongly acid; pH(1:5)=5.1, EC(1:5)=0.02 MS/cm

82-126 cm Reddish brown (2.5YR4/6) fine sandy clay loam; no mottle; moderate fine-medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; Fe/Mn soft-hard < 15 %; clearly wavy boundary; strong acid; pH(1:5)=5.4, EC(1:5)=0.01 MS/cm

126-150 cm Dark reddish brown (2.5YR3/6) laterite and fine sandy clay loam; moderate fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; no roots; bed Fe/Mn soft-hard 20 %, laterite 35 %; strongly acid; pH(1:5)=5.3, EC(1:5)=0.03 MS/cm

Profile No. 9

Soil series name: **Phato/Ranong Association (Pto/Rg)**

I. Information on the site.
- a. Date of examination: Dec. 02, 1991
- b. Location: Ban Pluthakean, Tambon Salui, Amphoe Tha Sae,
- c. Land form:
  - i. Physiographic position: Foot slope
  - ii. Relief and slop: Gently rolling, 8-10 %
  - iii. Elevation: 120 m
  - iv. Stoniness: None
- d. Land use: Kidney bean and some pineapple

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic
  b) USDA : Typic Paleudults
- b. Parent material: Residuum and local colluvium derived from sand stone and quartzite
- c. Drainage: Well drained
- d. Permeability: Rapid
- e. Run off: Rapid
- f. Ground water table: > 150 cm
- g. Moisture condition: Moist throughout profile

III. Additional Notes: Laterite at 88-130 cm in depth and down to hard pan

IV. Profile description.

Depth

0-26 cm Grayish brown (7.5YR6/2) sandy loam; no mottle; weak fine subangular blocky structure; soft, very friable, non sticky, non plastic; abundant very fine-fine roots; clear smooth boundary; strongly acid; pH(1:5)=5.5,

EC(1:5)=0.03 MS/cm

26-63 cm Dull orange (5YR6/4) sandy loam; no mottle; weak fine subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful very fine roots; clear wavy boundary; moderately acidic; pH(1:5)=5.9, EC(1:5)=0.02 MS/cm

63-88 cm Orange (5YR6/6), orange (5YR6/8) 5 % sandy loam; weak fine subangular blocky structure; soft, friable, slightly sticky, slightly plastic; few fine roots; Fe/Mn soft-hard < 2 %; clear wavy boundary; moderately acid; pH(1:5)=5.8, EC(1:5)=0.01 MS/cm

88-130 cm Dull yellowish brown (10YR6/6), reddish brown (5YR4/6) 10 %; laterite + sandy loam; moderate fine-medium subangular blocky structure; slightly hard, friable, non sticky, non plastic; laterite of Fe/Mn concretion 70 %; very slightly acidic; pH(1:5)=5.9, EC(1:5)=0.04 MS/cm

130 cm - Hard pan

Profile No. 10

Soil series name: **Bang Nam Prieo, gypsum variant (Bp-gy)**

I. Information on the site.
- a. Date of examination: Dec. 02, 1991
- b. Location: Ban Donsaingam, Tambon Bang Mark, Amphoe Muang
- c. Land form:
  - i. Physiographic position: Former tidal flat
  - ii. Relief and slop: Flat(0-1 %)
  - iii. Elevation: 5 m
  - iv. Stoniness: None
- d. Land use: Grass, paddy field

II. General information on the soil.
- a. Classification: a) National : Hydromorphic Alluvial
  b) USDA : Sulfic Tropaquents
- b. Parent material: Brackish water deposit
- c. Drainage: Poorly drained
- d. Permeability: Slow
- e. Run off: Slow
- f. Ground water table: 40 cm
- g. Moisture condition: Wet throughout

III. Additional Notes: Cat clay occurs below 40 cm in depth

IV. Profile description.

Depth

0-15 cm Brownish black (10YR3/1) sandy loam; no mottle; moderately fine-medium crumb structure; hard, friable, non sticky, non plastic; abundant fine and medium roots; clear wavy boundary; very strongly acid; pH(1:5)=4.7, EC(1:5)= >25 MS/cm

15-27 cm Brownish black (10YR5/1), bright yellowish brown (2.5Y6/6) 25 %, silty clay loam; moderately fine-medium subangular blocky structure; extremely hard, very firm, sticky, plastic; plentiful very fine-fine roots; clear smooth boundary; Fe/Mn soft < 2 %, many iron pipe; extremely acid; pH(1:5)=4.2, EC(1:5)=18 MS/cm

27-42 cm Brownish gray (10YR5/1), yellowish brown (10YR5/8) sandy clay loam; medium fine-medium subangular blocky structure; extremely hard, very friable, slightly sticky, slightly plastic; few fine roots; Fe/Mn soft < 2 %, many iron pipe; gradual smooth boundary; extremely acid; pH(1:5)=3.9, EC(1:5)= -

42-75 cm Grayish yellow brown (10YR6/2), orange (2.5YR7/6) 35 %, clay; slightly fine subangular blocky structure; very hard, firm, sticky, plastic; moderately iron pipe; extremely acidic; pH(1:5)=3.7, EC(1:5)= -

Profile No. 11

Soil series name: **Kohong (Kh)**

I. Information on the site.
- a. Date of examination: Jun. 06, 1992
- b. Location: Ban Khao Rad, Tambon Bang-Luk, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Low-middle terrace
  - ii. Relief and slop: Undulating, 4-5 %
  - iii. Elevation: 15 m
  - iv. Stoniness: None
- d. Land use: Coconut

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic soils
  b) USDA : Typic Paleudults
- b. Parent material: Old alluvium
- c. Drainage: Well drained
- d. Permeability: Moderate
- e. Run off: Medium
- f. Ground water table: > 150 cm
- g. Moisture condition: Throughout moist (very friable on soil surface)

III. Additional Notes: No flooded

IV. Profile description.

Depth

0-11 cm Dull yellowish brown (10YR5/3) sandy loam; no mottles; weak, fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful coarse roots, common very fine interstitial pores; no concretions; clear smooth boundary; very strongly acid; pH(paste)=5.0, ECe= <0.20 MS/cm

11-41 cm Dull yellowish brown (10YR5/4) sandy loam; no mottles; weak fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful coarse roots, common fine interstitial pores; Fe/Mn soft 2 %; gradually smooth boundary; very strongly acid; pH(paste)=4.9, ECe= <0.20 MS/cm

41-75 cm Orange (7.5YR6/6) sandy loam; no mottles; weak fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful coarse roots; common fine interstitial pores; Fe/Mn soft 2 %; gradually smooth boundary; very strong acid; pH(paste)=4.8, ECe= <0.20 MS/cm

75-114 cm Dull orange (5YR7/4) loamy sand; no mottles; weak fine subangular blocky structure; soft, very friable, non sticky, non plastic; plentiful fine roots, plentiful interstitial pores; Fe/Mn soft-hard 5 %; clear smooth boundary; strongly acid; pH(paste)=5.1, ECe= <0.20 MS/cm

114-132 cm Bright yellowish brown (10YR6/6) sandy loam; no mottle; moderately fine and moderate subangular blocky structure; soft, friable, non sticky, non plastic; few very fine roots, common fine tubular and interstitial pores; no concretions; diffuse broken boundary; very strongly acid; pH(paste)=4.9, ECe= <0.20 MS/cm

132-160 cm Dull orange (5YR7/4) loamy sand, bright yellowish brown (10YR7/6); weak fine subangular blocky structure; soft, very friable, non sticky, non plastic; no roots, common fine tubular and interstitial pores; no concretions; strongly acid; pH(paste)=5.1, ECe= <0.20 MS/cm

160-220 cm Light brownish gray (5YR7/1), yellowish brown (10YR5/6) 20 %, reddish brown (2.5YR4/8) 15 %; sandy clay loam; very hard, firm, non sticky, non plastic; no concretions; very strong acidic; pH(paste)=4.8, ECe= <0.20 MS/cm

220-310 cm Light gray (10YR7/1), yellowish brown (10YR5/6) 25 %, reddish brown (2.5YR4/6) 15 %; sandy clay; extremely hard, very firm, non sticky, non plastic; Fe/Mn soft 3 %;

310-400 cm Light brownish gray (2.5YR8/0), yellowish brown (10YR5/6) 20 %, bright reddish brown (2.5YR5/8) 5 %; sandy clay loam; extremely hard, very firm, non sticky, non plastic; no concretion;

Profile No. 12

Soil series name: **Pathiu (Pw)**

I. Information on the site.
- a. Date of examination: Jun. 06, 1992
- b. Location: Ban Kao Ta Muang; Tambon Na Cha-Ang; Amphoe Muang
- c. Land form:
  - i. Physiographic position: Middle terrace
  - ii. Relief and slop: Undulating, 3-5 %
  - iii. Elevation: 22 m
  - iv. Stoniness: None
- d. Land use: Coconut

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic soils
  b) USDA : Typic Paleudults
- b. Parent material: Old alluvium
- c. Drainage: Well drained
- d. Permeability: Moderate
- e. Run off: Rapid
- f. Ground water table: > 400 cm
- g. Moisture condition: Throughout moist (very friable on soil surface)

III. Additional Notes: No flooded

IV. Profile description.

Depth

0-17 cm Dull yellowish brown (10YR5/4) sandy loam; no mottles; weak, fine subangular blocky structure; hard, very friable, non sticky, non plastic; plentiful coarse and fine roots, fine common pores; Fe/Mn soft-hard; clear wavy boundary; strongly acid; pH(paste)=5.5, ECe=0.42 MS/cm

17-37 cm Orange (5YR6/6) sandy clay loam; no mottles; moderately strong medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine medium roots, very fine common pores; Fe/Mn soft 5 %; gradually smooth boundary; strong acidic; pH(paste)=4.9, ECe=0.20 MS/cm

37-78 cm Bright orange (7.5YR5/8) sandy clay loam; no mottles; moderately medium subangular blocky structure; very hard, friable, sticky, non plastic; common fine medium roots; very fine common pores; Fe/Mn soft 5 %; gradually smooth boundary; very strongly acid; pH(paste)=4.7, ECe= <0.20

78-99 cm Reddish brown (5YR4/6) sandy clay loam; no mottles; moderately medium fine medium subangular blocky structure; extremely hard, friable, sticky, non plastic; few very fine-fine roots, many very fine common pores; laterite 20 %; gradual smooth boundary; very strong acidic; pH(paste)=4.7, ECe= <0.20 MS/cm

99-130 cm Reddish brown (2.5YR4/6) sandy clay loam; no mottle; moderately fine and moderate subangular blocky structure; extremely hard, friable, sticky, non plastic; few very fine roots, many very fine common pores; laterite 30 %; very strongly acid; pH(paste)=4.7, ECe= <0.20 MS/cm

130-180 cm Reddish brown (2.5YR4/6), bright yellowish brown (10YR6/6); moderately fine subangular blocky structure; extremely hard, very friable, sticky, non plastic; laterite 30 %, strongly acid; pH(paste)=4.5, ECe=0.27 MS/cm

180-240 cm Light brownish gray (5YR7/2), bright yellowish brown (10YR6/6) 15 %, reddish brown (2.5YR4/6) 15 %; clay loam; extremely hard, firm, non sticky, non plastic; laterite 30 %, very strongly acid; pH(paste)=4.6, ECe= <0.20

240-280 cm Light brownish gray (5YR7/2), dark reddish brown (2.5YR3/6) 40 %, bright yellowish brown (10YR6/6) 15 %; silty clay; extremely hard, friable, sticky, non plastic; laterite 30 %;
280-300 cm Reddish brown (2.5YR4/6), yellowish brown (10YR5/6) 15 %; sandy clay loam; extremely hard, friable, slightly sticky, slightly plastic; laterite 45 %;

Profile No. 13

Soil series name: **Bangnara (Ba)**

I. Information on the site.
- a. Date of examination: Jun. 08, 1992
- b. Location: Ban Sala Loi; Tambon Bang Luk; Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Low terrace
  - ii. Relief and slop: Nearly flat 1 %
  - iii. Elevation: 5 m
  - iv. Stoniness: None
- d. Land use: Paddy field

II. General information on the soil.
- a. Classification: a) National : Low-humic Gray soils
  b) USDA : Typic Paleaquults
- b. Parent material: Old alluvium
- c. Drainage: Poorly drained
- d. Permeability: Slow
- e. Run off:
- f. Ground water table: > 400 cm
- g. Moisture condition: Throughout moist

III. Additional Notes: Subjected to flood every year
Estimated yield more than 500 kg/rai

IV. Profile description.

Depth

0-17 cm Brownish gray (5YR6/1), brownish gray (10YR6/1) 10 %; Silty clay loam; weak, Moderate strong medium coarse subangular blocky structure; very hard, friable, slightly sticky, slightly plastic; common fine roots, common fine discontinuous vertical simple tubular pores; Fe/Mn soft 3 % tabular; clear smooth boundary; very strongly acid; pH(paste)=4.7, ECe= <0.20 MS/cm

17-49 cm Brownish gray (10YR6/1), brown (7.5YR4/6) 30 %; clay; Strong medium coarse angular blocky structure; very hard, firm, sticky, plastic; few very fine roots, few fine discontinuous vertical simple tubular pores; Fe/Mn soft 15 %; gradually smooth boundary; very strongly acid; pH(paste)=5.0, ECe= <0.20 MS/cm

49-73 cm Light gray (10YR7/1), blight reddish brown (5YR5/6) 20 %, silty clay loam; moderately medium angular blocky structure; very hard, firm, sticky, plastic; no roots; few very fine continuous vertical simple tubular pores; Fe/Mn soft 5 %; gradually smooth boundary; very strongly acid; pH(paste)=4.8, ECe= <0.20 MS/cm

73-109 cm Light gray (10YR7/1), bright brown (7.5YR5/8) 40 %, silty clay; Moderately strong medium coarse subangular blocky structure; very hard, firm, sticky, plastic; no roots, few very fine continuous vertical simple tubular pores; Fe/Mn 3 %; gradually smooth boundary; very strongly acid; pH(paste)=4.8, ECe= <0.20 MS/cm

109-127 cm Brownish gray (10YR6/1), yellowish brown (10YR5/8) 35 %, silty clay; moderately medium coarse subangular blocky structure; very hard, friable, sticky, plastic; no roots, few very fine continuous vertical simple tubular pores; Fe/Mn 3 %; very strongly acid; pH(paste)=5.0, ECe= <0.20 MS/cm

127-170 cm Light brownish gray (7.5YR7/1), bright yellowish brown (10YR5/8) 35 %, silty clay; moderately medium coarse subangular blocky structure; very hard, friable, non sticky, non plastic; few very fine continuous vertical simple tubular pores; Fe/Mn 3 %, very strongly acid; pH(paste)=4.7, ECe= <0.20 MS/cm

170-200 cm Brownish gray (5YR6/1), orange (5YR6/6) 15 %, dark reddish brown (2.5YR3/6) 10 %, silty clay; very hard, firm, non sticky, non plastic; no concretions; very strongly acid; pH=4.4, ECe=0.23 MS/cm

200-300 cm Brownish gray (5YR6/1), yellowish brown (10YR5/6) 40 %, reddish brown (2.5YR4/6) 15 %, silty clay; extremely hard, friable, non sticky, non plastic; no concretions;

300-370 cm Light brownish gray (7.5YR7/1), yellowish brown (10YR5/6) 10 %; brown (10YR4/6) 30 %; loam; extremely hard, friable, non sticky, non plastic; no concretions;

370-400 cm Light brownish gray (7.5YR7/1) sandy clay; extremely hard, friable, non sticky, non plastic; no concretions;

Profile No. 14 Outside of the Project Area

Soil series name: **Kohong/Sawi (Kh/Sw)**

I. Information on the site.
- a. Date of examination: Jun. 08, 1992
- b. Location: Ban Fai Tha; Tambon Bang Luk; Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Middle terrace
  - ii. Relief and slop: Undulating 4-5 %
  - iii. Elevation:
  - iv. Stoniness: None
- d. Land use: Coconut with grass

II. General information on the soil.
- a. Classification: a) National : Red Yellow Podzolic soil
  b) USDA : Typic Paleudults
- b. Parent material: Old alluvium
- c. Drainage: Well drained
- d. Permeability: Moderate
- e. Run off:
- f. Ground water table: 75 cm +
- g. Moisture condition: Below 10 cm depth

III. Additional Notes:

IV. Profile description.

Depth

0-22 cm Brownish gray (10YR4/1), no mottles; silty loam; Moderate medium fine subangular blocky structure; soft, very friable, non sticky, non plastic; common very fine and fine roots, common very fine discontinuous vertical single tubular pores; no concretions; clear smooth boundary; moderately acid; pH(paste)=5.6, ECe=0.21 MS/cm

22-35 cm Orange (5YR6/6); silty clay, peat; moderately medium coarse subangular blocky structure; very hard, friable, non sticky, non plastic; common coarse roots, few fine continuous vertical simple tubular in ped; Fe/Mn hard-soft 5 %; clear wavy boundary; moderately acid; pH=5.7, ECe= <0.20 MS/cm

35-75 cm Orange (5YR6/8), no mottles, silty loam; single grain; very hard, friable, non sticky, non plastic; no roots; many medium intersectional vertical simple tubular in ped; hard iron soft nodules 70 %; strongly acid; pH(paste)=5.4, ECe= <0.20 MS/cm

75 cm + Hard pan

Profile No. 15

Soil series name: **Bangnara (Ba)**

I. Information on the site.
- a. Date of examination: Jun. 09, 1992
- b. Location: Ban Thaptakean; Tambon Na Cha-Ang; Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Low terrace
  - ii. Relief and slop: Nearly flat 1 %
  - iii. Elevation: 1 m
  - iv. Stoniness: None
- d. Land use: Paddy field

II. General information on the soil.
- a. Classification: a) National : Low-humic Gray soils
  b) USDA : Typic Paleaquults
- b. Parent material: Old alluvium
- c. Drainage: Poorly drained
- d. Permeability: Slow
- e. Run off:
- f. Ground water table: 150 cm
- g. Moisture condition: Below 30 cm in depth wet

III. Additional Notes: Many cracks on the surface 3-4 cm width and down to 80-100 cm in depth.
Flooded by river and rain water in rainy season for about 15 days.
Damaged by flooded in some years.
Estimated yield 400 kg/rai.
Peat soils at 17-131 cm in depth.

IV. Profile description.

Depth

0-17 cm Brownish gray (10YR4/1), bright yellowish brown (10YR6/6) 25 %, Fine silty clay loam; weak, strong medium coarse angular blocky structure; very hard, friable, slightly sticky, slightly plastic; common very fine-fine roots, common fine discontinuous vertical simple tubular pores; some fine strains + soft powder white color; clear smooth boundary; extremely acid; pH(paste)=3.5, ECe=3.9 MS/cm

17-36 cm Grayish brown (7.5YR6/2), no mottles, sandy clay, peat; fine angular blocky structure; very hard, very firm, sticky, plastic; common fine roots, common fine discontinuous vertical simple tubular pores; some fine strains + soft powder color; gradually smooth boundary; moderately acid; pH(paste)=5.6, ECe=2.6 MS/cm

36-73 cm Grayish brown (7.5YR4/2), orange (2.5YR7/6) 5 %, sandy clay loam, peat; moderately fine-medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; no roots; common fine discontinuous vertical simple tubular pores; some fine strains + soft powder color; gradually smooth boundary; extremely acid; pH(paste)=3.0, ECe=3.1 MS/cm

73-93 cm Brownish black (10YR3/2), yellowish brown (2.5YR5/4) 5 %; sandy loam, peat; moderately fine-medium subangular blocky structure; hard, firm, non sticky, non plastic; no roots, common middle discontinuous vertical simple tubular pores; some fine strains + soft powder color; gradual smooth boundary; extremely acid; pH(paste)=2.2, ECe=2.0 MS/cm(*)

93-131 cm Reddish gray (2.5YR6/1), brown (10YR4/6) 5 %, sandy loam +peat, gravel + sand stone; single grain; hard, firm, non sticky, non plastic; no roots, sand stone, gravel 90 %; very strongly acid; pH(paste)=2.2, ECe=3.5 MS/cm(*)

131-170 cm Light gray (10YR7/1), bright reddish brown (2.5YR5/6) 20 %; sandy clay loam, gravel sand stone; single grain; hard, firm, slightly sticky, slightly plastic; sand stone, gravel 70 %; slightly acid; pH(paste)=6.4, ECe=0.91 MS/cm(*)

170-240 cm Dull orange (5YR6/3), mixed; sandy loam, gravel, sand stone; non sticky, non plastic; extremely acid; pH(paste)=4.1, ECe=1.0 MS/cm(*)

240-cm Loose sand
Note: (*)= Electrical Conductivity after dilution 1:9

Profile No. 16
Soil series name: **Bang Pakong (Bpg)**

I. Information on the site.
- a. Date of examination: Jun. 09, 1992
- b. Location: Ban Khun Sedn, Tambon Na Tung Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Tidal flat
  - ii. Relief and slop: Nearly level, 1 %
  - iii. Elevation: 1 m
  - iv. Stoniness: None
- d. Land use: Grass

II. General information on the soil.
- a. Classification: a) National : Hydromorphic Alluvial soil
  b) USDA : Typic Hydraquents
- b. Parent material: Marine deposit
- c. Drainage: Well drained d. Permeability: Moderate
- e. Run off: Medium
- f. Ground water table: 90 cm
- g. Moisture condition: 0-35 cm and wet below down

III. Additional Notes: Flooded by rain water 7-10 days in some years.
Ground water flow is rapid, can't dig.

IV. Profile description.
Depth

0-13 cm Brownish black (10YR3/2), brown (10YR4/6) 20%, silty clay; strong coarse platy fine subangular structure; hard, firm, sticky, plastic; common fine roots, fine very fine continuous horizontal simple medium pores in ped; Few fine strain 5 %; clear smooth boundary; extremely acid; pH(paste)=4.0, ECe=1.7 MS/cm(*)

13-34 cm Dull orange (5YR6/3), reddish brown (5YR4/6) 25 %, silty clay loam; strong fine-medium subangular blocky structure; hard, firm, sticky, plastic;common fine roots, common very fine discontinuous vertical simple tubular in ped; Fe/Mn soft 10 %; gradually smooth boundary; extremely acid; pH(paste)=4.2, ECe=3.9 MS/cm

34-58 cm Grayish brown (7.5YR5/2), dark brown (7.5YR3/4) 20 %, silty clay; strong fine angular blocky structure; very hard, firm, sticky, plastic; common very fine roots, common very fine discontinuous vertical simple pores; Fe/Mn soft; gradually smooth boundary; strong acidic; pH(paste)=3.6, ECe=1.4 MS/cm(*)

58-165 cm Gray (5Y5/1) silty clay; no mottles; very hard, firm, sticky, plastic; many coarse medium roots, few very fine discontinuous vertical simple tubular in ped; extremely acid; pH(paste)=2.8, ECe=4.5 MS/cm(*)

165-235 cm Reddish gray (2.5Y4/1) sandy loam; no mottle; soft, very friable, non sticky, non plastic; extremely acid; pH(paste)=2.7, ECe=2.2 MS/cm

235 + Loose sand
Note: (*)= Electrical Conductivity after dilution 1:9

Profile No. 17

Soil series name: **Klaeng (Kl)**

I. Information on the site.
- a. Date of examination: Jun. 10, 1992
- b. Location: Ban Na Tung, Tambon Na Tung, Amphoe Muang,
- c. Land form:
  - i. Physiographic position: Low terrace
  - ii. Relief and slop: Smooth, < 1.5 %
  - iii. Elevation: 1 m
  - iv. Stoniness: None
- d. Land use: Paddy field

II. General information on the soil.
- a. Classification: a) National : Low Humic gray soils
  b) USDA : Oxic Plinthaquults
- b. Parent material: Old alluvium
- c. Drainage: Poorly drained
- d. Permeability: Slow
- e. Run off: Slow
- f. Ground water table: 200 cm
- g. Moisture condition: 0-108 cm in depth below wet

III. Additional Notes: Many cracks on the surface 2-4 cm width and down to 50 cm in depth
Flooded by impound rain water during rainy season on some years
Estimated yield 500 kg/rai
Iron pipe below 108 cm about 6 %
Loose sand 300 cm in depth
Ground water flows rapidly

IV. Profile description.

Depth

0-9 cm Grayish brown (7.5YR6/2), brown (7.5YR4/6) 20 %, silty clay loam; strong very fine subangular blocky structure; soft, firm, slightly sticky, slightly plastic; many very fine roots, common fine discontinuous vertical simple tubular pore; Fe/Mn soft 3 %; clear smooth boundary; extremely acid; pH(paste)=4.4, ECe=0.48 MS/cm

9-35 cm Brownish gray (10YR6/1), reddish brown (5YR4/6) 20 %, silty clay; strong fine medium angular blocky structure; very hard, very firm, sticky, plastic; common fine roots, common fine discontinuous vertical simple tubular pores in ped; Fe/Mn soft 3 %; gradually smooth boundary; very strongly acid; pH(paste)=4.8, ECe= <0.20 MS/cm

35-69 cm Light brownish gray (10YR7/1), orange (7.5YR6/6) 15 %, sandy clay loam; moderately fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; common medium coarse roots; common very fine discontinuous vertical simple tubular pores; Fe/Mn soft 1 %; gradually broken boundary; very strongly acid; pH(paste)=4.9, ECe=0.24 MS/cm

69-108 cm Light gray (10YR7/1), yellowish brown (10YR5/6) 5 %; sandy loam; moderately fine subangular blocky structure; soft, friable, non sticky, non plastic; common coarse roots, common very fine discontinuous vertical simple tubular pores in ped; Fe/Mn soft 1 %; gradual broken boundary; extremely acid; pH(paste)=4.4, ECe= <0.20 MS/cm

108-200 cm Grayish yellow brown (10YR6/2), bright yellowish brown (10YR6/8) 35 %, sandy loam, iron pipe; moderately fine subangular blocky structure; soft, very friable, non sticky, non plastic; common coarse roots, common fine discontinuous vertical simple tubular pore in ped; Fe/Mn soft 15 %; extremely acid; pH(paste)=3.9, ECe= 0.30 MS/cm

200-220 cm Brownish gray (5YR4/1), no mottle; coarse sandy loam; non sticky, non plastic; no concretions;

220-300 cm Reddish gray (2.5YR4/1), no mottle; coarse loamy sand; non sticky, non plastic;

300 cm + Loose sand

Profile No. 18

Soil series name: **Tha Muang (Tm)**

I. Information on the site.

a. Date of examination: June 10, 1992
b. Location: Ban Na Chung, Tambong Na Tung, Amphoe Muang,
c. Land form:
   i. Physiographic position: Recent natural levee
   ii. Relief and slop: Nearly level, < 2 %
   iii. Elevation: 3 m
   iv. Stoniness: None
d. Land use: Coconut, Mango, Banana

II. General information on the soil.

a. Classification: a) National : Alluvial soil
   b) USDA : Typic Ustifluvents

b. Parent material: Recent riverine alluvium
c. Drainage: Moderately well drained
d. Permeability: Moderate
e. Run off:
f. Ground water table: 290 cm
g. Moisture condition: Throughout

III. Additional Notes: Periodical flooding for short period during flash flood.
Loose sand 360 cm

IV. Profile description.

Death

0-15 cm Grayish yellow brown (10YR4/2) silty loam, no mottle; strong fine subangular blocky structure; hard, Firm, slightly sticky, slightly plastic; coarse very fine + coarse roots; coarse fine medium discontinuous vertical simple tubular pores; clear smooth boundary; very strongly acid; pH(paste)=4.9, ECe=0.31 MS/cm

15-31 cm Dull yellowish brown(2.5YR5/4) fine sandy clay loam; no mottles; strong fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; common very fine to medium roots; common fine discontinuous vertical simple tubular pores in ped; clear smooth boundary; very strongly acid; pH(paste)=4.6, ECe= <0.20 MS/cm

31-53 cm Yellowish brown (10YR5/8) fine sandy loam; no mottle; moderately fine subangular blocky structure; slightly hard, friable, non sticky, non plastic; common very fine to medium roots; few very fine discontinuous vertical simple

tubular pores; gradually smooth boundary; very strongly acid; pH(paste)=4.8, ECe= <0.20 MS/cm

53-74 cm Yellowish brown (10YR5/6); sandy loam; moderately fine subangular blocky structure; slightly hard, very friable, non sticky, non plastic; common very fine roots; few very fine discontinuous vertical simple tubular pores; gradually smooth boundary; very strongly acid; pH(paste)=5.1, ECe= <0.20 MS/cm

74-99 cm Yellowish brown (10YR5/6) sandy loam; moderately fine subangular blocky structure, soft, loose, non sticky, non plastic; few very fine roots; few very fine discontinuous vertical simple tubular pores; very strongly acid; pH(paste)=5.0, ECe= <0.20 MS/cm

99-141 cm Bright yellowish brown (10YR6/8) sandy loam; moderately fine subangular blocky structure, soft, loose, non sticky, non plastic; few very fine roots; few very fine discontinuous vertical simple tubular pores; strongly acid; pH(paste)=5.4, ECe= <0.20 MS/cm

141-170 cm Yellowish brown (10YR5/6) sandy loam; medium fine subangular blocky structure, soft, loose, non sticky, non plastic; strongly acid; pH(paste)=5.2, ECe= <0.20 MS/cm

170-220 cm Light gray (10YR7/1), brown (10YR4/6) 25 %, sandy loam; soft, loose, non sticky, non plastic; very strongly acid; pH(paste)=4.8, ECe= <0.20 MS/cm

220-290 cm Brown (7.5YR4/6) loamy sand;

290-360 cm Dull yellowish brown (10YR5/4), no mottle, loose sandy loam;

Profile No. 19

Soil series name: **Bangnara (Ba)**

I. Information on the site.
- a. Date of examination: Jun. 11, 1992
- b. Location: Ban Khun Seam; Tambon Na Cha-Ang; Amphoe Muang
- c. Land form:
  - i. Physiographic position: Low terrace
  - ii. Relief and slop: smooth < 1 %
  - iii. Elevation: 1 m
  - iv. Stoniness: None
- d. Land use: Paddy field

II. General information on the soil.
- a. Classification: a) National : Low-humic Gray soils
  b) USDA : Typic Paleaquults
- b. Parent material: Old alluvium
- c. Drainage: Poorly drained
- d. Permeability: Slow
- e. Run off: Slow
- f. Ground water table: 160 cm
- g. Moisture condition: 0-101 cm depth and below down to wet

III. Additional Notes: Subjected to flood every year
Many crack on the surface 2-4 cm width and down to 50 cm depth
Estimated yield more than 500 kg/rai
Ground water flows rapid
Peat soil at 118 cm depth

IV. Profile description.

Depth

0-16 cm Brownish gray (10YR6/1), bright reddish brown (5YR5/6) 20 %; Silty clay; strong fine medium subangular blocky structure; very hard, firm, sticky, plastic; many very fine, few fine roots; few very fine and common fine discontinuous vertical sample tubular pores; no concretion; clear smooth boundary; extremely acid; pH(paste)=4.1, ECe=1.3 MS/cm

16-31 cm Brownish gray (10YR6/1), brown (10YR4/6) 20 %; clay; strong medium coarse angular blocky structure; very hard, very firm, sticky, plastic; few very fine roots; common very fine discontinuous vertical simple tubular pores in ped;

few Fe/Mn soft 3 %; gradually smooth boundary; very strongly acid; pH(paste)=4.6, ECe=0.51 MS/cm

31-59 cm Brownish gray (10YR6/1), yellowish brown (10YR5/6) 15 %, bright reddish brown (2.5YR5/8) 10 %, clay; strong fine medium prismatic structure; extremely hard, very firm, sticky, plastic; few very fine roots; common very fine discontinuous vertical simple tubular pore in ped; Fe/Mn soft 3 %; gradually wavy boundary; very strongly acid; pH(paste)=4.5, ECe=0.53 MS/cm

59-86 cm Brownish gray (10YR6/1), yellowish brown (10YR5/6) 30 %, bright reddish brown (2.5YR5/8) 10 %, clay; strong fine medium prismatic structure; extremely hard, very firm, sticky, plastic; few very fine roots, common fine discontinuous vertical simple tubular pores in ped; Fe/Mn soft 5 %; gradual smooth boundary; extremely acid; pH(paste)=4.3, ECe=0.66 Ms/cm

86-101 cm Grayish yellow brown (10YR6/2), yellowish brown (10YR5/6) 10 %, reddish brown (5YR4/6), clay; strong fine medium prismatic structure; very hard, very firm, sticky, plastic; no roots, common fine discontinuous vertical simple tubular pores; Fe/Mn soft 5 %, some fine granule 1%; extremely acid; pH(paste)=4.3, ECe=0.61 MS/cm

101-118 cm Grayish brown (7.5YR6/2), reddish brown (5YR4/6) 25 %, clay; moderately fine medium subangular blocky structure; very hard, very firm, non sticky, non plastic; no roots; common fine discontinuous vertical simple tubular pores in ped; Fe/Mn soft 5 %, some fine granule; extremely acid; pH(paste)=4.3, ECe=0.73 MS/cm

118-160 cm Grayish brown (7.5YR4/2), no mottles, clay; extremely hard, extremely firm, very sticky, plastic; Fe/Mn soft 5 %, peat 30 %; extremely acid; pH(paste)=4.3, ECe=1.1 MS/cm

160-240 cm Brownish black (10R3/2), no mottles, clay; Fe/Mn soft 5 %, peat 30 %; extremely acid; pH(paste)=3.0, ECe=2.8 MS/cm(*)

240-340 cm Grayish yellow brown (10YR4/2), no mottles, clay; Fe/Mn soft 5 %, peat 30 %;

340-400 cm Brownish gray (5YR4/1), no mottles, sandy clay; Fe/Mn soft 5 %, peat 30 %;
Note: (*)= Electrical Conductivity after dilution 1:9

Profile No. 20 Outside of the Project Area

Soil series name: **Ranong (Rg)**

I. Information on the site.
- a. Date of examination: Jun. 11, 1992
- b. Location: Ban Mern Kiri, Tambon Na Cha-Ang, Amphoe Muang
- c. Land form:
  - i. Physiographic position: Foot slope
  - ii. Relief and slop: Undulating, 3-5 %
  - iii. Elevation:
  - iv. Stoniness: None
- d. Land use: Coconut

II. General information on the soil.
- a. Classification: a) National : Red-Yellow Podzolic soils
  b) USDA : Typic Paleudults
- b. Parent material: Residual and colluvium from sandstone
- c. Drainage: Well drained
- d. Permeability: Rapid
- e. Run off: Rapid
- f. Ground water table: > 160 cm
- g. Moisture condition: Throughout moist

III. Additional Notes: Sandstone on the surface some place 60-80 % sandstone fragment below 27 cm depth

IV. Profile description.

Depth

0-13 cm Dull yellowish brown (10YR5/3) sandy loam; no mottles; weak, fine subangular blocky structure; soft, very friable, non sticky, non plastic; many very fine and common roots; many fine and medium discontinuous vertical tubular pores; no concretions; clear smooth boundary; slightly acid; pH(paste)=6.4, ECe=1.3 MS/cm

13-29 cm Dull yellowish orange (10YR6/4) sandy loam; no mottles; weak fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; common very fine and common medium roots; common fine and medium discontinuous vertical tubular pores; sandstone 10 %; gradually smooth boundary; very strongly acid; pH(paste)=4.6, ECe=0.29 MS/cm

29-46 cm Dull yellowish orange (10YR7/4) sandy loam + sandstone fragment; no mottles; weak fine and medium subangular blocky structure; soft, very friable, non sticky, non plastic; common very fine roots; common fine discontinuous

vertical tubular pores; sandstone fragment 60 %; gradually smooth boundary; very strongly acid; pH(paste)=4.8, ECe=0.20 MS/cm

46-64 cm Orange (5YR6/6) sandy clay loam; no mottles; weak fine medium subangular blocky structure; soft, friable, non sticky, non plastic; few very fine and common medium roots; common coarse discontinuous vertical tubular pores; sandstone fragments 80 %; diffuse smooth boundary; very strongly acid; pH(paste)=4.7, ECe= <0.20 MS/cm

64-106 cm Reddish brown (2.5YR4/8) sandy clay loam, sandstone fragments; no mottle; strong fine angular blocky structure; soft, friable, slightly sticky, slightly plastic; no roots, common coarse discontinuous vertical tubular pores; sandstone fragments 50 %; very strongly acid; pH(paste)=5.0, ECe= <0.20 MS/cm

APPENDIX C. METEOROLOGY AND HYDROLOGY

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C - 1 METEOROLOGY

In the Chumphon basin, climate is of monsoontype with 2 clearly divided seasons of heavy rainfall wet season and the dry season. The wet season lasts from May to November, during which almost 80 percent of the annual precipitation (1,940mm) takes place in A. Muang. The monthly rainfall in the wet season is 220mm on an average during these wet months.While 80mm on an average takes place in the other months of a year.

The south-west monsoon in the period from May to October brings highly humid air and rainfall from the India Ocean, and the South-east monsoon brings natural calamities caused by typhoon or heavy atmospheric depression. General information on meteorology in Chumphon (A. Muang) is provided in Table C-1. and fluctuation in major meteorological factors are illustrated in Figure C-1.

C - 2 HYDROLOGY

C - 2 - 1 Rainfall

(1) Annual and Monthly Rainfall

The rainfall data have been collected at 11 gauging stations dotted in and around the Study Area. Rainfall at gauging station representing the Study Area can be verified on the average for a period from 1965 to 1986 and is shown as follows; there is considerable difference found in rainfall by months and locality.

AVERAGE RAINFALL
(1965 - 1986)

Unit : mm

Station	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
P.Chao	128	246	267	287	335	258	266	205	89	57	51	53	2,242
Tha Sae	107	220	175	185	228	172	233	243	112	65	65	41	1,846
Pathiu	70	121	118	117	146	119	189	293	114	59	62	40	1,448
A.Muang	77	187	177	182	215	158	265	373	135	88	66	46	1,969

Furthermore, the annual rainfall ratio at each gauging station with Kaeng Phra Chao as key station can be tabulated as Table C-4. The areal rainfall in the Study Area is about 1,920mm, and the monthly average rainfall from May to November is 232mm, while about 60mm for a period from December to April.

(2) Daily Rainfall

Annual maximum rainfall for 1-5 consecutive days is obtained from the observation records available at the above 11 stations. Probable consecutive rainfall at major gauging stations is shown below.

MAXIMUM CONTINUOUS RAINFALL

Unit : mm

Day	Return Period (Year) 2	5	10	30	50	100	Experienced Max.
Kaeng Phra Chao							
1 day	101	158	203	281	322	380	311 (224)
2 days	150	223	278	368	413	477	438 (339)
3 days	182	264	323	420	467	533	450 (394)
4 days	202	294	362	471	524	600	475 (465)
5 days	226	319	389	503	559	640	512 (512)
Tha Sae							
1 day	107	151	183	237	263	300	278 (248)
2 days	158	213	247	298	320	350	315 (293)
3 days	185	249	290	349	376	411	398 (346)
4 days	203	267	309	372	400	439	409 (359)
5 days	217	287	332	401	432	474	417 (413)
A. Muang							
1 day	112	165	207	280	317	372	423 (264)
2 days	155	219	270	357	401	466	446 (354)
3 days	181	255	310	402	448	513	489 (424)
4 days	201	276	332	426	473	540	509 (424)
5 days	224	305	365	463	511	580	520 (456)

Note : ( ) : Experienced 2nd.

There is little possibility that the rainfall in the Study Area occurs in covering the whole area at the same time with the same magnitude. For references, the maximum rainfall at 5 consecutive days for each year at Kaeng Phra Chao Station and that for the other stations are shown in Table C-14.

Besides Table C-13 covers the comparison of the latest large flooding in 1988 with the flood water in heavy flooding in the 1989.

(3) Hourly Rainfall

Only 3 stations out of 11 provide automatic recording equipment and Rep Ro X46 is only the station with automatic recording system in the catchment basins of the major flooding. The said recorder, however, is such a daily winding type that it is rather difficult to make correct records of heavy flooding.

C - 2 - 2 River Runoff

(1) Annual and Monthly Runoff

The discharge data were collected at 7 stations within the area. Most of observation period at these stations is short except about 22 years, the longest of all at Kaeng Phra Chao. And almost of all gauging work has been made with vertical stuffgauges. In particular only water level gauging has been practiced at X158 on the Tha Phao river which plays an important role in the flood analysis.

River runoff observed at major gauging stations are shown as follows.

ANNUAL RUNOFF

Station	River	D.A (sq.km)	Annual (MCM)	Runoff (mm)	Period	
K. P.Chao	Rap Ro	330	260.9	791	1965 - '86	(22)
X.46	Rap Ro	751	633.9	844	1978 - '90	(13)
X.64	Tha Sae	957	522.3	546	1973 - '90	(14)
X.53	Chumphon	223	269.5	1,209	1978 - '90	(10)

MONTHLY RUNOFF

Unit : MCM

Station	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
K. P.Chao	3.3	9.0	19.0	30.3	52.4	37.4	37.2	35.2	19.2	9.2	5.2	3.5	260.9
X46	6.6	27.9	54.5	63.7	127.8	90.0	93.9	104.8	31.8	15.6	9.4	7.9	633.9
X64	7.5	23.6	33.7	53.2	74.3	53.5	80.1	123.7	32.0	20.6	11.5	8.6	522.3
X53	2.9	9.5	26.3	25.1	57.4	39.3	38.3	47.3	12.9	4.8	3.0	2.7	269.5

(2) Rainfall-Runoff Relations

The annual runoff ratio of the observed discharge was estimated based on the limited period where the rainfall obtained by area rainfall computed by Thiessen method can coincide the discharge, and as a result the annual runoff ratio is obtained as 35-40 percent at the Rap Ro river, 30 percent at the Tha Sae river, and 60 percent at the Chumphon river, respectively.

ANNUAL RUNOFF COEFFICIENT

Gauging Station	Drainage Area (sq.km)	Average Annual Rainfall (mm)	Average Annual Runoff (mm)	Runoff Coeffic. (%)	Period of Water Year	
K. Phra Chao	330	2,241.5	790.7	35.3	1965 - '86	(22)
Som Paen	188	1,649.3	715.5	43.4	1983 - '86	(4)
Rap Ro X46	751	1,908.1	755.1	39.6	1979 - '86	(8)
Tha Sae X64	957	1,632.8	515.1	31.5	1979 - '80 '82, '84 - '86	(6)
Ta Ngo	352	1,688.7	501.6	29.7	1963 - '64 '66	(3)
Chumphon X53	223	1,873.9	1,144.5	61.1	1979 - '83'85,'87- '88'90	(9)

The annual runoff ratio at each station is shown in Table C-7 and the monthly runoff ratio, etc. at the Kaeng Phra Chao station are illustrated in Figure C-8.

(3) Flood Discharge

As clearly shown in Table C-8 that the annual maximum momentary peak discharge at gauging station is abstracted, the flood peak discharge at each station as well as rainfall can seldom coincide the amount of flood discharge and days and time of flood occurrence.

At immediately downstream of confluence of the Rap Ro and Tha Sae rivers, the annual maximum momentary peak discharge at X158(Tha Taphao river) where the observation data are unavailable was estimated by the method of the momentary peak discharge at the same time (one day delay allowable) or mean daily discharge at X46 and X64 and with the catchment area ratio. (Table C-9) The probable flood discharges observed at the respective stations (Table C-10) and the maximum flood discharges in the past are found equivalent to 1/20 to 1/50 in probability.

PROBABILITY OF FLOOD DISCHARGE

Return Period	Kaeng Phra Chao 330 sq.km		X 46 751sq.km		X 64 957sq.km		X158 1,918sq.km		X53 223sq.km	
	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$
5	219	0.664	589	0.785	456	0.477	1,029	0.566	290	1.302
10	270	0.818	697	0.928	549	0.573	1,182	0.650	345	1.546
20	322	0.977	794	1.057	640	0.668	1,318	0.725	398	1.783
30	354	1.073	848	1.129	693	0.724	1,393	0.766	429	1.922
50	396	1.199	914	1.217	761	0.795	1,483	0.815	468	2.097
Experienced Max.	496	1.503	727	0.968	699	0.730	1,320	0.726	438	1.963
2nd.	266	0.806	649	0.865	554	0.579	1,200	0.660	297	1.311

C-2-3 Flood Discharge Analysis

(1) Estimation Method of Design Flood

Runoff-function method by Dr. Seiichi Satho was applied for the estimation of probable flood. In the method, the direct flood discharge caused by rainfall of r (mm/hr) during a unit time ($t_0$hr), can be expressed by the following equations.

$$Q = 0.2778 \cdot A \cdot f \cdot r \cdot [e^{-at'}(at'+1) - e^{-at}(at+1)]$$
$$= 0.2778 \cdot A \cdot f \cdot r \cdot D$$
$$t' = t - t_0$$

Where;

A : catchment area (sq.km)

f : runoff coefficient

r : rainfall in unit time (t_0) for calculation

a : flood modulus definite by the following equation

$a = 2.30 \log [t_p / (t_p - 1)]$

t_p : flood concentration time(hr) obtained by Luziha formula

$t_p = L / (3{,}600V)$

$V = 20 (H/L)^{0.6}$

L : river length from the origin (m)

V : average velocity of river flow (m/sec)

H : height difference in the section of L (m)

D : distribution rate of discharge

t_0 : unit time for calculation (=3.0hr)

And the runoff caused by a long-term rainfall can be produced by synthesizing direct runoff in unit time expressed in the above equations.

The runoff coefficient was determined as follows when estimating the flood hydrograph, in considering the initial loss and the various conditions of the catchment area.

Proposed Reservoir Basin	80 %
Other Basin	75 %

Flood concentration time (tp), flood modulus (a) and other dimensions at the reference points are shown as follow.

Reference Point / Dimension		Rop Ro River		Tha Sae River	
		Dam	Basin	Dam	Basin
D. A	(km^2)	609	803	338	1,016
River Length	(km)	55	85	55	120
Elevation EM	(m)	400	400	640	650
EL	(m)	40	3	55	3
Velocity	(m/s)	1.0	0.8	1.3	0.9
F. Conc. tp	(hr)	15.6	29.5	11.7	38.3
F. Modu, a	(hr^{-1})	0.071	0.036	0.099	0.027

Distribution rate of discharge (D) and unit discharge (q) in case of to = 3.0 hr, r = 10 mm and f = 1.0 are shown in Table C-17, and those hydrographs are presented in Figure C-9

(2) Design Rainfall

As a result of rainfall analysis for the Study Area, it is clearly revealed that there is little possibility of rainfall to take place with the same probability and intensity in one certain day in the Area.

As the design rainfall for the Area, the 5 consecutive days rainfall to have caused a number of floods is employed. Distribution of the design rainfall in the Area was determined with the Kaeng Phra Chao as the key in considering the fact that there is much rainfall taking place in the said river basin to give a decisive effect to the downstream floodings.

Table C-14 shows the 5 consecutive days rainfall at each station for the same period that the Kaeng Phra Chao station recorded the annual maximum 5 consecutive days rainfall in 8 years from 1979 to 1986 when the necessary data / information area available. And the average comparative ratio between the Kaeng Phara Chao and the other station is as floows.

DISTRIBUTION OF DESIGN RAINFALL RATIO

K.P.Chao	x.46A	Tha Sae	Ta Ngo	Pathiu	GT.6	A. Muang	Sawi	Kra Buri
1.00	0.93	0.69	0.63	0.50	0.58	0.63	0.59	0.98

As the base for the design rainfall, the probability of the 1 to 5 consecutive days rainfall at the Kaeng Phra Chao Station is shown in Table C-11.

The daily arrangement of the design rainfall shall be of experienced pattern that was observed at x.64A with actual rainfall in flood to have taken place in November, 1988, and the daily arrangement shall have the pattern with the third day at the largest as shown below.

ACTUAL MAXIMUM RAINFALL AT RAP RO (X.64A) IN 1988

Nov.21	10.3	mm/day =	4 Days (216.9) - 3 days (206.6)
Nov.22	23.1	mm/day =	2 Days (193.5) - 1 day (170.4)
Nov.23	170.4	mm/day =	1 Day (170.4)
Nov.24	13.1	mm/day =	3 Days (206.6) - 2 Days (193.5)
Nov.25	8.3	mm/day =	5 Days (225.6) - 4 Days (216.9)
Total	225.2	mm/day	

The design daily rainfall based on each return period is shown in Table C-12.

On the other hand, the arrangement of the design hourly rainfall was interpreted from the records only available at X46A in the rainfall (21~25. Nov. 1988 : $\Sigma r = 225.2$mm) to show in Table C-16, and in the same table, the probable 3 hours rainfall is shown.

DAILY ARRANGEMENT OF DESIGN RAINFALL
(Kaeng Phra Chao)

Unit : mm

Return Period (Year)	1st Day	2nd Day	3rd Day	4th Day	5th Day	Total
5	30.7	64.9	158.3	40.4	25.1	319.4
10	38.8	74.4	203.4	45.0	27.0	388.6
20	46.7	82.5	251.7	49.1	29.9	459.9
30	51.6	86.7	281.7	51.2	32.0	503.2
50	57.7	91.4	321.6	53.7	35.0	559.4

(3) Design Flood

a) Tha Taphao River

The flood hydrographs at the proposed damsite and reference points with the respective probabilities were obtained by design rainfall and unit hydrograph previously available. The said design rainfall means the areal rainfall at respective reference points.

The areal rainfall cited here in is obtained by the Thiessen method, and each spot rainfall in this case can be obtained by multiplying the "Distribution Ratio of Design Rainfall " available at Phra Chao as Key Station with design rainfall at Phra Chao.

The following 5 examples show the design areal rainfall ; in this case, the rainfall coefficient (Table C-15) in considering the above ratio at respective reference points and the Thiessen area ratio together with 1/30 probability are employed.

DESIGN AREAL RAINFALL (P = 1/30)

Unit : mm

Location	Upper Rap Ro Reservoir 106 sq.km	Rap Ro Reservoir 609 sq.km	Rap Ro Basin 803 sq.km	Tha Sae Reservoir 338 sq.km	Tha Sae Basin 1,016 sq.km
Rain Ratio	1.00	0.98	0.96	0.70	0.68
1st Day	51.6	50.6	49.5	36.1	35.1
2nd Day	86.7	85.0	83.2	60.7	59.0
3rd Day	281.7	276.0	270.5	197.2	191.5
4th Day	51.2	50.1	49.2	35.8	34.8
5th Day	32.0	31.4	30.7	22.4	21.8
Total	503.2	493.1	483.1	352.2	342.2

The major probable flood discharge for the basins of the Rap Ro and the Tha Sae rivers was estimated as follows. For further reference, the flood discharge at x.158 of the Tha Taphao river, the most important point, can be prudently computed as the total of the flood discharges of the above 2 rivers.

The probability evaluation of observed momentary peak discharge is presented in Table C-10.

PROBABLE PEAK FLOOD DISCHARGE
(without project)

Unit : cu.m/sec

Return Period	Station		
	Rap Ro Basin	Tha Sae Basin	Tha Taphao x.158
(Year)	803 sq.km	1,016 sq.km	1,819 sq.km
2	370 (0.461) ⟨0.548⟩	270 (0.266) ⟨0.336⟩	640 (0.352) ⟨0.422⟩
5	540 (0.672) ⟨0.785⟩	390 (0.384) ⟨0.477⟩	930 (0.511) ⟨0.566⟩
10	670 (0.834) ⟨0.928⟩	480 (0.472) ⟨0.573⟩	1,150 (0.632) ⟨0.650⟩
20	800 (0.996) ⟨1.057⟩	570 (0.561) ⟨0.668⟩	1,370 (0.753) ⟨0.725⟩
30	880 (1.096) ⟨1.129⟩	630 (0.620) ⟨0.724⟩	1,510 (0.830) ⟨0.766⟩
50	980 (1.220) ⟨1.217⟩	700 (0.689) ⟨0.795⟩	1,680 (0.923) ⟨0.815⟩

Note ( ) : cu.m/sec - sq.km
⟨ ⟩ : 〃 ,Observed Momentary Discharge

The Design flood hydrograph at main reference points are shown in Table C-18.

b) Chumphon River

Design flood of Chumphon river was employed with 1/10 year probable flood for consecutive 5 days, since the flooded areas in this basin were mostly comprised of farm land.

The flood discharge of 343 m^3/sec at X53 point was resulted from the flood hydrograph analyzed basing on the design rainfall and unit hydrograph as well as the case of Tha Taphao river.

While, the flood discharge based on observed records at X53 point was obtained to 345 m^3/sec which was quite similar with the figure described above, therefore the design flood discharge of Chumphon river was employed with 345 m^3/sec.

c) Nong Sai River

Design flood of Nong Sai river which is one of tributary of Tha Taphao river, connecting at near the river mouth was preliminarily estimated with 1/10 year probability applying the Rational Formula due to its small watershed of 10 km^2.

$$Q = \frac{1}{3.6} \cdot f \cdot r \cdot A = 51.3 \text{ m}^3/\text{sec}$$

Where,

Q : Flood discharge (cu.m/sec)

f : Run-off coefficient 0.75

A : Watershed 10 km^2

r : Rainfall intensity for duration of time of concentration

$$r = \frac{R_{24}}{24}\left(\frac{24}{T}\right) = \frac{207.1}{24}\left(\frac{24}{5.0}\right)^{0.67} = 24.6 \text{ mm/hr}$$

R_{24} : Daily rainfall 207.1 mm/day
(1/10 year probable rainfall at Muang chumphon)

T : Time of concentration
T = L/V 9.0/1.8 = 5 hr
L ; River length 9.0 km
V ; Flow velocity 1.8 km/hr

C-2-4 Water Quality

In the course of field survey, the water quality investigation of surface water at gauging station of river flow and other points was carrid out. The observed figures are as follow. As a result, there are no problems for irrigation use in terms of pH, conductivity and D.O, except Phanang Tuk river.

WATER QUALITY OF SURFACE WATER

Location	pH	Cond. (ms/cm)	Turb. (NTU)	DO (PPM)	Sal. (%)	Temp. (°C)
Nov. 13~15' 1991						
G.S X.158	7.0	0.09	10	6.4	0	27.6
X.64	7.0	0.12	10	6.6	0	26.7
X.46	7.1	0.07	10	6.8	0	25.9
Paddy Field	6.2	0.16	80	7.5	0	32.5
Nong Yai Swamp	7.1	0.06	40	6.8	0	29.1
Sam Kaeo Canal (Upper)	7.1	0.18	10	5.4	0	27.4
Jun. 8~10' 1992						
G. S X.158	7.5	0.15	30	6.6	0	28.2
Nong Yai Swamp	7.0	0.26	39	4.6	0.01	28.3
Phanang Tuk River (Middle)	7.5	40.0	25	3.8	2.57	27.8
〃 (Upper)	6.9	40.0	20	3.3	2.56	29.0
Tha Taphao River (Sam Kaeo)	7.8	0.12	35	5.9	0	28.9
〃 (Chumphon G.S)	7.5	0.11	30	11.3	0	28.4
Standard Value For Paddy	6.0 ~ 7.5	Less than 0.3		Greater than 5.0		

Note Turb. : Turbidity (NTU)
Cond. : Electric Conductivity (ms/cm)
DO : Dissolved Oxygen (mg/ℓ or ppm)

TABLE C - 1 CLIMATOLOGICAL DATA FOR THE PERIOD 1961 - 1990

Station	CHUMPHON	Elevation of station avobe MSL	3 meters
Index station	48517	Height of barometer above MSL	5 meters
Latitudes	10° 29'N	Height of thermometer above ground	1.20 meters
Longitude	99° 11'E	Height of wind vane above ground	12.10 meters
		Height of raingauge	1.00 meters

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Pressure (Hectopascal)													
Mean	1012.43	1011.68	1010.84	1009.40	1008.24	1008.32	1008.50	1008.63	1009.23	1010.25	1011.25	1012.31	1010.09
Ext. Max.	1019.79	1018.61	1018.11	1017.09	1014.42	1015.12	1014.26	1014.69	1015.39	1016.68	1017.73	1019.44	1019.79
Ext. Min.	1005.32	1003.46	1003.64	1002.64	1002.23	1002.11	1001.44	1002.72	1001.85	1003.52	1003.43	1005.12	1001.44
Mean daily range	3.60	3.75	3.96	4.03	3.72	3.33	3.24	3.42	3.92	4.08	3.80	3.63	3.71
Temperature (Celsius)													
Mean	25.1	26.3	27.4	28.5	27.9	27.3	27.0	26.9	26.9	26.6	25.8	25.0	26.7
Mean Max.	30.0	31.3	32.6	33.8	32.9	31.7	31.4	31.0	31.3	30.9	29.8	29.5	31.4
Mean Min.	20.4	21.5	22.3	23.6	24.0	24.0	23.7	23.8	23.7	23.4	22.6	20.9	22.8
Ext. Max.	33.8	36.2	37.7	38.3	38.2	36.1	35.4	35.5	34.8	35.2	37.7	33.0	38.3
Ext. Min.	12.1	15.9	17.0	19.4	20.9	21.5	19.9	20.8	21.2	19.1	16.2	12.2	12.1
Relative Humidity (%)													
Mean	81	80	78	78	81	82	82	83	83	85	85	81	82
Mean Max.	95	95	95	95	95	95	95	95	95	96	96	94	95
Mean Min.	64	62	59	59	64	67	66	68	67	70	71	66	65
Ext. Min.	34	28	19	31	39	43	42	46	49	49	42	40	19
Dew Point (Celsius)													
Mean	21.4	22.3	22.9	23.9	24.1	23.8	23.5	23.6	23.6	23.8	22.9	21.4	23.1
Evaporation (mm.)													
Mean-pan	113.9	117.6	151.8	148.9	129.8	109.6	111.5	106.0	107.6	103.3	96.1	102.9	1399.0
Cloudiness (0-10)													
Mean	5.2	4.9	4.8	5.8	7.7	8.3	8.3	8.6	8.2	7.6	7.1	5.8	6.9
Sunshine Duration (hr.)													
						No	Observation						
Visibility (km.)													
0770 L.S.T.	5.8	5.8	5.6	6.9	9.2	9.7	9.8	9.7	10.0	8.6	7.5	7.2	8.0
Mean	10.4	10.5	10.1	10.7	11.5	11.4	11.5	11.2	11.7	11.3	10.6	10.7	11.0
Wind (knots)													
Mean wind speed	4.5	4.3	4.1	3.7	3.4	3.9	3.8	3.8	3.6	2.5	3.7	4.6	-
Prevailing wind	E	E	E	E	W	W	W	W	W	E	NE	E	-
Max. wind speed	42	40	42	40	45	44	40	42	42	47	60	42	60
Rainfall (mm.)													
Mean	93.9	62.8	56.5	74.4	188.9	173.5	174.2	206.0	157.7	275.5	375.1	118.1	1956.6
Mean rainy days	7.3	5.9	5.5	7.6	18.1	20.5	20.6	22.8	19.2	19.6	15.9	9.0	172.0
Greatest in 24hr.	423.4	138.3	102.0	67.8	73.5	82.1	90.7	108.5	116.2	144.9	264.1	208.8	423.4
Number of Days with													
Haze	8.2	6.7	12.3	9.3	0.8	0.0	0.1	0.1	0.0	0.7	2.3	6.8	47.3
Fog	5.4	4.7	4.4	2.1	0.5	0.1	0.2	0.3	0.5	3.2	3.0	2.9	27.3
Hail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thunderstorm	1.3	1.5	5.3	13.1	19.4	10.3	9.5	7.8	10.9	15.8	11.2	3.3	109.4
Squall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data Processing Sub-division
Climatology Division
Meteorological Department
November 26, 1991

TABLE C-2 SUMMARY OF AVAILABLE RAINFALL DATA

Code	Station	Location				EL. (M.S.L) m	Period of Record		Remarks
		Amphoe	Province	Latitude N	Longtitude E		From	To	
	Kaeng Phra Chao	Tha Sae	Chumphon	10°47.3'	99°04.1'	100	Feb.'64	Dec.'87	NEA Non Recording
	Ban Ta Ngo	〃	〃	10°52.5'	99°14.3'	60	Jan.'62	Present	〃 〃
10013	A. Muang	Muang	〃	10°29'30"	99°11'04"		Apr.'52	〃	MD
10022	A. Pa Thiu	Pa Thiu	〃	10°42'26"	99°19'15"		〃	〃	MD Non Recording
10032	A. Tha Sae	Tha Sae	〃	10°39'44"	99°10'30"		Apr.'53	〃	〃 〃
10082	Agrometeorological Sta.	Sawi	〃	10°20'	99°06'		Aug.'67	〃	〃 〃
10090	Sam Kaeo Regulator	Sam Kaeo	〃	10°31'00"	99°11'30"		Aug.'52	〃	RID Non Recording
10111	Ban Rap Ro X.46A	Tha Sae	〃	10°37'18"	99°03'39"		Apr.'78	〃	RID
45022	A. Bang Saphan	Saphan	Khiri Khan	11°12'46"	99°30'50"		Feb.'52	〃	MD Non Recording
45171	Yang Khwang GT.6	Ron Thong	〃	11°10'31"	99°21'27"		Apr.'78	〃	RID
46022	A. Kra Buri	Kra Buri	Ranong	10°24'01"	98°46'34"		Apr.'52	〃	MD Non Recording

TABLE C-3 ANNUAL RAINFALL

Unit : mm

Water Year	1 K.Phra Chao	2 Rap Ro x.46A	3 Tha Sae	4 Ta Ngo	5 Pathiu	6 Gt.6	7 A. Muang	8 Sam Kaeo	9 Saphan	10 Sawi	11 Kra Buri	Remarks
1952	-	-	-	-	1,948.0	-	1,962.1	-	-	-	2,217.3	
53	-	-	1,529.4	-	503.8	-	1,675.2	1,595.5	522.0	-	1,591.4	
54	-	-	-	-	972.8	-	1,891.6	1,662.8	851.8	-	947.8	
55	-	-	-	-	1,484.8	-	2,255.1	1,704.0	-	-	2,555.8	
56	-	-	1,520.3	-	1,377.4	-	2,046.0	1,750.2	1,401.6	-	2,870.2	
57	-	-	1,134.7	-	959.8	-	1,307.5	1,240.3	1,047.9	-	3,516.7	
58	-	-	1,809.6	-	1,685.8	-	1,537.1	1,527.8	979.5	-	3,714.2	
59	-	-	1,877.2	-	2,422.8	-	2,204.7	2,032.7	1,518.5	-	2,849.1	
60	-	-	2,660.3	-	1,812.0	-	1,962.3	1,988.5	1,719.3	-	4,207.9	
61	-	-	2,811.3	-	2,354.0	-	2,835.8	2,765.3	1,555.2	-	5,361.6	
62	-	-	2,467.6	-	2,179.6	-	2,064.7	1,837.3	1,204.4	-	3,524.8	
63	-	-	1,987.3	1,545.0	1,548.4	-	2,035.5	1,852.9	1,605.0	-	2,736.9	
64	-	-	1,765.2	1,464.1	1,605.3	-	1,766.1	1,626.0	1,584.5	-	2,714.3	
65	2,101.5	-	2,431.8	-	1,936.0	-	1,977.1	2,212.0	1,700.1	-	4,836.9	
66	2,271.1	-	2,455.6	2,057.1	1,956.5	-	2,311.1	2,016.2	1,922.8	-	3,568.0	
67	2,118.1	-	1,844.3	-	1,535.2	-	1,783.6	1,765.0	924.8	-	3,016.5	
68	2,233.7	-	2,104.2	1,159.3	2,047.4	-	2,116.4	2,379.4	1,268.8	1,922.3	2,517.2	
69	2,169.6	-	1,959.6	1,407.5	1,742.8	-	1,875.2	2,342.9	-	1,725.5	2,767.9	
70	2,650.3		2,373.9	1,110.5	2,330.6	-	2,498.1	2,979.8	-	2,359.5	3,081.3	
71	2,004.9	-	1,616.8	1,045.7	1,569.4	-	1,674.5	-	1,138.6	1,518.6	2,948.8	
72	2,545.2	-	2,145.6	1,873.7	2,238.0	-	2,174.8	2,681.2	618.0	2,218.8	2,427.7	
73	2,479.4	-	1,975.0	1,868.8	1,966.7	-	2,061.3	2,353.4	902.4	2,186.8	2,448.4	
74	2,444.2	-	1,914.8	1,899.0	1,402.2	-	2,302.7	-	434.9	2,385.8	2,762.0	
75	2,786.1	-	1,775.3	1,784.5	1,070.1	-	1,950.0	2,084.4	953.2	1,969.9	2,318.6	
76	2,540.4	-	1,799.0	1,794.6	1,153.8	-	1,958.1	2,132.9	442.1	2,172.7	-	
77	2,313.4	-	1,648.7	1,484.8	896.1	-	2,226.0	2,631.3	1,521.2	1,948.2	906.0	
78	2,391.8	-	1,784.3	1,744.2	1,053.0	-	1,798.4	2,533.9	1,186.3	1,690.0	1,915.2	
79	2,976.2	1,888.6	2,233.3	1,388.5	1,026.8	1,331.4	1,637.3	2,111.7	1,077.4	1,786.4	1,816.8	
80	2,310.6	1,785.3	1,879.2	1,412.5	1,163.0	1,324.3	1,812.7	2,310.6	970.4	1,799.1	2,290.9	
81	2,105.5	1,735.5	2,110.8	1,605.3	1,155.5	1,970.6	2,046.3	2,516.9	1,955.3	1,862.7	2,351.6	
82	2,282.0	1,620.5	1,675.6	1,952.2	1,360.1	1,437.8	2,437.1	2,961.3	1,543.5	1,941.1	1,930.8	
83	1,111.4	1,535.0	1,360.6	1,084.3	627.6	1,643.4	1,472.3	2,130.5	1,6127.	1,420.3	2,196.9	
84	1,736.0	1,659.2	836.0	1,552.3	1,119.1	1,627.0	1,730.4	2,268.5	1,026.4	1,567.7	2,536.7	
85	1,708.0	1,468.1	1,640.2	1,394.2	1,237.8	1,445.7	1,709.6	2,147.1	1,489.2	1,738.3	2,134.3	
86	2,034.6	1,941.7	1,038.6	1,697.6	1,273.5	1,777.8	1,772.8	2,179.5	1,762.3	1,768.6	2,141.3	
87	-	1,401.6	1,028.1	1,162.4	1,229.2	1,437.6	1,349.9	1,654.3	1,356.1	1,407.0	1,796.7	
88	-	1,926.2	1,412.5	1,919.6	1,657.3	1,711.1	2,019.0	2,677.9	1,473.5	1,973.6	1,791.2	
89	-	1,922.5	1,460.9	-	1,171.7	1,502.5	1,828.6	2,401.8	1,408.3	1,841.2	-	
90	-	1,710.6	-	-	1,005.0	1,329.5	1,627.1	-	-	1,627.2	3,300.3	
Mean	2,241.5	1,716.2	1,830.5	1,558.7	1,481.5	1,544.9	1,940.9	2,144.5	1,256.6	1,861.4	2,665.1	
1965~86	2,241.5	-	1,845.6	-	1,448.2	-	1,969.4	-	-	-	-	22 years
Year	(22)	(8)	(22)	(20)	(22)	(8)	(22)	(20)	(20)	(19)	(21)	
A	2,241.5	2,033.0	2,241.5	2,254.7	2,214.5	2,033.0	2,241.5	2,243.2	2,224.7	2,253.9	2,227.3	K. P. Chao
B	2,241.5	1,704.2	1,845.6	1,565.8	1,448.2	1,569.8	1,969.4	2,336.9	1,222.5	1,892.8	2,519.7	Each Station
B/A	1.000	0.838	0.823	0.694	0.646	0.772	0.879	1.042	0.550	0.840	1.131	

TABLE C-4 AREAL RIANFALL IN THE STUDY AREA

Unit: mm

Station	1979 - 1986 (8 Years)										1965 - 86 (22)	
	K.Phra Chao	Rap Ro X .46A	Tha Sae	Ta Ngo	Pathiu	GT.6	A.Muang	Sawi	Kra Buri	Total (Mean)	Areal Rainfall	
Thiessen Area (sq.km)	628	474	266	403	60	242	375	95	82	2,625	× 100 (%)	Rainfall
Apr.	142	75	131	109	76	84	72	80	77	103	0.059	113
May	253	181	240	192	104	181	200	200	232	209	0.119	229
Jun.	291	261	191	191	121	216	204	211	392	237	0.136	262
Jul.	278	220	177	158	110	148	192	148	324	207	0.118	227
Aug.	325	315	247	191	136	185	231	222	529	267	0.153	294
Sep.	242	179	127	169	104	180	166	173	321	188	0.107	206
Oct.	174	176	190	166	100	224	215	198	173	184	0.105	202
Nov.	133	188	177	133	231	175	332	300	77	186	0.106	204
Dec.	48	46	56	59	51	42	104	107	9	59	0.034	65
Jan.	29	19	7	30	27	24	30	35	4	24	0.014	27
Feb.	48	19	25	46	30	52	35	19	12	36	0.021	40
Mar.	70	25	29	67	30	59	46	40	25	49	0.028	54
Total	2,033	1,704	1,597	1,511	1,120	1,570	1,827	1,733	2,175	1,749	1.000	1,923
1979 - 86	1.000	0.838	0.786	0.743	0.551	0.772	0.899	0.852	1.070	0.860	-	-
1965 - 86	2,242	1,879	1,845	1,556	1,448	1,731	1,971	1,883	2,536	1,923	-	-
	1.000	0.838	0.823	0.694	0.646	0.772	0.879	0.840	1.131	0.858	-	-

TABLE C-5 SUMMARY OF AVAILABLE STREAMFLOW DATA

River	Station & Code	Location			EL. (A. D) m	Type of Gauge (D. A) sq.km	Period of record			Remarks
		Amphoe	Province	Lat. N Long. E			Water Level	Rating Operation	Discharge Data	
Rap Ro	Kaeng Phra Chao	Tha Sae	Chumphon	10°43.7' 99°04.1'	94	V 330			Jan. '64 Dec. '87	NEA 13 Times Daily
"	Khlong Mala Hat Som Paen	"	"	10°41.2' 99°03.4'		V 188			Jan.'82 Present	NEA 3 Times daily
"	X.46A Ban Hat Taeng	"	"	10°37'18" 99°03'39"		V 617	1977 Present	'77 '85	Apr.'78 Mar.'84	RID
"	X.46 Ban Tha Kham	"	"	10°36'47" 99°07'07"		F 751	1971 Present	'85 Present	'81, '86 Present	RID
Tha Sae	Ban Ta Ngo	"	"	10°52'5' 99°14'3'	50	V 352	1962 Present	Jan.'63 Dec.'68	Jan.'63 Dec.'68	NEA 5 Times Daily
"	X.64 Tambon Tha Sae	"	"	10°39'49" 99°10'17"		V/B 957	1973 Present	'74 - '75 '82 - Pre.	Apr.'73 Present	RID B : '82
Tha Taphao	X.158 Ban Wang Khrok	"	"	10°35'34" 99°08'42"		V 1819	1984 Present	'90 Present		RID
Chumphon	X.53 Ban Siap Yuan	Muang	"	10°29'57" 99°04'15"		F 223	1971 Present	'78 Present	Apr.'78 Present	RID

Notes: Type of Gauge V: Vertical Staff Gauge
F: Recorder Float Gauge
B: Recorder Bubble Gauge

TABLE C-6 ANNUAL RUNOFF

Unit : mm

Water Year	1 K.Phra Chao 330 km²	2 Som Paen 188 km²	3 Hat Taeng X.46A 617 km²	4 Tha Kham X.46 751 km²	5 Tha Sae X.64 957 km²	6 Siap Yuan X.53 223 km²	7 Ta Ngo 352 km²				
1952											
53	-	-	-	-	-	-	-				
54	-	-	-	-	-	-	-				
55	-	-	-	-	-	-	-				
56	-	-	-	-	-	-	-				
57	-	-	-	-	-	-	-				
58	-	-	-	-	-	-	-				
59	-	-	-	-	-	-	-				
60	-	-	-	-	-	-	-				
61	-	-	-	-	-	-	-				
62	-	-	-	-	-	-	-				
63	-	-	-	-	-	-	442.6				
64	-	-	-	-	-	-	492.6				
65	806.9	-	-	-	-	-	500.3				
66	804.0	-	-	-	-	-	569.5				
67	856.9	-	-	-	-	-	503.8				
68	607.4	-	-	-	-	-	-				
69	705.3	-	-	-	-	-	-				
70	1,073.5	-	-	-	-	-	-				
71	747.5	-	-	-	-	-	-				
72	908.4	-	-	-	-	-	-				
73	977.8	-	-	-	768.4	-	-				
74	697.3	-	-	-	607.3	-	-				
75	1,208.2	-	-	-	901.8	-	-				
76	770.0	-	-	-	627.5	-	-				
77	704.4	-	-	-	383.7	-	-				
78	966.4	-	1,200.2	(1,200.2)	-	1,785.7	-				
79	889.9	-	1,055.7	(1,055.7)	590.2	1,168.2	-				
80	606.4	-	713.9	(713.9)	316.2	1,337.1	-				
81	779.0	-	-	878.3	-	1,426.9	-				
82	594.8	-	624.6	(624.6)	503.3	1,221.9	-				
83	408.3	405.7	414.4	(414.4)	-	748.6	-				
84	687.1	782.2	742.7	(742.7)	578.1	-	-				
85	579.6	668.9	-	590.8	432.3	1,122.5	-				
86	1,015.7	1,004.8	-	1,020.0	670.4	-	-				
87	-	436.4	-	419.1	312.8	514.6	-				
88	-	-	-	864.4	562.0	1,607.5	-				
89	-	-	-	1,296.2	-	-	-				
90	-	-		1,152.8	387.6	1,153.6	-				
Mean	790.7	659.6	791.9	844.1	545.8	1,208.7	501.8				

TABLE C-7 ANNUAL RUNOFF COEFFICIENT

Water Year	Kaeng Phra Chao (D.A = 330 sq.km)			Som Paen (D.A = 188 sq.km)			Tha Kham X.46 (D.A = 751 sq.km)			Tha Sae X.64 (D.A = 957 sq.km)			Tha Ngo (D.A = 352 sq.km)			Siap Yuan X. 53 (D.A = 223 sq.km)		
	Rain-fall	Run off	Run off Coeffic	Rain-fall	Run off	Run off Coeffic	Rain-fall	Run off	Run off Coeffic	Rain-fall	Run off	Run off Coeffic	Rain-fall	Run off	Run off Coeffic	Rain-fall	Run off	Run off Coeffic
	(mm)	(mm)	(%)	(mm)	(mm)	(%)	(mm)	(mm)	(%)	(mm)	(mm)	(%)	(mm)	(mm)	(%)	(mm)	(mm)	(%)
1963													1545.0	442.6	28.6			
64													1464.1	492.6	33.6			
65	2101.5	806.9	38.4										-	500.3	-			
66	2271.1	804.0	35.4										2057.1	569.5	27.7			
67	2118.1	856.9	40.5										-	503.8	-			
68	2233.7	607.4	27.2															
69	2169.6	705.3	32.5															
1970	2650.3	1073.5	40.5															
71	2004.9	747.5	37.3															
72	2545.2	908.4	35.7															
73	2479.4	977.8	39.4							-	768.4	-						
74	2444.2	697.3	28.5							-	607.3	-						
75	2786.1	1208.2	43.4							-	901.8	-						
76	2540.4	770.0	30.3							-	627.5	-						
77	2313.4	704.4	30.4							-	383.7	-						
78	2391.8	966.4	40.4				-	1200.2	-	-	-	-				-	1785.7	-
79	2976.2	889.9	29.9				2562.9	1055.7	41.2	1739.7	590.2	33.9				1846.0	1168.2	63.3
1980	2310.6	606.4	26.2				2111.0	713.9	33.8	1593.1	316.2	19.8				1976.5	1337.1	67.6
81	2105.5	779.0	37.0				1964.9	878.3	44.7	-	-	-				1988.7	1426.9	71.8
82	2282.0	594.8	26.1				2030.6	624.6	30.8	1814.2	503.3	27.7				1786.5	1221.9	68.4
83	1111.4	408.3	36.7	1331.7	405.7	30.5	1272.4	414.4	32.6	-	-	-				1769.3	748.6	42.3
84	1736.0	681.7	39.3	1696.1	782.2	46.1	1706.8	742.7	43.5	1492.1	578.1	38.7				-	-	-
85	1708.0	579.6	33.9	1583.2	668.9	42.2	1616.8	590.8	36.5	1483.7	432.3	29.1				1761.3	1122.5	63.7
86	2034.6	1015.7	49.9	1986.3	1004.8	50.6	1999.3	1020.0	51.0	1673.8	670.4	40.1				-	-	-
87				-	436.4	-	-	419.1	-	-	312.8	-				1552.5	514.6	33.1
88							-	864.4	-	-	562.0	-				1882.0	1607.5	85.4
89							-	1296.2	-	-	-	-				-	-	-
1990							-	1152.8	-	-	387.6	-				2302.2	1153.6	50.1
Mean	2241.5	790.7	35.3	1649.3	715.4	43.4	1908.1	755.1	39.6	1632.8	515.1	31.5	1688.7	501.6	29.7	1873.9	1144.5	61.1

TABLE C - 8 MOMENTARY PEAK DISCHARGE

Unit: cu.m/sec

Water Year	Kaeng Phra Chao 330 km²		Som Paen 188 km²		Tha Kham x.46 751 km²		Tha Sae x.64 957 km²		Siap Yuan x.53 223 km²		Ta Ngo 352 km²	
	Dis-Charge	Day Month	Dis-Charge	Day Month	Dis-Charge	Day Month	Dis-Charge	Day Month	Dis-Charge	Day Month	Dis-Charge	Day Month
1952	1		2		4		5		6		7	
53	-	-	-	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	-	-	-
55	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	-	-	-
62	-	-	-	-	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	288.0	6 Nov.
64	-	-	-	-	-	-	-	-	-	-	287.6	3 Nov.
65	179.0	19 Oct.	-	-	-	-	-	-	-	-	118.0	19 Oct.
66	132.0	31 Oct.	-	-	-	-	-	-	-	-	132.0	1 Nov.
67	169.0	2 Aug.	-	-	-	-	-	-	-	-	214.0	2 Dec.
68	95.2	5 Aug.	-	-	-	-	-	-	-	-	49.1	20 Aug.
69	132.0	5 Nov.	-	-	-	-	-	-	-	-	-	-
70	496.0	30 Nov.	-	-	-	-	-	-	-	-	-	-
71	266.0	3 Nov.	-	-	-	-	-	-	-	-	-	-
72	170.0	5 Dec.	-	-	-	-	-	-	-	-	-	-
73	134.0	9 Jul.	-	-	-	-	278.0	10 Jul.	-	-	-	-
74	211.0	9 Jan.	-	-	-	-	351.0	9 Jan.	-	-	-	-
75	140.4	15 Aug.	-	-	-	-	431.1	5 Nov.	-	-	-	-
76	242.0	28 May	-	-	-	-	554.0	28 May	-	-	-	-
77	201.5	20 Aug.	-	-	-	-	211.0	12 Nov.	-	-	-	-
78	128.0	1 Oct.	-	-	589.1	14 May	400.6	14 May	259.0	22 Aug.	-	-
79	227.0	6 Jul.	-	-	726.8	6 Jul.	388.0	6 Aug.	437.7	9 Aug.	-	-
80	136.0	29 Aug.	-	-	562.1	29Aug.	155.5	2 Dec.	138.1	31 Aug.	-	-
81	94.4	15 Jun.	-	-	232.4	23 Nov.	303.0	16 Jun.	164.9	23 Nov.	-	-
82	124.0	25 Aug.	-	-	436.2	25 Aug.	253.2	26 Aug.	209.0	25 Aug.	-	-
83	74.4	10 Nov.	31.9	8 Nov.	151.2	28 Oct.	234.5	16 Nov.	145.4	15 Nov.	-	-
84	132.0	29 Jun.	160.0	11 Aug.	402.2	29 Jan.	229.2	30 Jun.	276.1	11 Aug.	-	-
85	102.0	13 Nov.	117.0	21 Jun.	239.0	14 Nov.	192.6	14 Nov.	179.1	20 Jun.	-	-
86	233.0	11 Aug.	240.0	11 Aug.	474.0	11 Aug.	401.0	12 Aug.	296.9	11 Aug.	-	-
87	96.4	11 Nov.	31.0	23 Aug.	175.7	12 Nov.	549.0	10 Nov.	107.8	8 Nov.	-	-
88	-	-	151.0	23 Nov.	541.0	24 Nov.	698.8	24 Nov.	263.5	16 Nov.	-	-
89	-	-	-	-	649.4	5 Nov.	-	-	225.0	5 Nov.	-	-
90	-	-	-	-	440.0	10 Nov.	321.5	2 Nov.	235.6	30 Oct.	-	-
Max. m^3/s	496.0	(1970)	240.0	(1986)	726.8	(1979)	698.8	(1988)	437.7	(1979)	288.0	(1963)
m^3/s-km^2	1.503		1.277		0.968		0.730		1.963		0.818	
Mean m^3/s	170.2		121.8		432.2		350.1		226.0		181.5	
m^3/s-km^2	0.516		0.648		0.575		0.366		1.013		0.516	

TABLE C-9 PRESUMPTION OF FLOOD DISCHARGE AT X.158

Unit : cu.m/sec

Water Year	Rap Ro X.46 751 sq.km		Tha Sae X.64 957 sq.km		Tha Taphao X.158 1,819sq.km		Remarks
	Discharge	Day/Month	Discharge	Day/Month	Discharge	Day/Month	
1973	305.0 (1)	9 Jul.	278.0 *	10 Jul.	620.9	10 Jul.	(1) 134.0×751/330
74	480.2 (2)	9 Jan.	351.0 *	9 Jan.	885.2	9 Jan.	(2) 211.0×751/330
75	263.3 (3)	4 Nov.	431.5 *	5 Nov.	740.0	5 Nov.	(3) 89.0×1.3×751/330
76	550.7 (4)	28 May	554.0 *	28 May.	1,176.5	28 May	(4) 242×751/330
77	137.6 (5)	12 Nov.	211.0 *	12 Nov.	371.3	12 Nov.	(5) 46.5×1.3×751/330
78	589.1 *	14 May.	400.6 *	14 May	1,054.0	14 May	
79	726.8 *	6 Jul.	331.3 (6)	7 Jul.	1,126.9	7 Jul.	(6) 301.2×1.1<388.0
80	562.1 *	29 Aug.	106.6 (7)	29 Aug.	712.2	29 Aug.	(7) 72.0×1.3
81	232.4 *	23 Nov.	288.0 (8)	23 Nov.	554.2	23 Nov.	(8) 261.8×1.1<303.0
82	436.2 *	25 Aug.	253.2 *	26 Aug.	734.2	26 Aug.	
83	88.8 (9)	16 Nov.	234.5 *	16 Nov.	344.3	16 Nov.	(9) 56.3×1.3×751/619
84	402.2 *	29 Jun.	229.2 *	30 Jan.	672.4	30 Jan.	
85	239.0 *	14 Nov.	192.6 *	14 Nov.	459.7	14 Nov.	
86	474.0 *	11 Aug.	401.0 *	12 Aug.	931.9	12 Aug.	
87	123.1 (10)	10 Nov.	549.0 *	10 Nov.	715.8	10 Nov.	(10) 94.7×1.3
88	541.0 *	24 Nov.	698.8 *	24 Nov.	1,320.4	24 Nov.	(11) 649.4 × 0.6 × 957/751
89	649.4 *	5 Nov.	496.5 (11)	5 Nov	1,200.0 (12)	5 Nov.	(12) estimated by RID
90	440.0 *	10 Nov.	162.0 (13)	11 Nov.	641.0	11 Nov.	(13) 124.6×1.3
Maximum	726.8		698.8		1,320.4		*: Oberved Momentary Peak Discharge
$m^3/s-km^2$	0.968		0.730		0.726		

X.158 = (X.46 + X.64) × 1,819/1,708

TABLE C-10 PROBABILITY OF MOMENTARY PEAK DISCHARGE

Return Period (Year)	Kaeng Phra Chao D.A = 330 sq.km		Tha Kham X.46 D.A = 751 sq.km		Tha Sae X.64 D.A = 957 sq.km		Tha Taphao X.158 D.A = 1,819 sq.km		Siap Yuan X.53 D.A = 223 sq.km	
	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$	m^3/s	$m^3/s\text{-}km^2$
2	150.6	0.456	412.2	0.548	321.9	0.336	767.5	0.422	210.5	0.944
3	181.6	0.550	498.5	0.664	384.4	0.402	896.1	0.493	247.9	1.117
4	202.8	0.615	551.3	0.734	425.4	0.445	973.6	0.535	272.3	1.221
5	219.1	0.664	589.3	0.785	456.1	0.477	1,028.7	0.566	290.4	1.302
10	269.9	0.818	696.7	0.928	548.6	0.573	1,182.0	0.650	344.7	1.546
15	300.3	0.910	754.5	1.005	601.8	0.629	1,263.2	0.694	375.8	1.685
20	322.4	0.977	794.0	1.057	639.5	0.668	1,318.2	0.725	397.7	1.783
30	354.2	1.073	848.1	1.192	692.9	0.724	1,392.7	0.766	428.5	1.922
50	395.6	1.199	913.9	1.217	760.7	0.795	1,482.6	0.815	467.6	2.097
100	454.7	1.378	1,000.6	1.332	854.5	0.893	1,599.5	0.879	521.3	2.338
200	517.3	1.568	1,084.8	1.444	950.7	0.993	1,711.5	0.941	576.0	2.583
300	555.5	1.683	1,133.2	1.509	1,008.1	1.053	1,775.3	0.976	608.6	2.729
500	605.5	1.835	1,193.5	1.589	1,082.0	1.131	1,854.1	1.019	650.3	2.916
750	647.1	1.961	1,241.2	1.653	1,142.1	1.193	1,916.0	1.053	684.2	3.068
1,000	677.1	2.052	1,274.6	1.697	1,185.1	1.238	1,959.1	1.077	708.3	3.176
Experienced										
Max.	496.0	1.503	726.8	0.968	698.8	0.730	1,32.04	0.726	437.7	1.963
2nd	266.0	0.806	649.4	0.865	554.0	0.579	1,200.0	0.660	296.9	1.331

TABLE C - 11 PROBABILITY OF CONTINUOUS RAINFALL

Unit: mm

Return Period (Year)	Kaeng Phra Chao 1965 - 1987 (23)					Tha Sae 1953, 1955 - 1990 (37)					A. Muang 1952 - 1990 (39)				
	1 Day	2 Days	3 days	4 days	5 days	1 Day	2 Days	3 days	4 days	5 days	1 Day	2 Days	3 days	4 days	5 days
2	100.9	149.8	182.3	201.8	226.1	106.9	157.7	184.8	203.0	217.1	111.5	155.4	181.0	201.1	223.8
3	126.4	183.0	219.4	244.1	268.4	126.9	184.1	215.7	233.3	250.1	135.2	183.8	214.2	234.7	260.7
4	144.3	205.7	244.4	272.6	297.2	140.5	200.5	235.1	252.7	271.2	151.9	203.8	237.1	257.9	285.8
5	158.3	223.2	263.6	294.3	319.4	150.9	212.5	249.2	266.9	286.7	165.0	219.4	254.7	275.8	305.0
10	203.4	277.8	322.8	361.6	388.6	183.3	247.2	290.0	308.8	332.4	207.1	269.7	310.0	332.0	364.8
15	231.2	310.5	358.0	401.4	430.0	202.7	266.2	312.4	332.3	357.9	233.1	300.6	343.3	365.9	400.4
20	251.7	334.2	383.3	430.0	459.9	216.6	279.3	327.9	348.7	375.8	252.2	323.4	367.4	390.5	426.1
30	281.7	368.4	419.6	471.2	503.2	236.8	297.5	349.4	371.7	400.7	280.2	356.8	402.4	426.2	463.2
50	321.6	413.0	466.7	524.4	559.4	262.9	319.9	375.9	400.3	431.9	317.4	401.0	448.2	473.0	511.3
100	379.7	476.6	533.3	599.6	639.7	300.1	349.8	411.3	439.2	474.1	371.7	465.6	513.8	540.0	579.7
200	442.7	544.0	603.2	678.5	724.5	339.4	279.4	446.4	478.2	516.5	430.4	535.6	583.4	611.3	651.7
300	481.8	585.1	645.7	726.4	776.3	363.3	396.6	466.8	501.2	541.5	467.0	579.1	626.1	655.1	695.6
500	533.8	639.1	701.1	788.8	844.1	394.6	418.3	492.5	530.3	573.1	515.6	636.8	682.2	712.6	753.0
750	577.5	683.8	746.9	840.2	900.3	420.5	435.6	513.0	553.8	598.6	556.4	685.3	728.8	760.4	800.5
1,000	609.4	716.2	779.8	877.3	941.0	439.2	447.7	527.5	570.5	616.7	586.2	720.7	762.6	795.1	834.7
Experienced															
Max	310.6	437.8	449.6	475.0	512.1	278.2	314.7	398.3	408.5	417.1	423.4	446.3	488.7	508.9	519.6
2nd	224.0	338.5	394.1	465.1	512.1	247.5	292.5	345.8	359.3	413.2	264.1	353.7	423.8	423.8	455.5

TABLE C-12 DAILY ARRANGEMENT OF CONSECUTIVE DESIGN RAINFALL (KAENG PHRA CHAO)

Unit: mm/day

Return Period	1 st Day	2nd Day	3rd Day	4th Day	5th Day	Total
2	19.5	48.9	100.9	32.5	24.3	226.1
3	24.7	56.6	126.4	36.4	24.3	268.4
4	28.2	61.4	144.3	38.7	24.6	297.2
5	30.7	64.9	158.3	40.4	25.1	319.4
10	38.8	74.4	203.4	45.0	27.0	388.6
15	43.4	79.3	231.2	47.5	28.6	430.0
20	46.7	82.5	251.7	49.1	29.9	459.9
30	51.6	86.7	281.7	51.2	32.0	503.2
50	57.7	91.4	321.6	53.7	35.0	559.4
100	66.3	96.9	379.7	56.7	40.1	639.7
200	75.3	101.3	442.7	59.2	46.0	724.5
300	80.7	103.3	481.8	60.6	49.9	776.3
500	87.7	105.3	533.8	62.0	55.3	844.1
750	93.3	106.3	577.5	63.1	60.1	900.3
1,000	97.5	106.8	609.4	63.6	63.7	941.0

Notes:

(1) 1st Day = 4 Days C.R - 3 Days C.R
2nd Day = 2 Days C.R - 1 Day C.R: Probable Continuous Rainfall
3rd Day = 1 Day
4th Day = 3 Days C.R - 2 Days C.R
5th Day = 5 Days C.R - 4 Days C.R

(2) Actual Rainfall at Rap Ro (X.46A) in 1988

Nov. 21 10.3 mm/day = 4 Days (216.9) - 3 Days (206.6)
Nov. 22 23.1 mm/day = 2 Days (193.5) - 1 Day (170.4)
Nov. 23 170.4 mm/day = 1 Day (170.4)
Nov. 24 13.1 mm/day = 3 Days (206.6) - 2 Days (193.5)
Nov. 25 8.3 mm/day = 5 Days (225.6) - 4 Days (216.9)
Total 225.2 mm/day

TABLE C-13 HEAVY RAINFALL IN 1988 AND 1989

Unit: mm

Station / Year	K.Phra Chao	Rap Ro x.46A	Tha Sae	Ta Ngo	Pathiu	GT.6	A. Muang	Sam Kaeo Reg.	Saphan	Sawi	Kra Buri	Discharge	
												X.46	X.64
1988												cu.m/sec	
Nov. 19	*	-	-	-	-	-	-	-	-	-	-	25.00	17.30
20	*	0.7	-	-	-	-	0.9	-	-	-	-	20.73	14.00
21	*	10.3	5.2	-	3.8	-	12.6	16.4	-	19.4	19.2	17.98	12.11
22	*	23.1	64.7	9.4	180.2	1.0	58.7	69.8	-	74.4	5.3	17.98	11.69
23	*	170.4	80.2	352.3	223.5	247.1	219.8	344.8	159.2	138.6	61.8	130.20	123.25
24	*	13.1	30.4	12.2	-	11.1	15.8	23.4	5.0	8.5	2.4	(541.0) 524.00	(698.8) 663.15
25	*	8.3	-	15.3	-	36.5	-	20.7	85.8	28.6	-	325.70	572.30
26	*	-	-	-	-	-	-	-	-	3.4	-	216.50	347.30
27	*	-	-	-	31.9	-	-	-	-	0.8	-	110.14	191.90
1989													
Nov. 1	*	27.7	-	12.1	50.2	-	50.1	58.4	-	29.4	0.1	19.64	*
2	*	-	-	-	-	1.4	1.6	2.1	14.7	7.6	-	40.55	*
3	*	-	-	27.2	-	27.3	28.9	66.2	41.6	31.6	18.3	25.59	*
4	*	271.2	209.4	-	-	215.5	88.8	92.4	125.3	50.9	60.1	159.36	*
5	*	-	83.1	-	-	0.3	3.2	11.6	-	5.2	-	(649.4) 505.10	*
6	*	-	105.8	-	-	7.8	-	3.1	12.5	0.4	-	290.80	*
7	*	-	10.2	-	-	-	-	-	-	-	-	180.70	*
8	*	54.4	4.7	15.2	-	9.1	72.8	76.9	5.6	134.3	17.9	106.10	*
9	*	23.6	15.9	-	-	8.0	37.4	48.2	5.5	7.9	2.8	114.90	*

*: No Observation, ( ): Momentary Peak

TABLE C - 14 DISTRIBUTION OF OBSERVED RAINFALL (1979 ~ 1986)

Unit : mm

Water year	Period	Kaeng Phra Chao	Rap Ro X.46A	Tha Sae	Ta Ngo	Pathiu	GT.6	A. Muang	Sawi	Kra Buri
1979	Jul. 4 - 8	(1.00) 512.1	(0.72) 368.5	(0.59) 302.1	(0.48) 248.0	(0.26) 131.0	(0.25) 129.0	(0.35) 181.7	(0.32) 165.7	(0.36) 183.3
1980	May. 17 - 21	(1.00) 199.3	(0.82) 163.5	(0.93) 185.4	(0.59) 118.5	(0.19) 36.9	(0.44) 86.9	(0.40) 79.1	(0.30) 59.0	(0.65) 128.7
1981	Jun. 12 - 16	(1.00) 190.3	(1.08) 205.9	(0.94) 178.5	(0.60) 113.8	(0.23) 44.5	(0.86) 163.2	(0.53) 101.5	(0.70) 134.1	(1.03) 196.3
1982	Aug. 23 - 27	(1.00) 194.7	(0.86) 168.1	(0.55) 107.5	(0.68) 131.9	(0.42) 82.6	(0.41) 80.3	(0.69) 134.3	(0.47) 92.0	(1.26) 245.3
1983	Nov. 6 - 10	(1.00) 123.6	(0.97) 119.6	(0.88) 109.3	(0.81) 99.6	(1.39) 171.7	(1.22) 151.0	(1.20) 148.1	(0.61) 75.7	(0.44) 54.0
1984	Jun. 25 - 29	(1.00) 235.7	(1.25) 295.8	(0.57) 135.2	(0.54) 128.4	(0.29) 67.3	(0.40) 94.1	(0.54) 127.8	(0.63) 148.9	(1.03) 242.5
1985	Jun. 18 - 22	(1.00) 136.9	(1.19) 162.3	(0.58) 79.4	(0.75) 103.2	(0.54) 73.9	(0.83) 113.5	(0.97) 133.0	(1.27) 174.1	(1.87) 255.8
1986	Aug. 6 - 10	(1.00) 219.8	(0.58) 128.1	(0.44) 96.7	(0.59) 128.8	(0.65) 141.9	(0.23) 50.7	(0.35) 76.7	(0.41) 89.6	(1.16) 255.4
Mean	5 days	(1.00) 226.6	(0.93) 201.5	(0.69) 149.3	(0.63) 106.1	(0.50) 81.2	(0.58) 108.6	(0.63) 122.8	(0.59) 117.4	(0.98) 195.2

Notes : Kaeng Phra Chao : Maximum 5 Days Rainfall

TABLE C - 15 THIESSEN AREAL RATIO & 5 DAYS RAINFALL COEFFICIENT

Reference Point \ Rain Gauge Station	Kaeng Phra Chao	Rap Ro X.46	Tha Sae	Ta Ngo	Pathiu	GT. 6	A. Muang	Sawi	Kra Buri	Total
	1.00	0.93	0.69	0.63	0.50	0.58	0.63	0.59	0.98	
1. Tha Sae Reservoir 338 sq.km	0.27			0.07		0.66				0.70
2. Tha Sae Basin 1,016 sq.km	0.16		0.18	0.38	0.05	0.12				0.68
3. Upper Rap Ro Reservoir 106 sq.km	1.00									1.00
4. Rap Ro Reservoir 609 sq.km	0.78	0.20		0.02						0.98
5. Rap Ro Basin 803 sq.km	0.58	0.39	0.01	0.02						0.96
6. Nong Yai Swamp 102 sq.km			0.56				0.44			0.66
7. Tha Taphao Basin 94 sq.km		0.32	0.03				0.65			0.73
8. Chumphon X.53 223 sq.km		0.47						0.20	0.33	0.88
9. Chumphon Basin 337 sq.km		0.38					0.16	0.24	0.22	0.81

TABLE C - 16 DESIGN STORM RAINFALL (KAENG PHRA CHAO)

Time (Hour)	Actual Rainfall Rap Ro X.46A 21-25 Nov. 1988			Probable Rainfall of Each Return Period (mm/3 Hours)														
				2	3	4	5	10	15	20	30	50	100	200	300	500	750	1,000
3		-	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	1st Day	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	mm	4.5	44	8.6	10.9	12.4	13.5	17.1	19.1	20.5	22.7	25.4	29.2	33.1	35.5	38.6	41.1	42.9
12	10.3	5.5	53	10.3	13.1	14.9	16.3	20.5	23.0	24.8	27.3	30.6	35.1	39.9	42.8	46.5	49.4	51.7
15		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24		0.3	3	0.6	0.7	0.9	0.9	1.2	1.3	1.4	1.6	1.7	2.0	2.3	2.4	2.6	2.8	2.9
27		0.2	1	0.5	0.6	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
30	2nd Day	0.5	2	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.1	2.1
33	mm	0.9	4	2.0	2.3	2.5	2.6	3.0	3.2	3.3	3.5	3.7	3.9	4.1	4.1	4.2	4.2	4.3
36	23.1	0.2	1	0.5	0.6	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
39		3.5	15	7.3	8.4	9.2	9.8	11.2	11.9	12.4	13.0	13.7	14.5	15.2	15.5	15.8	15.9	16.0
42		0.9	4	2.0	2.3	2.5	2.6	3.0	3.2	3.3	3.5	3.7	3.9	4.1	4.2	4.2	4.3	4.3
45		1.4	6	2.9	3.4	3.7	3.9	4.5	4.7	5.0	5.2	5.5	5.8	6.1	6.2	6.3	6.4	6.4
48		15.5	67	32.7	37.9	41.1	43.5	49.8	53.1	55.2	58.0	61.2	64.9	67.8	69.2	70.5	71.2	71.5
51		64.8	38	38.4	48.1	54.9	60.2	77.3	87.9	95.6	107.0	122.2	144.3	168.2	183.1	202.8	219.4	231.6
54	3rd Day	17.0	10	10.1	12.6	14.4	15.8	20.3	23.2	25.2	28.2	32.2	38.0	44.3	48.2	53.4	57.8	61.0
57	mm	20.5	12	12.1	15.2	17.3	19.0	24.4	27.7	30.2	33.8	38.6	45.5	53.1	57.8	64.1	69.3	73.1
60	170.4	20.4	12	12.1	15.2	17.3	19.0	24.4	27.7	30.2	33.8	38.5	45.5	53.1	57.8	64.0	69.3	73.1
63		17.1	10	10.1	12.6	14.4	15.8	20.4	23.1	25.2	28.2	32.2	38.0	44.3	48.2	53.4	57.9	60.9
66		17.0	10	10.1	12.6	14.4	15.8	20.3	23.1	25.2	28.2	32.2	38.0	44.3	48.2	53.4	57.7	60.9
69		8.5	5	5.0	6.3	7.2	7.9	10.2	11.6	12.6	14.1	16.1	19.0	22.1	24.1	26.7	28.9	30.5
71		5.1	3	3.0	3.8	4.4	4.8	6.1	6.9	7.5	8.4	9.6	11.4	13.3	14.4	16.0	17.3	18.3
75		11.0	84	27.3	30.6	32.5	33.9	37.8	39.9	41.2	43.0	45.1	47.6	49.7	50.9	52.1	53.0	53.4
78	4th Day	2.1	16	5.2	5.8	6.2	6.5	7.2	7.6	7.9	8.2	8.6	9.1	9.5	9.7	9.9	10.1	10.2
81	mm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	13.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
96		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
99		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	5th Day	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	mm	8.3	100	24.3	24.3	24.6	25.1	27.0	28.6	29.9	32.0	35.0	40.1	46.0	49.9	55.3	60.1	63.7
108	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
111		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	5 Days 225.2	225.2	-	226.1	268.4	297.2	319.4	388.6	430.0	459.9	503.2	559.4	639.7	724.5	776.3	844.1	900.3	941.0

TABLE C-17 DISTRIBUTION RATE AND UNIT DISCHARGE
(to = 3.0 hr, r = 10 mm, f = 1.0 × 100 %)

Unit : X100 %, m^3/s

River Point D. A (hr)	Rap Ro River				Tha Sae River			
	Dam		Basin		Dam		Basin	
	609 km^2		803 km^2		338 km^2		1,016 km^2	
	D. rate	q. dis.	D. rate	q. dis.	D. rate	q. dis.	D. rate	q. dis.
3	0.020	33.4	0.005	11.9	0.036	34.0	0.003	8.9
6	0.049	82.9	0.015	32.4	0.084	78.5	0.009	24.8
9	0.066	112.2	0.022	48.7	0.104	97.9	0.014	38.2
12	0.075	127.2	0.027	61.3	0.109	102.1	0.017	49.3
15	0.078	132.3	0.032	70.9	0.104	97.7	0.021	58.4
18	0.077	130.7	0.035	77.8	0.095	88.9	0.023	65.9
21	0.074	124.9	0.037	82.7	0.083	78.1	0.025	71.8
24	0.069	116.5	0.038	85.8	0.071	67.0	0.027	76.3
27	0.063	106.7	0.039	87.3	0.060	56.4	0.028	79.7
30	0.057	96.4	0.039	87.7	0.050	46.9	0.029	82.1
33	0.051	86.1	0.039	87.1	0.041	38.5	0.030	83.7
36	0.045	76.2	0.038	85.8	0.033	31.4	0.030	84.5
39	0.040	66.9	0.038	83.8	0.027	25.3	0.030	84.6
42	0.035	58.4	0.036	81.3	0.022	20.3	0.030	84.3
45	0.030	50.7	0.035	78.5	0.017	16.2	0.030	83.4
48	0.026	43.8	0.034	75.4	0.014	12.9	0.029	82.2
51	0.022	37.7	0.032	72.1	0.011	10.2	0.029	80.6
54	0.019	32.3	0.031	68.7	0.009	8.0	0.028	78.8
57	0.016	27.6	0.029	65.3	0.007	6.3	0.027	76.8
61	0.014	23.5	0.028	61.8	0.005	4.9	0.026	74.6
63	0.012	20.0	0.026	58.4	0.004	3.9	0.026	72.3
66	0.010	16.9	0.025	55.0	0.003	3.0	0.025	69.9
69	0.008	14.3	0.023	51.8	0.002	2.3	0.024	67.4
72	0.007	12.1	0.022	48.6	0.002	1.8	0.023	64.9
75	0.006	10.2	0.020	45.5	0.002	1.4	0.022	62.4
78	0.005	8.6	0.019	42.6	0.001	1.1	0.021	59.8
81	0.004	7.2	0.018	39.7	0.001	0.8	0.020	57.3
84	0.004	6.0	0.017	37.1	0.001	0.6	0.019	54.8
87	0.003	5.0	0.015	34.5	0.001	0.5	0.019	52.4
90	0.002	4.2	0.014	32.1	0.000	0.4	0.018	49.9
93	0.002	3.5	0.013	29.8	0.000	0.3	0.017	47.6
96	0.002	2.9	0.012	27.7	0.000	0.2	0.016	45.3
99	0.001	2.5	0.012	25.7	0.000	0.2	0.015	43.1
102	0.001	2.0	0.011	23.8	0.000	0.1	0.015	40.9
105	0.001	1.7	0.010	22.0	0.000	0.1	0.014	38.9
108	0.001	1.4	0.009	20.3	0.000	0.1	0.013	36.9
111	0.001	1.2	0.008	18.8	0.000	0.1	0.012	34.9
114	0.001	1.0	0.008	17.3	0.000	0.0	0.012	33.1
117	0.000	0.8	0.007	16.0	0.000	0.0	0.011	31.3
120	0.000	0.7	0.007	14.7	0.000	0.0	0.010	29.6
123	0.000	0.6	0.006	13.6	0.000	0.0	0.010	28.0
126	0.000	0.5	0.006	12.5	0.000	0.0	0.009	26.4
129	0.000	0.4	0.005	11.5	0.000	0.0	0.009	24.9
132	0.000	0.3	0.005	10.6	0.000	0.0	0.008	23.5
135	0.000	0.3	0.004	9.7	0.000	0.0	0.008	22.2
138	0.000	0.2	0.004	8.9	0.000	0.0	0.007	20.9
141	0.000	0.2	0.004	8.2	0.000	0.0	0.007	19.7
144	0.000	0.1	0.003	7.5	0.000	0.0	0.007	18.5
147	0.000	0.1	0.003	6.9	0.000	0.0	0.006	17.4
150	0.000	0.1	0.003	6.3	0.000	0.0	0.006	16.4

TABLE C-18 DESIGN FLOOD HYDROGRAPH (1/2)
(P = 1/30)

River	Rap Ro River				Tha Sae River			
	Dam, f=0.80 CA=609 km²		Basin, f=0.75 CA=803 km²		Dam, f=0.80 CA=338 km²		Basin, f=0.75 CA=1,016 km²	
Time (hr)	R=493.1 mm = 503.2×0.98		R=483.1 mm = 503.2×0.96		R=352.2 mm = 503.2×0.70		R=342.2 mm = 503.2×0.68	
	R	D	R	D	R	D	R	D
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	7.4	19.8	7.3	6.5	5.3	14.4	5.1	3.4
12	8.9	73.0	8.7	25.4	6.4	50.6	6.2	13.7
15	0.0	125.7	0.0	47.8	0.0	81.5	0.0	26.3
18	0.0	155.5	0.0	65.3	0.0	93.2	0.0	36.8
21	0.0	169.2	0.0	78.8	0.0	93.4	0.0	45.4
24	0.5	173.3	0.5	89.3	0.4	88.5	0.4	52.8
27	0.3	171.6	0.3	97.5	0.2	81.3	0.2	59.1
30	0.6	166.3	0.5	104.0	0.4	73.5	0.4	64.4
33	1.1	161.1	1.1	109.5	0.8	67.4	0.8	69.3
36	0.3	155.2	0.3	114.0	0.2	62.1	0.2	73.7
39	4.2	157.6	4.2	120.4	3.0	63.7	2.9	79.1
42	1.1	166.3	1.1	128.9	0.8	69.4	0.8	85.6
45	1.7	173.0	1.7	136.8	1.2	73.1	1.2	91.9
48	18.9	225.6	18.6	159.7	13.5	109.8	13.1	106.2
51	35.0	388.8	34.2	222.4	25.0	221.1	24.3	142.1
54	9.2	586.6	9.0	307.2	6.6	341.7	6.4	191.3
57	11.0	745.1	10.8	389.8	7.9	421.9	7.7	241.2
61	11.0	876.2	10.8	471.0	7.9	477.3	7.7	291.8
63	9.2	979.6	9.0	548.7	6.6	512.1	6.4	342.3
66	9.2	1056.9	9.0	621.2	6.6	530.1	6.4	391.5
69	4.6	1102.2	4.5	685.2	3.3	528.7	3.2	436.9
72	2.7	1109.1	2.7	735.8	2.0	505.7	1.9	476.0
75	14.0	1116.6	13.8	783.4	10.0	491.3	9.7	514.0
78	2.7	1120.0	2.6	827.7	1.9	478.6	1.9	550.7
81	0.0	1087.2	0.0	857.2	0.0	444.3	0.0	579.7
84	0.0	1025.7	0.0	872.3	0.0	396.0	0.0	600.6
87	0.0	947.7	0.0	875.3	0.0	343.1	0.0	614.6
90	0.0	861.8	0.0	868.7	0.0	291.3	0.0	623.0
93	0.0	774.0	0.0	854.7	0.0	243.5	0.0	626.2
96	0.0	688.2	0.0	834.4	0.0	201.0	0.0	625.0
99	0.0	606.8	0.0	809.3	0.0	164.2	0.0	620.1
102	0.0	531.3	0.0	780.9	0.0	133.1	0.0	612.2
105	10.5	490.4	10.2	759.1	7.5	127.4	7.3	606.7
108	0.0	469.8	0.0	742.0	0.0	132.6	0.0	602.7
111	0.0	439.0	0.0	720.7	0.0	126.7	0.0	595.8
114	0.0	402.7	0.0	696.0	0.0	115.0	0.0	586.2
117	0.0	364.3	0.0	669.1	0.0	100.9	0.0	574.3
120	0.0	325.8	0.0	640.2	0.0	86.6	0.0	560.9
123	0.0	288.7	0.0	610.4	0.0	72.9	0.0	546.0
126	0.0	253.8	0.0	580.1	0.0	60.5	0.0	529.9
129	0.0	221.5	0.0	549.5	0.0	49.6	0.0	513.1
132	0.0	192.3	0.0	519.4	0.0	40.3	0.0	495.6
135	0.0	166.2	0.0	489.6	0.0	32.7	0.0	477.8
138	0.0	142.9	0.0	460.5	0.0	26.3	0.0	459.5
141	0.0	122.4	0.0	432.4	0.0	20.8	0.0	441.4
144	0.0	104.7	0.0	405.2	0.0	16.6	0.0	423.3
147	0.0	89.3	0.0	379.1	0.0	13.1	0.0	405.2
150	0.0	75.7	0.0	354.1	0.0	10.3	0.0	387.4
153	0.0	64.2	0.0	330.0	0.0	8.1	0.0	369.9
156	0.0	54.3	0.0	307.4	0.0	6.4	0.0	352.8
159	0.0	45.9	0.0	282.8	0.0	5.0	0.0	330.1
162	0.0	38.6	0.0	258.9	0.0	3.8	0.0	307.0
165	0.0	32.5	0.0	240.4	0.0	2.9	0.0	292.0
168	0.0	27.4	0.0	222.9	0.0	2.2	0.0	277.5
171	0.0	23.1	0.0	206.7	0.0	1.7	0.0	263.5
174	0.0	19.3	0.0	191.0	0.0	1.3	0.0	249.4
177	0.0	16.2	0.0	176.5	0.0	1.0	0.0	236.2
180	0.0	13.5	0.0	162.9	0.0	0.8	0.0	223.2
183	0.0	11.7	0.0	149.8	0.0	0.6	0.0	210.3
186	0.0	9.4	0.0	138.2	0.0	0.4	0.0	198.7

TABLE C-18 DESIGN FLOOD HYDROGRAPH (2/2)
(CHUMPON RIVER X.53 P=1/10)

Time (hr)	Unit Hydrograph D.A=233km², L =40 km, EH =380 m, EL=4.0 m, V =1.1 m/s, tp =9.7 hr		Design Flood Hydrograph R=342.0 mm = 388.6×0.88, f =0.75×100 %	
	D.Rate (X100 %)	q. Discharge (m³/s)	Rain (mm)	Discharge (m³/s)
3	0.054	33.2	0.0	0.0
6	0.116	71.7	0.0	0.0
9	0.135	83.3	5.0	12.5
12	0.131	80.9	6.0	41.9
15	0.116	72.1	0.0	63.7
18	0.098	61.0	0.0	68.0
21	0.080	49.8	0.0	63.6
24	0.064	39.8	0.4	56.3
27	0.050	31.2	0.2	48.6
30	0.039	24.1	0.4	41.8
33	0.030	18.4	0.9	37.7
36	0.023	13.9	0.2	34.3
39	0.017	10.5	3.3	38.0
42	0.013	7.8	0.9	44.6
45	0.009	5.8	1.3	48.6
48	0.007	4.3	14.6	84.8
51	0.005	3.2	22.7	178.7
54	0.004	2.3	6.0	265.3
57	0.003	1.7	7.2	310.8
61	0.002	1.2	7.2	334.7
63	0.001	0.9	6.0	343.0
66	0.001	0.6	6.0	340.6
69	0.001	0.5	3.0	326.0
72	0.001	0.3	1.8	298.3
75	0.000	0.2	11.1	287.7
78	0.000	0.2	2.1	281.9
81	0.000	0.1	0.0	256.3
84	0.000	0.1	0.0	219.7
87	0.000	0.1	0.0	181.3
90	0.000	0.0	0.0	145.6
93	0.000	0.0	0.0	114.7
96	0.000	0.0	0.0	89.0
99	0.000	0.0	0.0	68.2
102	0.000	0.0	0.0	51.8
105	0.000	0.0	7.9	58.7
108	0.000	0.0	0.0	71.7
111	0.000	0.0	0.0	71.1
114	0.000	0.0	0.0	64.0
117	0.000	0.0	0.0	54.6
120	0.000	0.0	0.0	44.8
123	0.000	0.0	0.0	35.9
126	0.000	0.0	0.0	28.2
129	0.000	0.0	0.0	21.8
132	0.000	0.0	0.0	16.7
135	0.000	0.0	0.0	12.7
138	0.000	0.0	0.0	9.4
141	0.000	0.0	0.0	7.1
144	0.000	0.0	0.0	5.2
147	0.000	0.0	0.0	3.8
150	0.000	0.0	0.0	2.8
153			0.0	2.1
156			0.0	1.5
159			0.0	1.1
162	to =3.0 hr		0.0	0.7
165	r =10 mm		0.0	0.5
168	a =0.123		0.0	0.4
171	f =1.0		0.0	0.3
174			0.0	0.2
177			0.0	0.1
180			0.0	0.1

TABLE C - 19 10 DAYS INFLOW AT NONG YAI SWAMP (1/2)
(D.A = 102 sq.km)

Unit : 1,000 cu.m

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1980													
1	11.4	34.3	982.4	4066.6	2146.7	5907.5	3070.8	2375.7	2749.5	432.0	351.3	299.2	
2	100.0	1213.3	1685.6	2516.7	2813.8	5280.9	2952.3	2242.4	1006.2	369.9	387.7	277.8	
3	57.1	1307.8	4684.8	4999.6	10420.9	2779.4	2309.6	1389.9	689.1	339.9	248.5	299.9	
Total	168.5	2555.4	7352.8	11582.9	15381.4	13967.8	8332.7	6008.0	4444.8	1141.8	987.5	876.9	72800.5
1981													
1	99.0	373.6	771.6	1316.7	2587.6	2081.8	2310.4	2660.6	2849.3	1039.4	464.6	267.5	
2	212.3	367.5	8782.4	2110.0	8194.4	3979.5	2343.5	5842.4	1746.2	826.1	445.9	165.4	
3	217.5	605.5	3366.4	2040.3	7160.4	7347.3	4006.3	10143.9	1431.4	706.4	256.9	544.4	
Total	528.8	1346.6	12920.4	5467.0	17942.4	13408.6	8660.2	18646.9	6026.9	2571.9	1167.4	977.3	89664.4
1982													
1	371.9	205.8	312.6	637.7	894.1	7140.1	1854.9	4713.4	1449.7	731.8	452.9	229.3	
2	743.1	272.9	331.5	4070.4	4630.5	3476.9	2221.0	2666.6	1082.5	641.0	362.9	175.9	
3	366.9	525.6	859.9	1655.6	12550.0	2009.4	2312.9	1823.9	913.4	600.7	230.9	164.9	
Total	1481.9	1004.3	1504.0	7867.7	18074.6	12626.4	6388.8	9203.9	3445.6	1973.5	1046.7	570.1	64187.5
1983													
1	90.3	74.0	378.2	909.1	910.5	769.1	3129.4	3955.0	914.1	523.4	332.8	189.8	
2	36.0	294.3	518.7	1486.9	3403.7	992.6	2322.4	5831.3	699.8	349.9	361.3	128.6	
3	23.1	260.5	2095.3	991.2	1415.4	1765.4	4302.0	1502.4	605.6	393.5	198.9	113.1	
Total	149.4	628.8	2992.2	3387.2	5729.6	3527.1	9753.8	11288.7	2219.5	1266.8	893.0	431.5	42267.6
1984													
1	186.9	276.8	556.3	3195.7	1649.7	5470.5	5588.9	2019.6	945.2	658.8	463.0	262.0	
2	171.9	503.4	890.5	2035.3	9008.3	4627.7	3796.6	1544.0	835.0	545.0	367.2	339.6	
3	198.3	510.0	8062.8	1369.4	6753.0	4981.9	4213.5	1207.4	1404.4	588.3	238.8	279.9	
Total	557.1	1290.2	9509.6	6600.4	17411.0	15080.1	13599.0	4771.0	3184.6	1792.1	1069.0	881.5	75745.6
1985													
1	183.0	390.1	513.5	1507.9	799.2	3549.8	4447.6	2545.3	3813.9	510.5	269.8	159.3	
2	140.3	1591.3	3426.8	991.7	3048.8	1984.4	3013.4	6647.9	919.7	388.5	219.5	121.3	
3	488.4	897.1	7033.0	1115.3	3217.7	1644.1	1701.4	1691.0	694.9	329.6	145.8	99.3	
Total	811.7	2878.5	10973.3	3614.9	7065.7	7178.3	9162.4	10884.2	5438.5	1228.6	635.1	379.9	60251.1
1986													
1	62.0	584.0	728.4	1632.3	7305.0	4062.4	8416.3	5334.9	1137.6	719.5	445.4	435.2	
2	340.5	2074.9	628.9	10287.1	19059.4	4685.8	4050.9	2132.2	936.4	612.3	397.5	290.5	
3	66.7	1989.1	4730.5	3468.9	4001.4	7012.8	3041.9	1376.5	920.0	560.5	282.5	220.9	
Total	469.2	4648.0	6087.8	15388.3	30365.8	15761.0	15509.1	8843.6	2994.0	1892.3	1125.4	946.6	104031.1
1987													
1	165.2	433.2	463.8	970.3	422.2	2608.7	1067.3	4719.8	1639.4	500.8	252.2	162.4	
2	196.5	360.0	2524.2	592.9	886.4	2579.4	1481.0	5054.5	854.8	365.1	239.2	180.4	
3	183.5	274.4	2012.4	443.1	3974.8	1476.3	1864.7	2364.6	689.2	335.6	200.5	200.8	
Total	545.2	1067.6	5000.4	2006.3	5283.4	6664.4	4413.0	12138.9	3183.4	1201.5	691.9	543.4	42739.4

TABLE C - 19 10 DAYS INFLOW AT NONG YAI SWAMP (2/2)
(D.A = 102 sq.km)

Unit : 1,000 cu.m

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1988													
1	252.2	628.9	5396.9	1248.4	1370.3	1250.0	5496.4	1655.8	3113.3	1048.4	662.4	1334.3	
2	243.4	596.2	3873.5	3222.4	1130.4	1476.5	7125.4	7144.3	1849.4	871.8	707.8	688.4	
3	216.5	550.3	1647.4	2142.9	2120.5	3972.3	4133.6	17634.0	1469.2	1004.5	411.3	465.8	
Total	812.1	1775.4	10917.8	6613.7	4621.2	6698.8	16755.4	26434.1	6431.9	2924.7	1781.5	2488.5	88255.1
1989													
1	559.7	513.5	2108.4	2174.4	3791.5	5414.0	3433.8	19118.0	2631.0	1440.0	1003.3	705.4	
2	848.8	959.0	1901.1	1635.9	8483.6	4498.0	5395.9	11487.0	2016.1	1282.4	908.2	663.9	
3	436.5	7395.4	6769.0	7808.4	9217.8	5376.0	3708.3	3943.0	1816.4	1235.7	614.6	690.9	
Total	1845.0	8867.9	10778.5	11618.7	21492.9	15288.0	12538.0	34548.0	6463.5	3958.1	2526.1	2060.2	131984.9
1990													
1	536.0	647.2	2127.6	1742.8	1396.4	5223.2	9271.8	13229.0	2308.3	1337.8	815.3	593.8	
2	873.8	1585.5	2467.4	1760.3	3689.5	4810.2	6086.9	10366.0	1985.0	1086.4	673.4	850.1	
3	764.0	2592.5	1804.8	1926.9	9254.5	5989.6	8876.7	6721.8	1767.3	1032.0	730.1	643.8	
Total	2173.8	4825.2	6399.8	5430.0	14340.4	16023.0	24235.4	30316.8	6060.6	3456.2	2218.8	2087.7	117567.7

Note

1980, 1982 ~ '84

(X46A (m^3/s - 10 days total)) × 86.4 × 102/617

1981. 1985 ~ '90

(X46 (m^3/s - 10 days total)) × 86.4 × 102/751

TABLE C-20 MONTHLY INFLOW AT PROPOSED POINT

Unit : MCM

Water Year	Month	Rap Ro River		Tha Sae Ri	Tha Taphao River		Chumphon Ri
		Upper Rap Ro Reservoir 106 sq.km	Rap Ro Reservoir 609 sq.km	Tha Sae Reservoir 338 sq.km	Gauging Sta. X.158 1,819 sq.km	Nong Yai Swamp 102 sq.km	Gauging Sta. X.53 223 sq.km
1984	Apr.	(1) 0.512	(2) 2.171	(3) 1.632	(4) 16.751	(5) 0.557	(6) 3.459
	May	0.859	5.990	2.740	28.380	1.290	6.442
	Jun.	6.703	47.135	21.375	122.170	9.510	51.398
	Jul.	5.720	33.115	18.241	117.426	6.602	33.234
	Aug.	15.612	109.518	49.781	221.745	17.413	94.065
	Sep.	16.835	92.841	53.681	224.584	15.083	49.198
	Oct.	15.411	83.863	49.141	233.148	13.601	43.322
	Nov.	4.715	27.512	15.035	77.732	4.772	11.213
	Dec.	2.694	16.476	8.591	58.878	3.185	6.959
	Jan.	1.630	9.367	5.199	35.919	1.792	4.697
	Feb.	1.116	5.942	3.559	24.670	1.069	3.078
	Mar.	1.029	5.544	3.281	21.850	0.882	2.945
	Total	72.836	439.474	232.256	1,183.253	75.756	310.010
1985	Apr.	0.996	5.303	3.175	12.401	0.812	2.285
	May	2.379	14.817	7.587	39.924	2.879	9.694
	Jun.	10.541	68.832	33.611	137.603	10.975	46.243
	Jul.	3.767	24.682	12.011	48.961	3.615	10.098
	Aug.	9.803	52.408	31.260	83.528	7.067	27.704
	Sep.	8.544	49.382	27.244	93.009	7.180	42.429
	Oct.	10.205	65.625	32.540	193.093	9.164	38.954
	Nov.	8.772	51.851	27.970	182.118	10.885	37.044
	Dec.	3.239	21.309	10.329	78.939	5.439	26.176
	Jan.	1.771	10.322	5.656	22.674	1.229	4.695
	Feb.	0.842	5.068	2.685	12.329	0.635	2.714
	Mar.	0.577	3.098	1.839	8.520	0.380	2.280
	Total	61.436	372.697	195.907	913.099	60.260	250.316
1986	Apr.	0.663	3.367	2.113	8.559	0.469	1.824
	May	6.148	30.548	19.603	66.154	4.649	2.380
	Jun.	6.689	37.711	21.329	73.910	6.089	29.803
	Jul.	20.202	107.778	64.419	218.602	15.390	77.109
	Aug.	26.634	165.539	84.926	402.203	30.366	94.921
	Sep.	13.896	41.922	44.309	180.157	15.762	60.341
	Oct.	16.027	87.208	51.106	248.917	15.511	30.205
	Nov.	8.902	47.816	28.386	191.692	8.845	25.313
	Dec.	4.282	23.819	13.655	46.089	2.994	7.949
	Jan.	2.111	12.098	6.730	27.798	1.893	4.536
	Feb.	1.096	6.085	3.496	16.427	1.126	2.794
	Mar.	1.019	55.240	3.248	18.596	0.947	3.249
	Total	107.669	569.131	343.320	1,499.104	104.041	340.424

Notes (1) Upper Rap Ro reservoir = ①×106/330
(2) Rap Ro Rservoir = (①+②)×609/518
(3) Tha Sae Reservoir = ①×338/330
(4) Gaunging StationX.158 = (③+④)×1,819/1,708
(5) Nong Yai Swamp = ③ × 102/751
(6) Gauging StationX.53 = ⑤

Observed Discharge
① : Kaeng Phra Chao (330 sq.km)
② : Som Paen (188 〃)
③ : X.46 (751 〃)
④ : X.64 (957 〃)
⑤ : X.53 (223 〃)

TABLE C-21 (1/11) MONTHLY RAINFALL AT KAENG PHRA CHAO

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952													
53													
54													
55													
56													
57													
58													
59													
60													
61													
62													
63													
64	*	*	*	*	*	*	*	*	*	-	13.1	94.9	-
65	65.2	221.2	197.5	328.0	219.2	305.5	300.4	77.5	258.4	12.6	63.6	52.4	2,101.5
66	31.9	190.7	179.1	300.5	187.6	388.4	413.1	249.0	178.8	126.3	20.1	5.6	2,271.1
67	171.1	280.5	188.4	360.5	463.6	171.5	241.1	94.7	77.6	3.5	53.3	12.3	2,118.1
68	128.4	283.6	172.5	194.8	440.4	198.0	238.4	124.7	78.5	179.6	134.4	60.4	2,233.7
69	60.3	182.6	222.4	361.7	185.9	348.3	239.5	344.0	16.1	111.0	57.3	40.5	2,169.6
70	188.1	110.9	308.1	273.2	471.3	153.5	161.1	574.7	266.1	5.2	22.0	16.1	2,650.3
71	129.6	126.4	273.6	296.7	99.0	145.4	493.4	262.8	105.3	7.2	9.2	56.3	2,004.9
72	273.1	46.1	324.9	352.2	275.8	230.9	257.2	333.9	253.4	45.9	45.7	106.1	2,545.2
73	71.0	168.9	301.4	615.5	341.8	184.8	336.5	292.4	44.7	6.3	46.4	69.7	2,479.4
74	109.5	366.8	261.2	273.7	294.8	215.2	178.9	244.6	67.4	348.2	34.5	49.4	2,444.2
75	63.3	320.1	580.5	113.7	474.6	239.7	509.9	327.8	112.4	0	0	44.1	2,786.1
76	206.3	620.0	162.0	180.4	166.9	408.5	323.0	211.7	54.7	42.3	125.1	39.2	2,540.4
77	11.7	177.0	206.1	239.3	518.1	402.8	215.4	247.5	40.5	118.2	100.4	36.4	2,313.4
78	172.5	293.5	160.4	187.6	634.9	347.5	456.5	67.6	25.3	11.1	14.6	20.3	2,391.8
79	175.9	359.3	300.7	775.0	562.5	458.7	161.5	9.6	11.7	12.0	10.0	139.3	2,976.2
80	244.0	347.1	428.2	264.3	306.7	155.4	195.0	135.1	80.3	12.3	113.5	80.7	2,310.6
81	102.6	274.7	399.7	203.5	277.0	223.6	177.2	272.1	4.2	0	57.5	113.4	2,105.5
82	145.9	149.5	196.5	322.8	417.7	257.7	169.6	205.1	32.0	99.4	129.8	156.0	2,282.0
83	179.1	132.9	79.6	99.7	71.6	85.5	74.0	81.9	90.4	81.7	62.1	72.9	1,111.4
84	55.1	161.4	421.8	136.5	327.1	298.8	159.9	24.1	96.5	24.0	9.5	21.3	1,736.0
85	148.7	235.4	310.3	125.9	250.7	142.1	205.3	263.1	18.1	5.6	1.0	1.8	1,708.0
86	86.6	343.7	188.7	299.2	388.8	309.2	249.3	75.0	50.8	0.5	0	42.8	2,034.6
87	44.6	198.9	246.6	97.7	286.4	168.7	200.9	286.0	0	*	*	*	-
88													
89													
90													
Mean 65 - 86	128.2	246.0	266.5	286.6	335.3	257.8	266.2	205.4	89.2	56.9	50.5	52.9	2,241.5

TABLE C-21 (2/11) MONTHLY RAINFALL AT BAN RAP RO (X.46 A)

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952													
53													
54													
55													
56													
57													
58													
59													
60													
61													
62													
63													
64													
65													
66													
67													
68													
69													
70													
71													
72													
73													
74													
75													
76													
77													
78	202.6	459.2	-	123.9	372.5	246.8	300.1	-	27.6	6.5	28.7	30.6	-
79	102.9	143.5	217.1	506.7	456.5	157.9	128.1	52.9	10.0	2.2	22.5	88.3	1,888.6
80	42.9	292.5	246.3	239.3	315.1	140.9	172.1	260.9	73.2	2.1	0	0	1,785.3
81	123.1	74.7	399.6	237.9	284.3	205.6	106.2	267.3	3.6	15.8	10.7	6.7	1,735.5
82	165.4	170.3	105.6	205.1	340.4	127.7	184.2	246.9	53.0	11.7	0	10.2	1,620.5
83	0	122.0	208.3	114.9	157.0	222.9	260.8	242.8	30.6	48.1	98.5	29.1	1,535.0
84	21.3	194.7	437.7	99.7	427.6	131.4	173.8	47.3	27.9	62.3	13.5	22.0	1,659.2
85	51.0	170.5	293.9	78.8	204.6	154.9	162.3	244.6	97.0	7.0	3.5	0	1,468.1
86	95.1	278.7	180.2	279.6	339.5	288.3	223.5	142.6	69.8	2.3	0	42.1	1,941.7
87	56.1	182.0	336.4	37.9	226.2	94.5	141.0	272.0	0	3.0	17.3	35.2	1,401.6
88	46.0	203.7	360.7	207.6	119.8	105.0	211.2	437.0	0.6	48.1	46.1	140.4	1,926.2
89	53.6	333.7	248.8	191.9	247.1	195.4	110.6	475.5	14.7	9.6	5.4	36.2	1,922.5
90	79.4	217.4	174.0	100.4	239.7	129.1	384.7	316.7	8.6	8.9	33.0	18.7	1,710.6
Mean (12)	69.7	198.6	267.4	191.7	279.8	162.8	188.2	250.6	32.4	18.4	20.9	35.7	1,716.2

TABLE C-21 (3/11) MONTHLY RAINFALL AT A. THA SAE

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952													
53	109.0	433.6	158.0	209.0	42.7	102.7	245.4	229.0	0	0	0	0	1,529.4
54	12.7	60.3	34.2	42.9	57.5	77.5	0	0	-	0	0	0	-
55	51.7	114.6	227.1	-	52.0	92.7	715.0	280.0	0	20.2	0	0	-
56	14.9	66.8	79.7	173.7	81.3	138.9	615.1	159.8	31.0	14.6	33.5	111.0	1,520.3
57	18.2	39.8	58.1	242.9	104.7	179.0	313.1	73.2	30.6	13.4	30.1	31.6	1,134.7
58	45.5	112.4	279.6	201.5	366.2	89.0	322.0	208.8	61.2	24.3	0	99.1	1,809.6
59	90.9	72.1	181.5	260.4	183.3	213.2	282.6	225.6	196.0	38.1	133.5	0	1,877.2
60	60.1	250.3	266.2	501.3	262.5	260.6	431.5	304.8	19.3	53.4	181.1	69.2	2,660.3
61	118.6	474.4	215.3	223.3	281.2	172.5	222.4	600.2	159.8	206.9	31.9	104.8	2,811.3
62	9.8	178.8	78.0	507.5	377.9	273.6	638.2	219.3	48.7	45.2	90.6	0	2,467.6
63	52.8	71.8	123.5	139.0	318.5	235.4	471.2	173.5	54.3	35.7	98.0	213.6	1,987.3
64	20.6	195.9	117.5	149.0	267.5	265.9	235.1	297.5	60.7	55.7	33.7	66.1	1,765.2
65	192.7	209.7	134.0	224.8	257.3	187.6	429.6	199.0	409.0	20.2	105.6	62.3	2,431.8
66	21.8	262.6	321.7	147.0	139.8	343.5	358.6	382.5	241.4	169.9	42.9	23.9	2,455.6
67	56.8	263.6	123.2	277.8	315.3	86.4	244.8	142.0	158.2	14.7	136.1	25.4	1,844.3
68	115.5	157.2	97.5	166.4	296.5	107.1	241.6	168.4	236.4	247.2	169.7	100.7	2,104.2
69	87.6	159.3	121.3	265.7	183.4	248.7	189.3	367.5	29.6	172.4	60.7	74.1	1,959.6
70	169.5	151.6	297.2	152.3	328.9	103.9	223.1	490.8	370.4	7.0	17.3	61.9	2,373.9
71	30.9	148.7	218.6	188.3	95.8	133.0	355.9	300.6	57.7	66.4	0	20.9	1,616.8
72	115.7	92.1	217.9	207.8	150.5	228.7	156.1	588.3	219.5	22.3	32.1	114.6	2,145.6
73	0	112.1	136.7	382.5	167.0	294.1	396.4	265.7	73.1	5.0	90.2	52.2	1,975.0
74	136.6	158.4	108.5	154.6	165.5	181.6	125.9	296.0	66.9	418.5	66.5	35.8	1,914.8
75	43.7	250.7	304.5	42.8	236.5	308.6	232.9	215.5	81.5	0	0	58.6	1,775.3
76	106.7	422.9	104.8	138.7	63.0	131.4	260.2	137.3	33.4	41.5	316.5	42.6	1,799.0
77	54.3	103.7	62.8	236.7	310.9	186.9	131.5	211.0	23.4	171.2	152.8	3.5	1,648.7
78	167.7	424.7	79.5	74.3	320.9	227.8	255.2	168.9	20.2	15.3	29.8	0	1,784.3
79	149.0	220.0	176.2	556.7	631.5	103.2	110.8	131.2	41.5	5.0	61.4	46.8	2,233.3
80	278.1	227.7	242.0	240.7	221.7	141.5	108.0	292.0	126.4	0	0.7	0.4	1,879.2
81	119.4	504.8	359.4	63.5	300.1	149.4	206.1	294.1	0	0.5	57.9	55.6	2,110.8
82	172.0	196.8	150.7	269.7	228.9	57.3	351.3	199.9	49.0	0	0	0	1,675.6
83	0	333.4	135.7	81.8	196.8	111.2	212.1	212.2	4.6	0	70.8	2.0	1,360.6
84	29.5	54.3	207.3	29.6	109.9	111.6	123.7	19.8	83.0	47.3	7.7	12.3	836.0
85	298.1	259.1	140.1	1.4	117.3	203.2	284.5	201.5	130.0	5.0	0	0	1,640.2
86	0	120.1	115.7	170.3	173.0	135.9	123.2	68.3	11.8	1.2	1.2	117.9	1,038.6
87	8.0	66.3	197.7	2.0	177.3	92.5	50.2	279.1	146.2	0	1.5	7.3	1,028.1
88	103.3	46.9	255.4	93.1	102.2	146.2	73.2	344.3	0	141.7	15.0	91.2	1,412.5
89	32.8	113.8	94.2	162.1	108.7	237.6	92.3	574.6	18.3	0	3.4	23.1	1,460.9
90	54.1	79.4	65.1	17.7	210.6	159.5	91.3	285.1	15.8	0	-	10.8	-
Mean (35)	86.6	198.8	170.3	198.2	219.6	176.8	260.4	258.3	94.1	58.8	59.2	49.4	1,830.5
1965-86	106.6	219.7	175.3	185.2	227.8	171.9	232.8	243.3	112.1	65.0	64.5	41.4	1,845.6

TABLE C-21 (4/11) MONTHLY RAINFALL AT TA NGO

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952													
53													
54													
55													
56													
57													
58													
59													
60													
61													
62	*	*	*	*	*	*	*	*	*	68.4	74.6	6.6	-
63	42.1	53.7	123.3	161.0	133.9	166.3	320.4	214.7	88.4	32.7	76.7	131.8	1,545.0
64	3.4	168.0	92.3	110.5	215.0	220.6	173.5	280.5	30.1	30.8	114.1	25.3	1,464.1
65	115.5	201.8	188.4	244.5	141.5	194.9	254.8	123.2	330.2	3.9	-	-	-
66	67.8	205.6	138.0	149.6	272.2	300.4	270.6	296.2	204.0	61.9	75.9	14.9	2,057.1
67	64.0	179.4	93.0	254.2	-	50.8	230.5	128.2	120.1	0	83.5	48.0	-
68	55.5	125.1	74.8	111.7	173.2	69.5	164.5	102.1	31.6	86.5	72.9	91.9	1,159.3
69	0	29.8	292.2	206.6	140.7	278.7	84.3	201.1	0	102.9	50.4	20.8	1,407.5
70	61.2	135.8	138.2	75.4	270.0	23.9	98.2	49.5	214.4	11.0	10.1	22.8	1,110.5
71	73.4	124.3	146.3	169.5	61.0	161.9	132.8	85.7	39.3	0	30.4	21.1	1,045.7
72	0	17.7	221.4	198.2	241.5	58.3	281.4	473.7	202.0	24.1	34.9	120.5	1,873.7
73	33.2	264.4	167.6	385.9	198.6	140.1	233.2	273.4	61.2	1.0	32.9	77.3	1,868.8
74	243.5	264.4	144.9	108.9	181.6	105.4	239.9	279.5	52.2	224.5	50.7	3.5	1,899.0
75	23.4	212.0	317.2	94.3	274.7	360.7	231.4	208.0	47.7	0	0	15.1	1,784.5
76	67.0	414.6	69.0	128.1	133.7	122.0	296.7	288.4	34.7	65.8	109.6	65.0	1,794.6
77	4.1	50.9	83.5	210.8	194.7	199.0	171.2	197.2	61.5	88.1	220.0	3.8	1,484.8
78	145.8	396.1	55.5	98.5	420.3	190.6	292.1	45.4	68.3	27.4	4.2	0	1,744.2
79	50.8	243.2	164.1	316.5	257.9	208.8	58.1	16.0	3.6	4.4	5.0	60.1	1,388.5
80	89.1	205.3	246.4	161.0	201.5	79.8	151.8	92.3	61.4	8.5	99.4	16.0	1,412.5
81	89.8	201.7	276.3	97.5	186.9	163.2	124.9	288.5	7.7	11.3	62.8	94.7	1,605.3
82	236.9	141.3	143.8	175.6	258.4	144.0	175.9	256.1	37.3	114.7	114.0	154.2	1,952.2
83	167.1	124.9	82.6	104.6	80.5	97.5	73.0	79.3	96.1	66.3	71.3	41.1	1,084.3
84	71.7	150.9	247.0	133.9	248.7	178.7	268.1	29.9	152.8	21.9	6.7	42.0	1,552.3
85	140.1	177.4	236.2	81.5	105.5	200.4	216.5	190.0	32.1	9.3	5.2	0	1,394.2
86	29.2	290.8	127.6	196.8	190.8	282.3	261.3	112.0	77.3	1.2	0	128.3	1,697.6
87	13.6	73.2	163.4	20.4	216.0	86.9	101.3	452.1	0	0	12.5	23.0	1,162.4
88	175.5	73.7	138.4	136.8	91.6	206.6	335.4	462.9	0	91.6	70.7	136.4	1,919.6
89	137.3	304.6	175.7	162.0	162.8	296.8	176.2	247.5	5.2	*	*	*	-
90													
Mean (24)	78.5	172.7	162.1	151.4	197.9	168.6	198.2	207.3	66.8	45.2	55.4	54.6	1,558.7

TABLE C-21 (5/11) MONTHLY RAINFALL AT A. PATHIU

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952	44.0	15.0	76.0	19.0	107.0	42.0	892.0	545.0	70.0	0	138.0	0	1,948.0
53	11.0	76.0	82.5	80.5	57.0	33.0	75.2	78.3	4.0	3.0	3.0	0.3	503.8
54	7.2	25.8	28.8	33.5	134.6	213.7	329.9	13.4	148.4	22.8	6.2	8.0	972.3
55	70.6	272.3	209.7	78.6	102.2	91.7	569.1	38.8	0	51.8	0	0	1,484.8
56	109.1	142.2	150.2	126.7	121.6	172.8	407.5	121.8	5.8	10.6	9.1	0	1,377.4
57	6.6	125.2	45.6	41.0	82.6	148.9	220.1	165.7	26.6	23.5	58.0	16.0	959.8
58	25.7	109.7	182.3	184.8	267.3	108.5	287.9	172.1	70.6	152.4	0	124.5	1,685.8
59	181.6	188.1	178.7	385.8	297.8	267.6	365.2	215.0	191.9	11.4	139.7	0	2,422.8
60	91.6	117.4	76.9	108.4	222.6	160.9	352.0	271.1	11.1	59.5	160.5	180.0	1,812.0
61	113.6	268.6	182.8	128.1	183.5	112.8	172.3	566.2	206.9	219.3	70.5	129.4	2,354.0
62	32.7	126.7	77.6	254.7	264.8	191.0	645.5	355.5	98.3	51.3	68.0	13.5	2,179.6
63	6.4	25.4	260.5	83.2	95.3	114.9	355.3	164.6	91.6	53.8	123.5	173.9	1,548.4
64	0	209.2	160.0	55.1	164.9	205.1	161.7	356.2	109.8	77.1	24.2	82.0	1,605.3
65	113.3	158.9	77.2	119.3	169.2	115.3	515.0	139.5	327.9	17.8	124.6	58.0	1,936.0
66	11.8	86.1	149.8	156.1	181.7	378.5	333.4	404.3	141.8	71.3	33.6	8.1	1,956.5
67	47.0	178.4	70.7	175.6	222.1	44.0	313.8	185.0	172.1	7.5	91.6	27.4	1,535.2
68	191.7	139.2	138.0	109.0	173.2	82.9	270.5	292.5	209.4	206.1	201.5	33.4	2,047.4
69	31.8	148.8	105.6	172.4	193.0	149.1	145.3	416.1	53.7	199.7	115.1	12.2	1,742.8
70	122.7	47.0	225.0	68.6	313.2	59.3	164.2	736.4	473.3	27.6	69.0	24.3	2,330.6
71	3.5	210.6	199.6	125.6	97.8	301.6	323.5	207.9	57.5	26.0	0	15.8	1,569.4
72	122.6	53.2	211.1	162.6	150.2	110.4	207.1	776.4	244.2	0	0	200.2	2,238.0
73	0	98.9	148.0	343.9	127.0	180.6	350.0	360.8	121.3	9.7	52.4	174.1	1,966.7
74	21.0	154.6	62.2	30.1	58.0	120.4	145.6	276.8	170.1	262.0	101.4	0	1,402.2
75	43.6	66.7	110.4	53.0	204.4	56.0	126.6	289.5	75.7	0	0	44.2	1,070.1
76	164.9	251.0	12.8	44.2	17.0	50.7	174.5	167.3	11.2	10.6	209.1	40.5	1,153.0
77	0	30.4	113.9	55.4	95.2	58.9	47.7	122.8	15.2	228.9	127.7	0	896.1
78	47.8	199.5	8.6	75.3	135.8	79.6	245.6	215.0	30.6	5.4	9.8	0	1,053.0
79	20.6	68.1	54.3	258.5	319.6	102.0	110.1	15.0	3.4	7.3	53.9	14.0	1,026.8
80	139.0	48.9	126.0	159.2	68.0	45.8	81.7	299.1	59.8	4.8	130.7	0	1,063.0
81	42.5	134.2	152.4	35.2	49.7	88.1	51.5	506.4	0	19.5	0	76.0	1,155.5
82	181.5	94.2	112.2	115.2	147.6	71.9	85.0	366.3	165.6	20.6	0	0	1,360.1
83	0	26.8	87.3	44.1	23.5	24.8	58.6	287.6	0	27.2	47.7	0	627.6
84	51.5	47.8	156.6	46.8	188.4	178.8	119.5	21.0	100.0	141.7	0	67.0	1,119.1
85	175.0	130.8	201.0	40.6	74.5	232.9	97.5	237.7	40.5	0	7.3	0	1,237.8
86	0	283.3	77.2	181.6	211.8	90.2	196.3	115.1	35.1	0	0	82.9	1,273.5
87	71.1	223.7	76.6	8.7	84.5	57.5	153.9	476.7	1.6	13.6	58.5	2.8	1,229.2
88	50.3	62.8	210.7	91.5	31.0	146.8	173.6	519.5	0	14.2	126.1	230.8	1,657.3
89	43.7	215.8	136.5	167.0	95.4	140.4	82.9	193.0	12.5	7.3	28.5	48.7	1,171.7
90	27.4	82.4	59.1	22.1	140.9	40.9	262.8	235.6	4.8	6.0	38.5	84.5	1,005.0
Mean (39)	62.2	126.8	122.9	113.9	145.5	124.9	247.9	280.2	91.3	53.1	62.2	50.6	1,481.5
65 - 86	69.6	120.8	118.2	116.9	146.4	119.2	189.2	292.7	114.0	58.8	62.5	39.9	1,448.2

TABLE C-21 (6/11) MONTHLY RAINFALL AT KHLONG YANG KHWANG (GT.6)

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952													
53													
54													
55													
56													
57													
58													
59													
60													
61													
62													
63													
64													
65													
66													
67													
68													
69													
70													
71													
72													
73													
74													
75													
76													
77													
78	-	364.9	53.2	22.1	263.1	125.5	281.0	50.3	2.5	5.4	25.6	35.0	-
79	135.0	153.0	125.7	307.8	255.3	142.7	76.9	19.8	10.0	7.9	57.5	39.8	1,331.4
80	65.4	172.6	237.6	158.2	124.7	110.1	161.0	44.1	137.9	13.8	94.7	4.2	1,324.3
81	168.8	224.5	286.9	44.5	243.2	175.4	331.3	354.8	3.2	4.7	59.2	74.1	1,970.6
82	107.1	119.2	120.9	177.4	248.7	134.8	221.4	173.0	39.3	14.4	46.1	35.5	1,437.8
83	21.5	176.5	284.9	100.7	93.7	129.0	248.0	365.3	30.7	68.4	106.7	18.0	1,643.4
84	35.3	125.1	325.7	217.9	195.4	265.5	145.2	15.6	85.8	78.2	48.0	89.3	1,627.0
85	92.0	171.2	206.3	34.4	196.3	219.7	297.5	218.2	0	5.2	4.9	0	1,445.7
86	47.1	308.5	142.3	143.6	119.6	262.7	311.9	206.5	27.8	1.6	0.6	205.6	1,777.8
87	2.0	109.3	151.6	86.5	138.0	122.9	139.5	583.5	0	0	81.0	23.3	1,437.6
88	134.8	166.2	120.4	161.4	133.7	171.4	159.7	345.8	2.5	86.3	52.4	176.5	1,711.1
89	68.3	242.5	77.9	151.1	135.8	174.3	176.7	377.5	10.4	39.8	25.5	22.7	1,502.5
90	61.4	174.4	93.8	37.4	149.2	142.9	393.7	80.5	26.6	19.6	70.0	80.0	1,329.5
Mean (12)	78.2	178.6	181.2	135.1	169.4	171.0	221.9	232.0	31.2	28.3	53.9	64.1	1,544.9

TABLE C-21 (7/11) MONTHLY RAINFALL AT A. MUANG

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952	57.2	180.6	180.8	46.7	232.5	81.9	199.1	447.8	213.5	306.3	0	15.7	1,962.1
53	22.4	162.2	159.2	254.5	116.7	78.8	336.0	287.6	23.9	67.7	123.3	42.9	1,675.2
54	88.3	145.9	216.5	146.4	210.4	274.4	422.1	15.5	236.2	133.4	0	2.5	1,891.6
55	92.3	270.5	243.1	87.3	101.8	167.9	473.7	620.0	33.0	87.9	13.6	64.0	2,255.1
56	76.7	195.3	144.5	195.0	111.7	157.6	504.2	445.0	60.2	24.1	40.4	91.3	2,046.0
57	13.5	79.0	95.4	185.2	119.9	209.0	270.1	148.3	34.4	77.8	29.5	45.4	1,307.5
58	49.5	128.8	159.2	157.0	257.1	74.0	292.9	217.4	55.7	27.8	2.5	115.2	1,537.1
59	130.7	148.1	131.2	307.2	138.0	159.5	585.7	218.1	145.8	35.9	199.3	5.2	2,204.7
60	59.9	150.6	162.3	284.9	232.3	136.2	279.2	197.2	67.9	57.9	207.3	126.6	1,962.3
61	159.1	291.4	161.3	125.5	150.3	138.1	183.7	741.3	415.5	356.6	54.7	58.3	2,835.8
62	23.6	143.8	75.7	356.6	246.0	162.0	613.8	200.6	123.0	95.3	21.3	3.0	2,064.7
63	60.4	78.7	226.5	115.9	151.0	209.5	440.3	289.0	155.1	71.1	53.9	184.1	2,035.5
64	53.1	268.4	81.8	106.6	210.8	175.1	234.9	312.7	87.6	66.1	38.0	131.0	1,766.1
65	115.2	214.9	161.2	221.3	165.9	137.4	365.8	220.0	217.2	21.6	29.9	106.7	1,977.1
66	11.3	138.3	142.9	156.6	123.6	370.9	367.6	468.9	247.6	193.0	64.0	26.7	2,311.1
67	57.1	270.6	93.7	224.3	214.5	63.3	346.5	185.6	145.4	52.3	121.5	8.8	1,783.6
68	164.1	126.3	177.6	205.5	269.5	135.2	227.9	210.9	192.8	228.0	77.2	101.4	2,116.4
69	105.2	192.4	134.5	229.4	157.9	178.2	192.4	370.3	98.5	153.3	48.5	14.6	1,875.2
70	139.8	109.5	243.6	159.4	353.5	56.9	148.1	794.0	412.8	11.1	37.2	32.2	2,498.1
71	5.0	178.5	224.9	145.9	92.0	143.6	425.3	365.6	51.7	13.9	0.8	27.3	1,674.5
72	115.5	89.3	220.1	186.4	194.4	79.4	289.2	642.9	216.6	19.7	9.9	111.4	2,174.8
73	7.5	148.5	166.6	276.1	139.9	268.8	315.5	434.2	93.6	3.1	141.1	66.4	2,061.3
74	56.6	202.8	106.6	137.0	145.7	106.5	142.2	557.3	180.0	593.9	71.3	2.8	2,302.7
75	34.0	102.1	257.3	144.5	362.3	159.8	381.6	345.2	107.0	4.5	0	51.7	1,950.0
76	112.0	285.9	98.9	118.0	75.6	113.2	369.5	200.5	48.9	134.4	346.3	55.2	1,958.1
77	7.1	127.4	134.6	146.5	275.6	193.4	194.1	554.4	107.0	262.5	196.3	27.1	2,226.0
78	191.0	326.2	110.4	116.4	314.1	148.0	330.8	195.6	29.4	5.8	28.6	2.1	1,798.4
79	55.0	187.5	178.2	344.3	398.9	132.1	142.4	104.6	19.8	4.6	54.5	15.4	1,637.3
80	110.3	125.7	194.8	202.8	168.6	133.6	124.3	567.3	89.0	16.2	80.0	0.1	1,812.7
81	67.3	301.4	218.0	95.8	173.1	161.9	298.8	470.8	27.2	18.9	16.1	197.0	2,046.3
82	198.0	261.0	168.8	318.2	307.6	218.2	243.9	463.8	199.0	48.1	9.4	1.1	2,437.1
83	3.0	109.4	158.5	165.3	76.9	135.8	189.5	410.3	72.7	22.0	103.2	25.7	1,472.3
84	49.9	79.6	297.4	80.3	310.2	181.4	240.7	198.9	92.2	101.0	16.6	82.1	1,730.4
85	91.0	287.6	246.3	84.6	175.9	136.8	220.4	254.4	189.7	8.9	2.6	11.4	1,709.6
86	3.2	247.8	165.8	243.0	233.6	230.1	264.4	188.8	140.2	17.8	0.5	37.6	1,772.8
87	3.5	214.8	186.4	41.0	134.9	83.1	272.8	340.9	5.2	33.0	24.2	10.1	1,349.9
88	134.1	113.0	211.2	178.9	134.0	166.6	184.7	534.7	7.8	175.1	20.6	158.3	2,019.0
89	94.3	272.5	194.1	250.8	204.3	166.0	142.1	435.9	28.4	26.6	11.1	2.5	1,828.6
90	44.0	165.8	138.4	45.6	195.6	100.8	346.3	353.7	36.8	54.2	33.6	112.3	1,627.1
Mean (39)	73.4	182.6	171.0	176.6	196.9	154.5	297.5	359.2	120.7	93.1	59.7	55.7	1,940.9
65 - 86	77.2	186.9	177.3	181.9	215.0	158.4	264.6	372.9	135.4	87.9	66.2	45.7	1,969.4

TABLE C - 21 (8/11) MONTHLY RAINFALL AT SAM KAEO REGULATOR

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952	-	-	-	-	246.4	159.9	251.6	404.3	197.5	265.2	190.3	20.3	-
53	107.5	124.0	201.6	231.0	122.1	56.5	362.0	255.5	0	59.0	46.5	29.8	1595.5
54	79.1	129.1	152.1	140.9	149.1	262.7	416.4	31.7	170.1	101.0	30.6	0	1662.8
55	11.3	100.5	191.5	93.3	92.1	147.1	482.8	545.7	22.7	7.7	0	9.3	1704.0
56	149.5	198.5	139.7	200.8	105.2	135.6	407.6	208.4	23.1	36.7	27.4	117.7	1750.2
57	24.0	48.4	92.0	214.8	99.7	259.9	297.3	129.5	13.4	19.3	0	42.0	1240.3
58	61.0	139.5	155.8	187.6	221.1	52.9	313.1	170.9	55.6	27.7	2.2	140.4	1527.8
59	147.9	135.2	134.4	273.2	179.4	167.7	426.1	147.5	124.5	61.3	218.3	17.2	2032.7
60	58.1	183.8	173.1	289.6	219.2	144.1	252.9	224.6	35.8	81.5	206.8	119.0	1988.5
61	197.9	331.4	174.8	129.3	146.9	107.3	184.9	717.3	154.4	378.5	78.2	64.4	2765.3
62	20.9	175.0	81.4	365.6	248.6	98.1	497.0	162.5	106.1	58.0	24.1	0	1837.3
63	33.5	48.9	216.0	101.9	143.5	156.7	393.4	252.2	164.7	76.0	58.7	207.4	1852.9
64	15.7	261.0	92.1	101.9	227.3	171.2	193.1	254.5	75.5	67.3	45.5	120.9	1626.0
65	104.5	174.2	167.7	250.1	178.6	172.4	479.5	257.0	234.4	11.6	59.2	122.8	2212.0
66	12.6	156.4	153.1	170.1	143.1	316.6	245.1	416.9	225.8	101.4	25.1	50.0	2016.2
67	33.8	219.4	109.5	235.5	261.9	95.1	286.4	225.4	127.0	40.0	122.3	8.7	1765.0
68	135.0	108.3	173.9	207.1	350.6	159.5	268.6	317.8	210.6	215.5	113.0	119.5	2379.4
69	91.8	258.0	122.7	310.5	172.1	221.0	297.9	457.7	132.4	188.7	72.3	17.8	2342.9
70	139.2	103.8	295.3	183.0	459.4	54.6	136.5	1038.3	536.5	7.8	25.4	0	2979.8
71	-	-	-	-	-	-	177.0	257.0	56.9	14.7	0	21.2	-
72	133.0	99.7	290.1	240.2	298.3	86.0	274.6	811.0	315.0	12.0	12.6	108.7	2681.2
73	16.2	131.4	222.8	291.5	190.8	195.2	451.6	471.8	122.2	5.1	166.7	88.1	2353.4
74	87.7	244.8	120.1	183.8	210.4	105.5	204.9	635.7	145.0	-	-	4.2	-
75	36.7	143.6	327.6	171.0	418.6	153.7	280.6	420.0	68.2	9.0	0	55.4	2084.4
76	145.4	334.5	101.7	121.8	88.1	106.7	358.7	252.9	42.1	141.8	367.9	71.3	2132.9
77	0	159.2	174.7	163.9	363.3	212.1	238.1	607.4	144.0	294.4	244.5	29.7	2631.3
78	238.8	509.7	98.6	242.6	437.7	218.5	418.8	232.0	49.4	22.2	59.4	6.2	2533.9
79	59.2	262.6	206.3	446.9	480.4	140.9	204.3	126.8	34.8	2.0	100.5	47.0	2111.7
80	147.2	169.2	217.1	212.7	211.6	215.0	188.3	722.5	92.8	38.5	95.7	0	2310.6
81	66.2	353.2	304.8	54.4	226.9	200.4	381.1	645.9	30.7	15.5	41.9	195.9	2516.9
82	281.3	329.7	218.8	321.8	399.9	263.7	234.3	604.1	211.3	80.2	6.2	0	2961.3
83	0	188.4	246.0	196.3	107.9	229.3	320.9	573.9	30.4	64.2	139.0	34.2	2130.5
84	53.2	87.7	463.9	128.0	419.6	247.0	269.2	220.1	117.1	120.0	0	142.7	2268.5
85	163.1	309.0	315.1	66.2	233.4	194.5	385.3	273.3	185.7	21.5	0	0	2147.1
86	0	347.1	207.1	350.0	319.1	174.5	299.5	226.3	182.6	1.8	1.7	69.8	2179.5
87	4.6	258.4	277.7	42.6	197.7	123.2	316.5	373.2	2.4	34.3	23.7	0	1654.3
88	109.5	120.3	322.0	241.8	230.8	196.8	210.9	803.6	8.4	207.4	25.5	200.9	2677.9
89	98.4	379.8	248.5	336.7	307.9	178.8	197.9	597.0	18.7	21.3	13.2	3.6	2401.8
90	92.1	219.5	167.5	48.1	303.7	-	-	-	-	-	-	-	-
Mean (35)	85.0	202.3	202.0	209.0	241.5	169.0	313.5	393.6	119.4	75.1	70.1	64.0	2144.5

TABLE C-21 (9/11) MONTHLY RAINFALL AT A. BANG SAPHAN

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952	-	-	-	-	-	-	-	-	-	-	136.0	0	-
53	12.7	85.1	144.2	62.5	2.2	55.0	41.8	115.4	0	0	0	3.1	522.0
54	8.1	136.0	98.0	47.0	85.6	160.3	240.5	0	0	32.6	12.0	31.7	851.8
55	56.8	215.5	184.5	18.2	67.1	126.2	-	329.0	39.5	0	8.2	74.8	-
56	56.5	293.1	93.0	168.6	96.6	108.0	374.8	166.5	2.1	7.6	14.5	20.0	1401.6
57	30.3	17.7	39.9	224.4	108.4	176.2	232.1	91.2	5.7	66.1	41.1	14.8	1047.9
58	6.2	68.1	86.2	144.6	179.7	68.9	309.4	51.8	0	16.9	1.3	46.4	979.5
59	91.8	82.2	115.5	229.6	126.4	138.3	296.8	73.7	201.9	10.3	152.0	0	1518.5
60	72.7	98.0	164.1	102.2	128.7	152.3	370.7	229.2	11.1	62.9	217.9	109.5	1719.3
61	233.8	238.2	83.4	110.8	125.6	41.7	138.9	219.4	137.4	165.3	29.2	31.5	1555.2
62	22.7	71.5	79.1	93.8	161.3	68.6	371.6	89.2	74.2	81.1	91.3	0	1204.4
63	49.2	75.4	183.2	120.6	73.0	295.6	333.9	250.2	4.3	69.2	50.8	144.6	1650.0
64	12.3	143.3	39.6	331.6	316.3	184.6	99.2	189.1	20.8	105.6	87.8	54.3	1584.5
65	63.9	140.3	109.2	185.2	132.9	100.7	525.7	86.9	225.5	1.3	123.7	4.8	1700.1
66	28.6	200.4	116.2	55.7	106.9	360.8	252.2	512.9	33.7	20.3	167.6	67.5	1922.8
67	9.3	63.9	45.5	131.5	40.4	17.0	297.5	155.4	18.6	15.6	84.0	46.1	924.8
68	20.2	102.2	134.7	137.8	155.5	136.5	110.0	226.4	48.3	119.6	33.1	44.5	1268.8
69	10.1	33.5	-	-	-	-	-	-	-	-	-	-	-
70	-	-	-	-	-	-	-	-	-	-	-	-	-
71	18.3	100.9	128.5	90.5	87.8	130.8	506.5	17.2	0	10.5	18.4	29.2	1138.6
72	28.3	10.0	43.3	78.9	27.3	30.0	38.0	188.0	174.2	0	0	0	618.0
73	8.7	18.0	48.2	100.9	42.7	0	364.1	259.2	0	0	28.0	32.6	902.4
74	29.4	121.2	41.6	62.0	76.0	37.7	57.0	0	10.0	0	0	0	434.9
75	0	129.0	139.2	154.2	76.9	325.9	0	0	121.5	0	0	6.5	953.2
76	11.4	55.6	22.5	28.1	57.0	81.0	115.1	71.4	0	0	0	0	442.1
77	0	54.5	63.7	203.0	146.1	134.0	194.9	226.2	7.3	81.8	409.7	0	1521.2
78	28.5	375.7	26.7	98.3	219.0	136.5	260.3	23.1	0	13.6	4.6	0	1186.3
79	76.2	104.6	80.4	233.3	226.7	161.1	75.6	27.1	9.1	3.1	60.2	20.0	1077.4
80	2.1	73.1	170.4	134.2	92.2	78.3	138.1	31.3	112.1	13.5	112.6	12.5	970.4
81	98.7	322.6	204.6	32.1	167.9	190.1	249.1	543.2	0	9.9	87.6	49.5	1955.3
82	119.5	167.2	145.1	201.9	247.6	155.0	181.2	271.8	28.9	15.2	0	10.1	1543.5
83	0	105.7	280.7	69.7	168.7	97.8	265.6	308.7	114.9	61.1	133.0	6.8	1612.7
84	4.3	47.7	264.7	64.4	152.0	145.2	122.0	23.9	57.1	61.0	49.7	34.4	1026.4
85	97.4	232.0	172.5	42.8	129.3	242.4	307.0	258.3	0	0	7.5	0	1489.2
86	0.8	284.0	146.6	146.4	97.7	256.6	425.1	72.0	37.3	0	4.0	291.8	1762.3
87	0	105.4	145.5	21.2	105.7	49.1	189.7	710.3	0	0	26.7	2.5	1356.1
88	193.3	50.1	90.0	112.2	61.6	251.1	158.6	300.1	0	60.2	87.8	108.5	1473.5
89	17.3	105.6	87.0	182.1	145.4	129.4	224.7	398.2	2.9	40.1	42.3	33.3	1408.3
90	65 5	89.9	44.3	39.5	90.7	97.3	361.1	123.6	41.5	3.2	79.6	-	-
Mean (34)	42.7	125.8	112.7	123.6	122.6	138.1	231.4	182.0	42.9	33.7	64.1	37.0	1256.6

TABLE C-21 (10/11) MONTHLY RAINFALL AT SAWI AGROMETOROLOGICAL STATION

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952													
53													
54													
55													
56													
57													
58													
59													
60													
61													
62													
63													
64													
65													
66													
67	-	-	-	-	239.9	77.4	306.4	296.6	0	0	0	0.1	-
68	122.8	118.7	131.0	149.0	241.7	129.9	306.6	179.0	177.7	167.7	98.5	99.7	1922.3
69	109.8	224.9	71.9	209.0	120.3	217.9	130.6	284.8	78.8	188.2	27.3	62.0	1725.5
70	91.9	185.7	226.2	185.8	276.8	60.4	94.3	731.4	376.5	8.6	39.9	82.0	2359.5
71	18.6	72.3	215.1	120.5	132.5	129.4	429.1	307.6	55.9	11.5	1.0	25.1	1518.6
72	104.3	79.7	285.8	260.7	156.3	169.3	252.6	569.5	243.2	11.6	17.9	67.9	2218.8
73	1.6	318.2	84.5	243.4	154.1	217.6	420.7	481.5	100.1	7.0	111.9	46.2	2186.8
74	123.8	195.7	80.6	164.3	222.4	135.2	83.2	550.5	139.4	589.3	94.7	6.7	2385.8
75	49.9	189.9	356.4	80.0	373.9	150.8	256.4	364.6	118.6	12.2	1.4	15.8	1969.9
76	61.8	327.0	285.4	68.1	220.5	112.2	397.1	239.9	47.6	173.7	180.9	58.5	2172.7
77	9.8	112.3	250.7	103.7	234.9	178.4	159.8	415.2	114.0	196.0	156.2	17.2	1948.2
78	156.2	323.9	67.6	177.6	297.3	153.3	299.2	99.2	42.6	8.1	58.7	6.3	1690.0
79	81.5	216.2	250.7	305.1	355.0	111.1	142.2	151.7	33.9	10.4	41.6	87.0	1786.4
80	122.7	115.4	215.7	141.1	181.3	151.0	204.5	503.3	93.7	6.5	43.9	0	1779.1
81	118.1	244.8	235.9	67.6	174.2	242.5	218.3	432.8	41.0	20.4	5.7	61.4	1862.7
82	184.5	270.0	139.8	211.9	219.3	176.9	212.3	331.6	137.7	45.1	0	2.0	1941.1
83	3.6	67.1	172.5	94.8	147.1	209.2	191.2	307.7	49.8	89.7	54.4	33.2	1420.3
84	29.9	141.9	255.4	91.1	273.7	123.5	181.4	177.8	141.0	79.2	2.0	70.8	1567.7
85	96.9	265.0	252.3	78.9	158.3	137.9	261.6	277.0	180.8	8.8	3.2	17.6	1738.3
86	3.2	282.5	162.0	181.6	270.0	233.4	168.2	216.0	176.7	21.5	4.2	49.3	1768.6
87	18.9	211.0	167.7	46.0	140.2	128.0	191.6	306.8	12.7	25.7	111.5	46.9	1407.0
88	97.1	169.5	199.6	249.1	157.9	151.2	152.6	600.7	12.1	109.4	5.5	68.9	1973.6
89	56.9	529.1	110.6	147.1	151.2	212.0	190.2	382.1	43.5	13.0	1.3	4.2	1841.2
90	125.9	180.6	131.4	67.3	235.3	126.9	294.4	210.4	20.0	35.2	21.9	177.9	1627.2
Mean (23)	77.8	210.5	189.1	150.2	212.8	159.0	227.8	353.1	106.0	79.9	47.1	48.1	1861.4

TABLE C-21 (11/11) MONTHLY RAINFALL AT A. KRA BURI

Unit : mm

Water Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1952	0	120.2	300.6	324.0	529.0	278.0	264.0	118.0	120.1	103.4	25.0	35.0	2217.3
53	30.0	279.0	285.0	258.0	137.0	277.0	164.2	242.6	0	0	0	18.6	1591.4
54	106.9	77.4	105.5	132.9	145.0	262.9	0	28.6	20.8	43.1	24.7	0	974.8
55	158.5	299.3	472.6	213.9	231.5	393.0	339.3	315.1	4.6	0	29.2	98.9	2555.8
56	123.4	422.5	578.1	646.3	420.8	367.6	137.9	147.3	0	0	0	26.3	2870.2
57	189.1	362.7	406.6	414.3	526.7	941.0	647.5	10.6	0	18.2	0	0	3516.7
58	37.4	437.2	856.5	493.1	904.5	283.8	441.9	167.2	12.2	0	0	80.4	3714.2
59	75.8	96.8	530.9	751.8	690.5	361.3	261.3	27.0	53.7	0	0	0	2849.1
60	12.6	448.1	696.2	612.6	535.3	951.6	710.6	187.2	0	18.6	11.5	23.6	4207.9
61	281.0	1015.3	583.8	850.9	816.2	1114.4	353.2	188.6	85.0	0	0	73.2	5361.6
62	69.9	557.2	751.8	928.9	334.5	367.8	384.7	10.2	0	11.2	0	108.6	3524.8
63	25.3	282.7	564.6	264.3	702.8	390.7	301.6	67.7	66.6	0	4.2	66.4	2736.9
64	59.4	510.3	382.9	130.7	685.2	566.8	132.6	137.6	30.4	1.5	57.6	19.3	2714.3
65	38.8	495.5	514.0	883.1	760.5	1271.7	528.7	112.4	159.4	0	13.0	59.8	4836.9
66	70.3	798.3	99.5	864.5	483.7	581.2	254.8	323.5	20.9	52.4	0.6	18.3	3568.0
67	189.2	312.7	363.9	749.9	869.0	179.3	212.2	83.0	41.5	1.8	14.0	0	3016.5
68	124.8	313.7	369.3	332.4	545.7	579.1	156.2	11.7	18.2	25.1	41.0	0	2517.2
69	6.7	255.5	317.5	564.3	213.1	789.1	268.7	278.8	11.4	37.7	0	25.1	2767.9
70	104.2	189.0	700.8	337.1	760.6	238.9	147.5	423.9	115.4	0	3.1	60.8	3081.3
71	225.4	150.2	526.0	517.4	417.0	353.6	687.2	50.1	0	0	3.4	18.5	2948.8
72	29.1	207.3	532.2	605.2	406.7	214.8	64.3	169.6	198.5	0	0	0	2427.7
73	16.2	34.2	324.9	793.3	578.8	300.9	195.6	195.3	0	0	9.2	0	2448.4
74	71.5	321.0	449.5	282.8	768.8	97.4	382.6	279.4	0	52.6	32.9	23.5	2762.0
75	36.6	280.4	512.5	88.5	647.9	350.8	233.0	139.9	13.6	0	0	15.4	2318.6
76	-	557.5	275.2	201.6	-	405.8	147.4	40.9	0.5	0	27.4	0	-
77	0	27.4	93.1	103.4	366.7	192.4	70.1	33.5	0	10.9	0	8.5	906.0
78	46.3	244.7	348.8	256.9	548.9	280.3	132.7	29.6	0	0	0	27.0	1915.2
79	81.2	243.7	171.9	522.9	423.0	225.4	121.8	26.9	0	0	0	0	1816.8
80	0	233.3	499.0	332.3	634.1	330.6	205.8	12.1	0	0	16.3	27.4	2290.9
81	75.3	178.8	505.9	460.9	393.1	303.9	178.6	228.9	0	0	0	26.2	2351.6
82	148.3	159.2	179.6	297.7	684.6	235.2	137.4	55.7	30.5	0	2.6	0	1930.8
83	0	290.6	284.9	316.2	444.7	376.8	216.9	161.8	4.9	13.9	0	86.2	2196.9
84	199.9	263.6	648.4	170.7	626.2	326.2	186.8	16.3	0	19.3	79.3	0	2536.7
85	66.3	162.8	526.7	104.3	450.2	374.9	302.0	83.7	35.5	0	0	27.9	2134.3
86	47.7	324.7	316.4	383.7	578.6	394.3	34.5	33.5	0	0	0	27.9	2141.3
87	70.7	226.3	242.3	77.8	424.9	357.8	118.2	225.6	19.1	1.0	7.3	25.7	1796.7
88	85.0	172.5	235.4	221.1	150.9	366.8	320.9	203.5	0	29.8	5.3	0	1791.2
89	95.5	500.9	383.2	232.0	412.2	186.8	76.7	136.7	0	-	-	-	-
90	119.8	246.0	797.4	421.1	668.8	485.4	419.3	97.3	1.9	26.3	6.2	10.8	3300.3
Mean (37)	81.7	298.4	434.4	424.6	527.2	426.0	262.5	130.4	28.8	12.6	10.4	28.1	2665.1