Ministry of Water Resources and Meteorology,
Ministry of Agriculture, Forestry and Fisheries,
The Kingdom of Cambodia

THE STUDY
ON
COMPREHENSIVE AGRICULTURAL DEVELOPMENT OF PREK THNOT RIVER BASIN
IN
THE KINGDOM OF CAMBODIA

FINAL REPORT

Volume - VI
Appendixes for Master Plan

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Appendix-A

HYDROMETEOROLOGY

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Chapter A-1 Hydrometeorological Conditions

A-1.1 Existing Conditions of Hydrometeorological Observation

A-1.1.1 Meteorological Observation

There is only one meteorological observation station in and around the Prek Thnot River basin. That is located at Pochentong in Phnom Penh City being managed by the Department of Meteorology (DOM) under MOWRAM. This is an automatic gauging station and the meteorological data of temperature, relative humidity, wind speed, sunshine hours, evaporation and rainfall data have been recorded. The rainfall gauge is a tipping bucket type gauge with data logger. Data record is made on a magnetic card. The data logger at Pochentong station was replaced with a new one in August 2005 but the old data log was lost at that time and the data in the old logger period are not available.

A meteorological observation station for agricultural purpose was established in 1994 at the Tonle Bati Center. But according to the Department of Hydrology and River Works (DHRW) under MOWRAM, it was not maintained after the project was over. Some meteorological stations have been established by an on-going project of the Technical Service Center (TSC) but data are not available yet. If these stations are maintained as permanent stations after the project, it may contribute to future meteorological study.

Automatic rain gauge at Pochentong

Data logger of rainfall, temperature etc. in box

A-1.1.2 Rainfall Observation

Other than the Pochentong station, there is another automatic rainfall gauging station at Kampong Speu PDOWRAM office. This station was established in 2000. The type of rain gauge and the recording system are the same with those of the gauging station in Pochentong. Kampong Speu gauging station of Hymos code 110404 renamed from Chbar Mon has a record of rainfall from 1966.

The rainfall gauge at Kampong Tuol station managed by Engineering Department under MOWRAM is tipping bucket type rain gauge with data logger. Presently the measurement and data downloading are not possible because of mechanical trouble.

As for the ordinary rainfall gauging station, there are 16 rainfall gauging stations in and around the Prek Thnot River basin.

Long term monthly rainfall records from 1901 to 1972 at Phnom Penh station were prepared by the Euroconsultant in the Reappraisal Report of the Prek Thnot Multipurpose Project, Volume 5.2 - Annex I for Australian Catholic Relief in December 1991. The following are existing rainfall gauging stations under the Mekong River Commission in the study area.

Existing Rainfall Gauging Stations in the Study Area

No.	HYMOS Code No.	Station Name	Location		Remarks (Record, Gauge Type, etc.)
			East	North	
1	110404	Kampong Speu	11°20'38"	104°03'20"	Chbar Mon('66-'02), Automatic ('02)
2	110413	Phnom Srouch	11°23'03"	104°22'46"	Record ('66-), Manual
3	110415	Odongk	11°47'00"	104°44'00"	Record ('87-), Manual
4	110416	Srae Klong	11°19'36"	104°17'26"	Record ('66-), Manual
5	110419	Krang Ampil	11°22'27"	104°31'34"	Record ('00-), Manual
6	110421	Kirirom	11°19'00"	104°03'20"	Record ('00-), Manual
7	110423	Thnal Toteung	11°29'00"	104°40'00"	Record ('83-), Manual
8	110431	Basedth	11°09'03"	104°32'26"	Record ('87-), Manual
9	110432	Kong Pisel	11°17'54"	104°37'54"	Record ('84-), Manual
10	110433	Aoral	11°41'15"	104°08'16"	Record ('97-), Manual
11	110434	Ou Taroth	11°32'11"	104°25'25"	Record ('00-), Manual
12	110435	Prey Pdau	-	-	Record ('83-), Manual
13	110436	Prey Dob	11°13'17"	104°33'23"	Record ('00-), Manual
14	110437	Sdok	11°15'36"	104°31'00"	Record ('00-), Manual
15	110445	Trapeang Thor	11°49'02"	104°08'13"	Record ('00-), Manual
16	120427	Thpong	-	-	Record ('87-), Manual
17	110425	Pochentong	-	-	Record ('1901-), Automatic
18	-	Peam Khley	-	-	Record ('00-), Manual

Manual rain gauge at Aoral

Automatic rain gauge with data logger
At Kampong Speu

The daily rainfall is measured by a villager under a contract with Kampong Speu PDOWRAM. Rainfall data are collected to PDOWRAM through district office and kept in the PDOWRAM office. The rainfall data recorded by automatic recorders with data logger at Kampong Speu is collected by PDOWRAM and DHRW.

Figure A.1 shows a list of hydrological and meteorological data available in and around the Prek Thnot River basin. Figure A.2 shows a location map of hydrological and meteorological observation stations.

A-1.1.3 Water Level Observation and Discharge Measurement

There are 3 ordinary water level gauging stations along the Prek Thnot River. Gauging stations at Peam Khley and Thnuos Luong were established by DHRW in 1996. Gauging station at Roleang Chrey regulating weir was established in 1999. Water level is observed twice a day at 7 a.m. and 7 p.m. on the staff gauge. The first water level gauging along the Prek Thnot River started at Thnuos Luong in 1962. The water level gauging began at Peam Khley by DHWR in Year 1996. The staff gauges at Roleang Chrey regulating weir was installed in 1999 and managed by PDOWRAM. As of September 2005, there are six water level gauging stations along the Prek Thnot River.

The existing water level gauging stations along the Prek Thnot River are shown in the below table:

Water Level Gauging Station along the Prek Thnot River

HYMOS Code No.	Station Name	Location		Remarks
		East	North	
640103	Peam Khley	11° 28′13″	104° 21′68″	Automatic (Pressure Type)
640102	Thnuos Luong	11° 27′22″	104° 30′36″	Bridge of No.4 Road, No equipment
640101	Anlong Touk	11° 26′07″	104° 26′36″	No operation, Staff Gauge, access far
	Roleang Chrey			Staff Gauge
	Trapeang Kong			14 km downstream of Thnuos Luong, No operation
	Kampong Tuol	(Tuk Thla Regulating Weir)		Atutomatic (Pressure Type), No operation

The water level gauge at Peam Khley has a pressure sensor with data logger and the staff gauge reading is continued at Roleang Chrey Regulator. The operation at Thnuos Luong and Trapeang Kong stopped because of the demolition of the facilities. In the upstream catchments of the River basin, staff gauges were temporally installed on the Areang River at Aoral Bridge for the water resources development study by donor countries, but the water level observation was not continued after the study. The water level gauging equipment with pressure sensor at Tuk Thla regulating weir was installed under JICA Grant Aid Project but the observation is not active because of mechanical trouble.

Water level gauging station with data logger
At Peam Khley

Staff gauge downstream at Roleang Chrey
Regulator

Thnuos Luong Station Site
Staff gauge on the pier of Kampong Speu Bridge

Trapeang Kong Station

Staff gauge at Aoral, Areang River

Water level gauging station at Tuk Thla Regulating
Weir

Discharges at these gauging stations are computed from the discharge rating curves developed by DHRW based on the discharge measurement. Data on discharge

measurement, data log, rating curves, daily water stage and discharge at Peam Khley, Thnuos Luong and Roleang Chrey Regulator are available. The periods of available data vary from 5 years to 9 years by stations. However discharge measurement has not been conducted since 2000 due to the shortage of budget.

The recorded flood discharge at Peam Khley and Thnuos Luong will be used for the calibration of flood simulation. Discharge data at Peam Khley are utilized for low flow analysis and flood analysis.

A-1.2 Hydrometeorological Conditions

A-1.2.1 Climate

The climatic classification of Cambodia is the tropical monsoon climate with definite rainy and dry seasons. Monthly meteorological situations such as temperature, relative humidity, wind speed, sunshine hours and evaporation, at Pochentong are shown in Tables A.1 to A.5.

Monthly mean temperature at the Pochentong station in Phnom Penh city shows small seasonal variation from 26.1°C in December to 30.5°C in April. Monthly maximum temperature higher than 31°C is common and just prior to the rainy season, it rises to higher than 35.8°C. Monthly minimum temperature rarely falls below 21°C. Monthly mean relative humidity ranges from 66% to 77% in February and March and 80% to 90% in September and October. The relative humidity is high at night and low at daytime throughout the year.

A-1.2.2 Rainfall and Discharge

Long term monthly rainfall records from 1901 to 1972 at Phnom Penh station were prepared by the Euroconsultant in the Reappraisal Report of the Prek Thnot Multipurpose Project, Volume 5.2 - Annex I for Australian Catholic Relief in December 1991. Monthly rainfall data are updated till 2005 as shown in Table A.6.

Basin rainfall is computed on the basis of rainfall data at 15 existing stations and 4 new stations by Thiessen method. Data of the stations at new locations, Phum Chum, Prey Kaniech, O Kon Trom and Roleang Chrey are supplemented by the data from existing adjacent stations for the calculation of basin rainfall. Missing data at the existing station is also supplemented by the data from adjacent stations data. Average annual rainfall in the Prek Thnot River basin is estimated at 1,225 mm, and the heaviest amount falls in the southwest of the Prek Thnot River basin. Isohyetal map of the basin is shown in Figure A-3. The seasonal distribution is the rainy season from May to November and the dry season from December to April. The rainy season accounts for 90% of the annual rainfall. Most rain is showery and hyetal region is small.

These gauging stations with Thiessen Polygon covering area are as shown in Figure A.4. The basin rainfall for the year 2001 to 2004 is calculated by this Thiessen Polygon as shown in Table A.7. The average annual basin rainfall is 1,225mm for 4 years from 2001 to 2004. Annual maximum daily rainfall of the Prek Thnot River basin is listed in Table A.8.

The recorded annual maximum daily discharge at Peam Khley for 8 years from 1997 to 2004 are listed in the table on the right.

Annual Flood Records at Peam Khley

Date	m^3/s
4/8/1997	826.48
5/10/1998	506.88
1/11/1999	797.92
16/10/2000	1276.09
11/10/2001	866.23
22/8/2002	131.88
26/07/2003	926.24
7/10/2004	214.02

A-1.2.3 River System

The Prek Thnot River flows in the direction of southeast to east from the Elephant

mountain region as the origin. The highest elevation of the basin is El. 1,543 m above mean sea level. The major tributaries of the Prek Thnot River are the Ta Sal River, the Trang Krang River, the Areang River, the Phleach River, the Ou Koun Tadak River, the Tang Haong River, and the Ou Krang Ambel River.

The schematic diagram of the Prek Thnot River system is shown in Figure A.5. The Prek Thnot River joins the Bassac River at Kandal. The catchment area of the Prek Thnot River and the length of river course are about 5,740 km^2 and 232 km at the confluence with the Bassac River.

The Prek Thnot River basin is divided into sub-basins in consideration of the basin size proper for flood runoff calculation. The basic basin division of the Prek Thnot River basin is shown in Figure A.6. Catchment area is measured on the topographic map on a scale of 1/100,000. Total catchment area of the basin is derived at 5,740 km^2 and this figure is used to calculate basin rainfall. The catchment areas of sub-basins are shown in the table on the right.

Catchment Area of Each Sub-basin

Sub-basin	C.A.(km^2)
Trang Krang River	294
Ta Sal River	674
Aveaeng River	431
Phleach River	235
Aoral Sub-basin	502
Tang Haong River	1,435
Aulong Ramlich River	228
Bat Kmeng River	300
Krang Ambel River	455
Kandal Sub-basin	78
Residual Basin	18
Total	4,650

A-1.2.4 Discharge Rating Curve

The water stage records of the Prek Thnot River are collected at the Peam Khley and Thnuos Luong gauging stations by DHRW since 1997 and those at Roleang Chrey Regulator since 2000. Discharge measurements of these stations are carried out by DHRW.

In order to convert the water stage to discharge, an equation of rating curve is derived by least square method based on the above measurement as expressed below.

Peam Khley gauging station;

$H > 2.3m$

$Q = 20.891 \times H^2 - 45.194 \times H + 30.069$

$H \leq 2.3m$

$Q = 12.805 \times H^2 - 15.27 \times H + 3.9947$

where, Q: discharge in m^3/s, H: gauge height in m

Thnuos Luong gauging station;

$Q = 7.805 \times H^2 + 8.427 \times H$

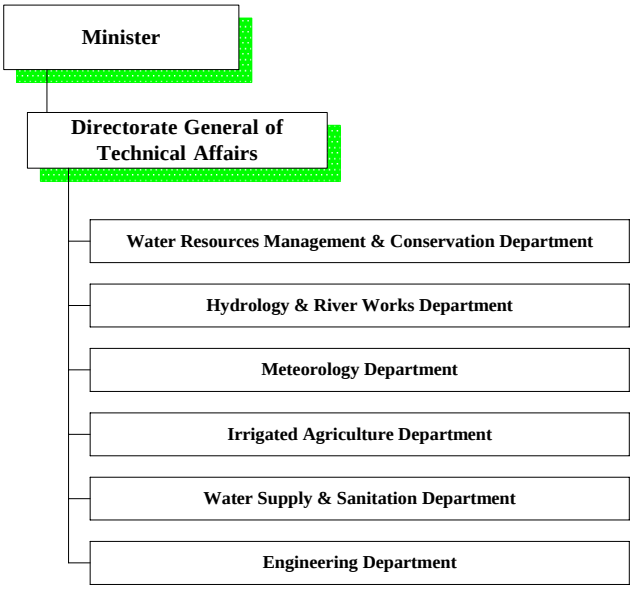
Rating curves with discharge measurement data for Peam Khley gauging station are shown in Figure A.7. Rating curve generally varies year by year in accordance with the change of river cross section. As to above gauging stations, such time trend of rating curve change is not recognized yet.

A-1.3 Current Observation Structure

A-1.3.1 Institutional Frame

(1) MOWRAM

The Ministry of Water Resources and Meteorology (MOWRAM) was established in the second mandate of the Royal Government of Cambodia by the Royal Law, dated on June 23, 1999.



MOWRAM has the function to manage the water resources and meteorology sector in Cambodia. MOWRAM has the responsibility to collect, compile and utilize meteorological and hydrological data to serve other sectors of the nation.

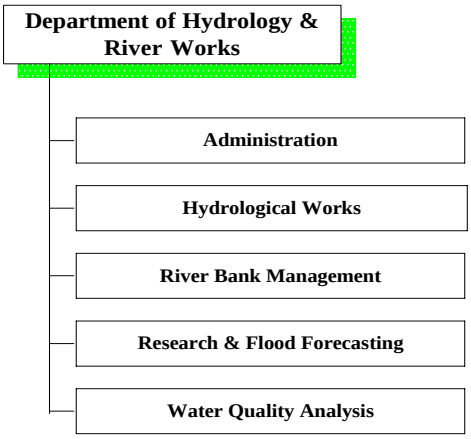
MOWRAM is composed of, three Directorates of Inspection, Administration Affairs, and Technical Affairs, and Provincial Districts of Water Resources and Meteorology. The Directorate General of Technical Affairs has six Departments. Among the Departments, the Department of Hydrology and River Works (DHRW), the Department of Meteorology (DOM) and Provincial District of Water Resources and Meteorology (PDOWRAM) in Kampong Speu are key agencies in meteohydrological monitoring in this Study. The roles and functions of MOWRAM are shown below:

- To define the policies and strategic development of water resources in order to serve the exploitation, development and sustainable conservation at the national and international level consistent with the policy program of the Royal Government of Cambodia.
- To study and research the potential of available water resources, including surface, underground and atmospheric.
- To prepare the short, medium and long term plans for the exploitation, development and conservation of water resources and meteorology to serve the national economy and living standards of Cambodian people in cities and rural areas.
- To manage and supervise all of the direct and indirect exploitations of water resources in a rational manner and to minimize water/flood related disasters.
- To draft the water law, including major principles and regulations related to the management of water resources, and monitoring the enforcement of the law.
- To collect, compile and utilize meteorological and hydrological data to serve other sectors of the nation.
- To provide technical support and advice to private sectors, organizations, communities, and all people, related to improvement and exploitation of water resources.
- To expand and provide new technologies and promote training.
- To strengthen and expand the national and international collaboration on water resources management and meteorology.
- To participate in the implementation of works by the Mekong River Commission (MRC) consistent with the obligations of MOWRAM

(2) DHRW

Organization of meteorological and hydrological activities in Cambodia was changed in

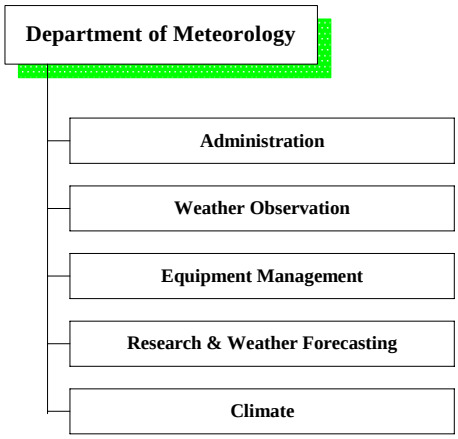
January 1999 with a decree by the Prime minister. DHRW has the main responsibilities of administration and operation of hydrological services and river works for water resources development and flood forecasting in Cambodia. DHRW has five units as shown below with following roles and functions.



- To prepare and install hydrological stations in all major river basins
- To prepare short-, medium-, and long-term plans on hydrological and river works
- To monitor and research the hydrological regime in surface water and groundwater
- To measure the water level, water flow and sedimentation in rivers
- To monitor the water quality at main hydrological stations
- To research and study on hydrological and hydrodynamic model, and water potential on surface and ground water
- To manage and exchange the hydrological information including flood forecasting and warning
- To forecast the natural disaster and inform in advance according to the needs of various organizations
- To prepare the geographic information system of development and improvement of water sector

(3) DOM

The Department of Meteorology is in charge of meteorological service activities and the project operation and maintenance under supervision of MOWRAM.

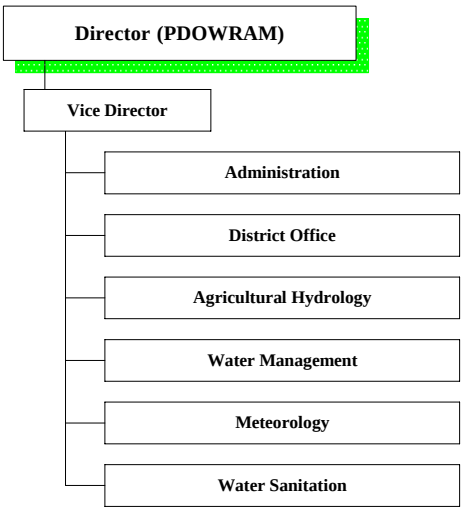


The main responsibility of the Department is that administration and operation of the whole meteorological services in Cambodia and provision of the meteorological information to the neighboring countries as per WMO charter. The Department has the following responsibilities in Cambodia.

- To prepare the plan for rehabilitation and development of the meteorology.
- To establish and manage the meteorological stations.
- To observe the weather conduction for the purpose of serving for all concerning sectors.
- To collect and exchange the meteorological data in external and internal.
- To forecast for the needs of various organizations and inform in advance the natural disaster.
- To prepare the annual report on condition of meteorology.
- To strengthen and broaden national and international cooperation on meteorology.
- To strengthen on natural disaster phenomena related to the climate and seismology.

(4) PDOWRAM

The agency with the responsibilities of administration and operation of meteorological and hydrological services, water management, and sanitation in the province is the Provincial Department of Water Resources and Meteorology (PDOWRAM) under MOWRAM.



Three provinces of Kampong Speu, Kandal and Takeo are included in the Study Area. The major study area belongs to Kampong Speu with five districts of Aoral, Chbar Mon, Kong Pisei, Phnum Sruoch and Samraong Tong.

PDOWRAM of Kampong Speu is composed of five units and eight district offices. The operation and management of eighteen rainfall gauging stations and Roleang Chery gate facility belong to Kampong Speu PDOWRAM.

A-1.3.2 Monitoring Conditions

(1) Monitoring Item

The meteorological monitoring items at Pochentong station in Phnom Penh City are rainfall, temperature, humidity, pressure and wind. The monitoring item in the study area is only rainfall.

The hydrological parameters to be measured at hydrological observation stations are water level, discharge, sedimentation load, water quality and temperature.

(2) Data Transmission

DOM generally contacts the synoptic offices for meteorological data via HF/SSB radios. Pochentong is only one synoptic office in the Prek Thnot River basin. Rainfall data at other rainfall stations in the basin are sent to DOM headquarters and DHRW in paper form monthly or yearly by PDOWRAM.

The water level data at Peam Khley stored in the data logger is downloaded by a PC connecting to the logger by DHRW. Staffs gauge reading data at Roleang Chrey Regulator is filled in the form by PDOWRAM and the observation report is sent to DHRW monthly. During flood, PDOWRAM staff contacts PDOWRAM Headquarter via HF radio or mobile phone and the water level data of short interval is informed. The water level observation at Tuk Thla is under Engineering Department of MOWRAM and the data is reported to DHWR monthly.

(3) Data Base System

HYMOS data base system is installed in DHRW's computer and information system for storage, processing and presentation of hydrological and environmental data is available. The system combines an efficient database structure with powerful tools for data entry, validation, analysis, retrieval and presentation.

HYMOS optimally serves the needs of water authorities like hydro-meteorological services and water boards responsible for monitoring network operation and database management. The wide variety of data processing and analysis features make HYMOS very suitable for typical project application in water-related studies, research and consultancy. These projects often require processing of large amounts of data in a limited time frame.

Chapter A-2 Establishment of Additional Rainfall Gauging Stations and Water Level Gauging Stations

A-2.1 Rainfall Gauging Station

A-2.1.1 Selection of Locations

The following have been considered for the selection of new ten rainfall gauging stations:

- to grasp the rainfall depth, spatial distribution and duration in upstream catchments from the viewpoint of runoff characteristics of the basin
- to link the past long term record at existing stations
- to lay balance adjustment in Thiessen Polygon network for flood runoff model
- to access the site easily and maintain the recorder by village people

In consideration of the above, the following locations have been selected as the new rainfall gauging station:

1) Phum Chum for the Ta Sal River basin
2) Prey Kaniech for the Sa Slab River basin
3) Kon Trom for the Slab Kong River
4) Peam Khley of water resources development site
5) Roleang Chrey Regulator of existing water resources development site
6) Kirirom
7) Wat Kdey Lvea
8) Kong Pisey
9) Thpong
10) Trapeang Chour

Rainfall should be representative of the actual rain falling at the given area. The following should be considered so that the rainfall would not be influenced by the local surroundings:

- The site should be as horizontal as possible. It is necessary to avoid the sloping site.
- The site should not be subject to strong winds.
- The site should be far from high buildings and high trees. The gauge should be located as far as the height of the buildings or trees
- The ground surface of the gauge should be the one to avoid splashing of rainfall to the gauge.

The following sites for new rainfall gauging stations have been decided in consideration of the above matters and with consultation with DHRW and PDOWRAM concerned:

New Rainfall Gauging Stations

No.	Station Name	Equipment	District/Village	Location (UTM)		Remarks
				Northing	Easting	
1	Kirirom	Automatic	Phnom Sruoch	1252931	396882	Replaced
2	Wat Kdey Lvea	Automatic	Samrongtong	1268598	462114	Newly installed

3	Kong Pisey	Automatic	Kong Pisey	1247922	459627	Newly installed
4	Trapeang Chour	Automatic	Aoral	1306348	405995	Replaced
5	Thpong	Automatic	Thpong	1299115	438559	Replaced
6	Peam Khley	Automatic	Phnom Sruoch	1267566	430740	Replaced
7	Phum Chum	Automatic	Aoral	1294020	383194	Newly installed
8	Roleang Chrey	Automatic	Samrongtong	1264829	439962	Newly installed
9	Prey Kaniech	Automatic	Phnom Sruoch	1262000	409200	Newly installed
10	O Kon Trom	Automatic	Phnom Sruoch	1238125	417515	Newly installed

A-2.1.2 Rain Gauge

A rain gauge of tipping bucket type is selected as the rain gauge for the new rainfall gauge in the Prek Thnot River basin. The tipping bucket type rain gauge is widely accepted in many countries. KADEC is selected as the maker of the gauge. KADEC rain gauge operates with the tipping bucket made of brass. The body of the gauge is made of stainless steel with the diameter of 200 mm.

Tipping of the brass bucket occurs with each 0.1mm, 0.5mm, or 1.0mm of precipitation collected. The rain gauge here is of the type of 0.5 mm tipping. A reed switch detects these events and produces a momentary contact closure signal for data logger.

Tipping bucket type rain gauge and data logger

Inside of data logger

A-2.1.3 Rainfall Gauging Station Sites

The following are some site photos of established rainfall gauging stations:

O Kom Trom rainfall gauging station site as of January 12, 2006/01/23

Phum Chuam rainfall gauging station site as of January 13, 2006

Kong Psey rainfall gauging station site as of January 17, 2006

A-2.2 Water Level Gauging Station

A-2.2.1 Selection of Locations

For the selection of locations of new water level gauging stations, the locations of existing hydrological stations, important river structure sites, and the sites of runoff estimation for water balance study and for flood forecasting and warning are taken into consideration. The sites have been decided in consideration of the above matters and with consultation with DHRW and PDOWRAM concerned.

New Water Level Gauging Stations

No.	Station Name	Equipment	District/Village	Location (UTM)		Remarks
				Northing	Easting	
1	Peam Khley Bridge	Logger & S.G.	Phnom Sruoch	1266500	430871	Replaced
2	Thnuos Luong	Logger & S.G.	Chbr Mon	1266357	446561	Replaced
3	Krang Chek	Logger & S.G.	Phnom Sruoch	1261082	402458	Newly installed
4	Cheneang Kpuos	Logger & S.G.	Phnom Sruoch	1265906	427244	Newly installed
5	Sangkea Tasal	Logger & S.G.	Aoral	1290500	405000	Replaced

6	Trapeang Kyorn	Logger & S.G.	Samrongtong	1267436	458215	Newly installed
7	Roleang Chrey	S.G.	Samrongtong	1265095	440236	Newly installed
8	Prey Mean	S.G.	Aoral	1285872	406818	Newly installed

A-2.2.2 Water Level Gauge

OTT MESSTECHNIK instrument is adopted as the water level gauge for the above stations. This gauge is popular in Cambodia and DHRW is familiar with this. Two float type gauges and three pressure type gauges are installed at the stations.

The float-operated Trailheads Shaft Encoder with integral data logger (Thalimedes) is designed for continuous monitoring of water level for ground- and surface water. Thalimedes is composed of the combination with conventional mechanical chart recorders upgraded from a mechanical system to digital system.

The data logger OTT Orpheus Mini with a pressure probe has been designed for monitoring and recording of water level and temperature for the water management. The main application of OTT Orpheus Mini is the installation in groundwater pipes and wells. In addition, application in open waters and tanks is possible.

Float operated shaft encoder with integral data logger

A-2.2.3 Water Level Gauging Station Sites

The profiles of established water level gauging station are as presented below:

- Peam Khley

The site is the old water level gauging station site where the gauge facility is constructed to a wooden bridge pier. The new gauge has been installed with a pressure sensor and data logger. The necessary improvement works have been painting, new vertical staff gauge setting and replacement of a float type sensor and data logger. The current measurement of low flow season can be done at the downstream near the bridge. The current measurement during flood season can be done at upstream slightly from the bridge.

Peam Khley Water Level Gauging Station

- Roleang Chrey

At Roleang Chrey Regulator, vertical staff gauges have been installed in the regulating pond and on the right abutment downstream of the regulator. Under the present study, new staff gauges are installed about 200 m downstream of the regulator. The discharge from the regulator shall be measured at this point. PDOWRAM staff records water levels at the pond and at this station.

Roleang Chrey Regulator

- Thnuos Luong

The operation of this gauging station has been stopped by DHRW. This station is very close to Kampong Speu Town. The vertical staff gauge is set on the pier of Kampong Speu Bridge on No. 4 National Road. New water level gauge has a float type sensor with data logger. This station is very important for judgments of evacuation from the flood risk based on the flood water level.

Thnuos Luong (Kampong Speu Bridge)

- Sangkea Tasal

At this site, the staff gauge had been set for the purpose of study research by a university. This station is important for the runoff estimation from the Ta Sal River basin of upstream catchments in the Prek Thnot River basin. The station has a water level recorder with a pressure type sensor with data logger. The station site is in a flood plain area

Sangkea Tasal Water Level Gauging Station

- Cheneang Kpuos

A water level gauge of pressure type sensor with data logger is installed at this station. The Tang Hoang River basin where the station is established is the biggest sub-basin and the river is a right branch river of the Prek Thnot River. The station site is near the confluence with the Prek Thnot River. The station is located near the suspension pedestrian bridge.

Cheneang Kpous Water Level Gauging Station

- Krang Chek

A water level gauge of pressure type sensor with data logger is installed. The station is located at the outlet of gorge in the upstream basin of the Sva Slab River. In the upstream reaches of the station, mass water extraction for irrigation or drinking is not identified. The runoff estimation at this site is representative of natural flow in the upstream catchments.

Krang Chek Water Level Gauging Station

Chapter A-3 Hydrological Analysis

A-3.1 Low Flow Analysis

A-3.1.1 Available Period of Discharge Data

The discharge is calculated based on the water stage records and rating curve at Peam Khley. The record period of the Peam Khley gauging station is 9 years from January 1997 to September 2005. Daily discharges and 5-day discharge for the period from 1997 to 2005 are shown in Table A.9. The hydrograph of 5-day discharge for the period from 1997 to 2005 are shown in Figure A-8. Monthly discharge at Peam Khley for the period from 1901-1972 and 1997-2004 is available as shown in Table A.10. Monthly summary with 80% and 50% dependable discharge amount is shown below.

Summary of Monthly Discharge at Peam Khley (MCM)

Discharge	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Mean	11.3	5.0	5.7	11.6	36.1	48.2	116.6	155.7	238.2	408.1	158.6	35.0	1,232.2
Max	63.5	34.1	53.3	54.7	345.6	221.6	354.5	373.9	505.8	851.0	614.7	391.5	2,931.2
Min.	2.4	0.4	0.4	1.5	3.7	3.0	5.3	12.7	69.8	45.6	12.0	2.4	398.4
80%dependable	8.8	3.0	4.2	7.8	16.6	24.3	71.3	133.2	193.7	274.2	55.7	22.9	
50%dependable	8.9	3.2	4.2	10.3	35.3	44.3	116.7	160.0	229.1	383.6	110.7	22.9	

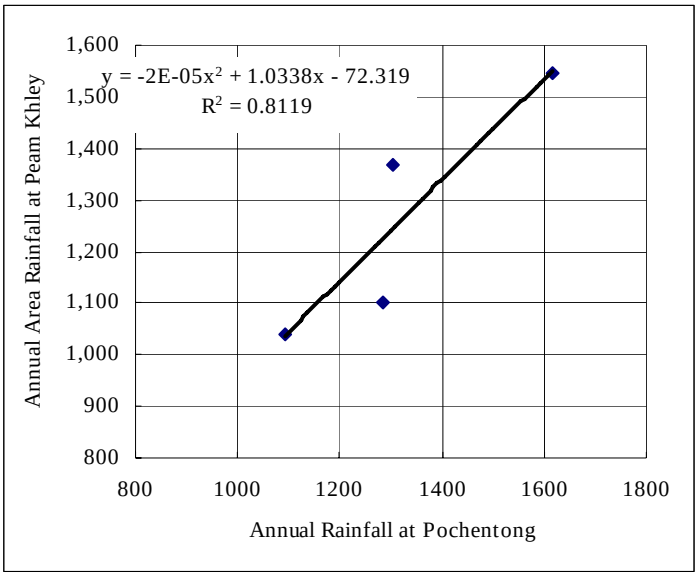
Source:JICA STUDY Team

A-3.1.2 Runoff Ratio

Long term runoff ratio (annual discharge amount/annual rainfall amount) at Peam Khley is estimated to see the environmental change such as deforestation. The basin rainfall at the Peam Khley is estimated from point rainfall at Pochentong with the least square method although available data period for least square method is only four years. The equation is derived as follows:

Basin rainfall = $-2E^{-05}$ x (rainfall at Pochentong)^2 + 1.0338 x (rainfall at Pochentong) - 72.319

The correlation between area rainfall at Peam Khley and point rainfall at Pochentong is as follows:



Runoff ratio varies from 0.51 (in 1999) to 0.09 (in 1928) and the mean runoff ratio is 0.26 as shown in Figure A.9.

A-3.1.3 Dependable 5-day Discharge at Peam Khley

Dependable 5-day discharge of the Prek Thnot River at Peam Khley is estimated to assure the 5-day available discharge for irrigation. The record period of more than 10 years is generally necessary to estimate the reliable discharge for statistic analysis. The runoff data for non-recording periods at Peam Khley are produced from the runoff data at Thnuos Luong based on the runoff relation of both sites.

The 80% and 50% dependable 5-day discharges are estimated by the distribution from dependable monthly discharge for the period from 1901-1972 and 1997-2004 in proportion to actual 5-day runoff distribution pattern in every month for 8 years from 1997 to 2004.

The result is shown in Table A.11.

A-3.1.4 Dependable 5-day Discharge at Roleang Chrey Regulator and Krang Ambel River

Dependable 5-day discharge at the Roleang Chrey Regulator can be estimated from those at Peam Khley proportional to catchment area. As the catchment area at Peam Khley and Roleang Chrey Regulator are calculated in this Study at 3,654 km^2 and 3,911 km^2 respectively, the equation for conversion is as follows:

Qr = 3911/3654 x Qp = 1.07 x Qp

Where,

Qr: discharge at Roleang Chrey
Qp: discharge at Peam Khley

Dependable 5-day discharge at the Roleang Chrey Regulator is shown in Table A.12.

Dependable 5-day discharge of the Krang Ambel River at the confluence with the Prek Thnot River can be estimated from those at Peam Khley proportional to catchment area and rainfall amount. The catchment area of the Krang Ambel River is 453 km^2. Area rainfall at Peam Khley and Krang Ambel River basin are calculated for 4 years from 2001 to 2004 as shown below.

Annual Area Rainfall (mm)

Year	Peam Khley	Krang Ambel River Basin	Ratio
2001	1,547	1,551	1.00
2002	1,100	1,004	0.91
2003	1,369	1,279	0.93
2004	1,041	928	0.89
Mean			0.93

The equation for conversion is as follows:

Qk = 453/3654 x Qp x Rk/Rp= 0.124 x Qp x Rk/Rp

Where,

Qk: discharge of Krang Ambel River Basin
Qp: discharge at Peam Khley
Rk: area rainfall of Krang Ambel River Basin
Rp: area rainfall at Peam Khley
Rk = area rainfall at Krang Ambel

A-3.1.5 Maintenance Flow

A few irrigation systems and population which take water from the Prek Thnot River are located in downstream reaches of Roleang Chrey Regulating weir, namely Kandal Stung Irrigation System, Dangkor Pump Irrigation Project.

The water requirement of Kandal Stung Irrigation System (1,950 ha) and responsible

discharge to further downstream was estimated by Japan International Cooperation Agency and Nippon Koei Co., Ltd. in the Basic Design of Kandal Stung Irrigation Project in 2005.

Summary of Monthly Water Requirement and Maintenance Flow of Kandal Stung Irrigation Project and to Downstream (m^3/sec)

Discharge	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Irrigation req.	0.8	0.7	0.0	0.1	0.8	1.3	2.33	1.0	0.3	0.6	1.3	1.5
Maintenance	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Total	1.4	1.3	0.6	0.7	1.4	1.9	2.93	1.6	0.9	1.2	1.9	2.1

Source: Basic Design Report of Kandal Stung Irrigation Project, 2005

Dangkor Pump Irrigation Project area was originally planned for 300 ha paddy field. The irrigation water requirement has not been estimated so far. It, however, appears to be similar with that of proposed cropping pattern in the present study. Therefore, irrigation activity of Dangkor Pump Irrigation Project should be considered in the irrigation study and water balance study of the present study.

A-3.2 Flood Analysis for Flood Forecasting

A-3.2.1 Options of Flood Forecasting Method

(1) General

Flood forecasting and warning plan for the Prek Thnot River basin is going to be prepared in the present Study. Accordingly flood analysis is going to be conducted for establishing flood forecasting and warning system in the Prek Thnot River basin. Therefore, flood analysis should be conducted in view what kind of methodology is to be adopted in flood forecasting.

(2) Flood Forecasting System in the Mekong, the Bassac and the Tonle Sap Rivers

Regarding flood forecasting and warning system in Cambodia, a flood forecasting system has been already established for the downstream basin of the Mekong, the Bassac and the Tonle Sap Rivers. The basic methodology of the flood forecasting is the water level correlation method between the river water levels and the inundation water levels of the Target Area. The inundation water levels in Target Area are to be calculated by use of EXCEL file with use of visual basic application to EXCEL. The necessary operation for flood forecasting is just input of river water levels of the Mekong, the Bassac and the Tonle Sap Rivers. The forecasting calculation is to be conducted by macro program built onto the EXCEL file. The necessary information of water levels of the objective rives are transmitted through telemetering system to the flood forecasting center in MOWRAM. This present situation on flood forecasting in Cambodia should be taken into consideration for establishing the flood forecasting system in the Prek Thnot River basin.

(3) Options of Flood Forecasting Method

The runoff characteristics of the Prek Thnot River basin are quite different from those of the Mekong, the Bassac, and the Tonle Sap Rivers. The rise of the river water levels of the Prek Thnot River during flood is quite abrupt and the flood travel time is very short compared with that of the Mekong, the Bassac and the Tonle Sap Rivers. It is necessary to take into consideration, not only the present flood forecasting system in Cambodia, but also the characteristics of flooding in the Prek Thnot River basin.

Possible options of flood forecasting method in the Prek Thnot River basin are, accordingly, as follows:

Option-1: Water level correlation method

This is just the same method with that of the Mekong, the Bassac and the Tonle Sap Rivers. But in consideration of the runoff characteristics of the Prek Thnot River basin, a simple correlation method of water levels may not give an accurate flood forecast. It will be necessary to consider the multiple correlation method. The advantage of this method is that additional telemetering system for rainfall information will not be needed for flood forecasting. The present practice being conducted in the said basin that the water levels of upstream gauging stations are reported to the related agencies at hourly basis when needed by use of HF radio or mobile phone can be directly used.

Option-2: Water level and rainfall correlation method

This is a method to forecasts the water levels downstream by use of correlation method with the data of water levels upstream and rainfall in the upstream basins. In consideration of flash floods in the objective river basin, the rainfall information may be indispensable for correct flood forecasting. The disadvantage of this method is that the telemetering system is indispensable for the real time rainfall information in the basin.

Option-3: Real Time Update of Runoff Model and Inundation Model

This is a method to modify the runoff model and inundation model during the flood based on the difference between the actual observed hydrograph and calculated hydrograph so that the calculated hydrograph may trace the observed hydrograph well within the allowable error. The disadvantage of this method is that not only the telemetering system for rainfall data is needed, but also high performance computer system and well experienced hydrologists will be needed.

In the coming stage for preparation of flood forecasting and warning plan in the present study with the accumulation of hydrological data in the basin, flood and inundation analysis will be conducted to make clear which option in the above may be well applicable for the Prek Thnot River basin.

A-3.2.2 Use of Storage Function Method for Flood Analysis

It is proposed to use the Storage Function method for calculation of both runoff and inundation in the Prek Thnot River basin. The characteristics of the method for the purpose of flood runoff calculation are as follows:

(1) It is applicable both for basin runoff calculation and for river channel routing.

(2) The equation form is simple as explained hereinafter.

(3) Model parameters can be determined based on the data of basin rainfall and discharge hydrograph. The model becomes more appropriate by constants analysis with new flood records.

(4) Even graphical solution can be made as well as computer programming solution.

(5) It is applicable to a large river basin by dividing it into some sub-basins and river channels.

The Storage Function method consists of continuity equation and Kinetic equation. They are expressed as follows:

(a) Kinetic equation (storage function)

$$S_l = K \times Q_l^p \quad \cdots\cdots (A.1)$$

Where,

Sl : Storage in basin or river channel
K, p: Constants
Ql : Outflow from basin or river channel

(b) Continuity equation

For basin:

$$(1/3.6 \times f \times r \times A) - Ql = dSl/dt \quad \text{.....(A.2)}$$

Where,

f : Inflow coefficient
r : Basin average rainfall
A : Catchment area
Ql(t) = Q(t+Tl) : Direct runoff considering time lag
Sl: Apparent storage in basin
Tl : Time lag

For river channel:

$$(fj \times Ij) - Ql(t) = dSl/dt \quad \text{.....(A.3)}$$

Where,

fj: Inflow coefficients
Ij: Inflow from basins and upstream river channels
Ql(t) = Q(t+Tl) : Outflow with time lag
Sl : Water storage in river channel with time lag
Tl : Time lag

Eq.(A.2) and Eq.(A.3) are modified to the difference equation expressed as follows:

For Eq.(A.2):

$$1/3.6 \times f \times A \times rt+dt-T1 = (Qt + Qt+t)/2$$

$$= (St+dt-St)/dt \quad \text{.....(A.4)}$$

Substituting Eq.(A.1) to Eq.(A.4),

$$K \times Qpt+dt/dt + (Qt+dt)/2$$

$$= K \times Opt/dt - Qt/2 + 1/3.6 \times f \times A \times rt+dt-Tl \quad \text{.....(A.5)}$$

For Eq.(A.3):

$$\{f \times (I_{t-Tl}+I_{t+dt-Tl})/2\} - (Q_t + Q_{t+dt})/2$$

$$= (S_{t+dt} - S_t)/dt \quad \text{.....(A.6)}$$

Substituting Eq.(A.1) to Eq. (A.6),

$$K \times Q^p_{t+dt}/dt + (Q_{t+dt})/2$$

$$= K \times Q^p_t/dt - Qt/2 + \{f \times (I_{t-T1} + I_{t+dt-Tl})/2\} \quad \text{.....(A.7)}$$

If the right hand side of Eq.(A.5) and Eq.(A.7) are given condition at the time "t", outflow "Q_{t+dt}", at the time "t+dt" of the left hand side can be derived.

A-3.2.3 Runoff Analysis by Storage Function Method

Flood analysis for the Prek Thnot River basin will be carried out to grasp the flood characteristics in the basin and to examine the application of the Storage Function method to the flood runoff and inundation after the data of new gauging stations are available.

The scope of the analysis will cover the following:

- Study on basin average rainfall
- Construction of flood runoff model for the basin

- Constants analysis of the Storage Function method
- Analysis on water level correlation between related water levels

A3.2.4 Procedure of Real Time Runoff Model Update

The procedure of real time runoff model update for the third option of flood forecasting is discussed here. It is necessary for the flood forecasting by the Storage Function method to determine the runoff model constants by trial and error method within limited time in order to adjust the difference between forecasted hydrograph and observed hydrograph for more accurate forecasting. The general procedure of updating the runoff model constants is presented below.

(1) Rainfall and water level data and outflow data from weirs are collected at Flood Forecasting Center.

(2) Basin rainfall is calculated for each sub-basin by Thiessen method. If there are any defective data, they are supplemented by the data of other stations.

(3) River water level data is converted to discharge by rating curve.

(4) Flood runoff from basin and channel routing calculations are executed by the Storage Function method.

(5) The calculated runoff is compared with observed runoff periodically. If there is much difference between calculated runoff and observed runoff, runoff model constants of Storage Function method shall be revised and recalculation shall be done until the difference is within allowable limit.

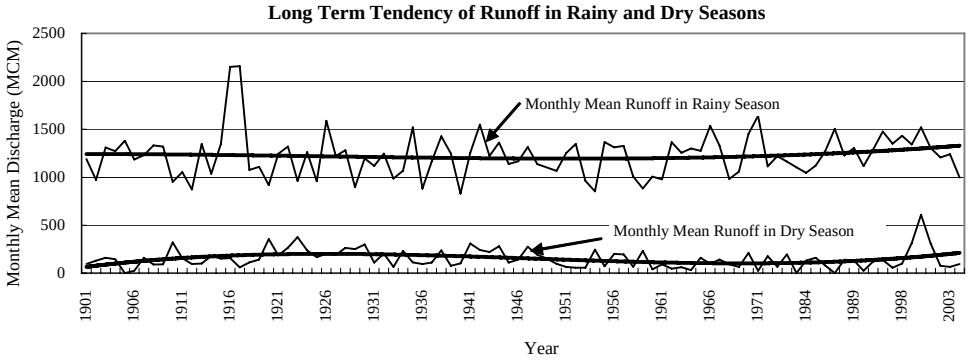
(6) If the difference is within the allowable limit, flood forecasting is proceeded for the next base point in the same manner as the procedure from (1) to (5).

(7) The procedure from (1) to (6) is repeated at a certain time interval until the flood is over.

In general, constants of the Storage Function method vary depending on the magnitude of flood. Accordingly, for the flood forecasting, it is recommended to use average values as initial values for runoff model estimated in the runoff analysis of various floods.

A-3.3 Long Term Runoff Tendency

Long term runoff tendency is studied to grasp the negative environmental change in the basin, such as deforestation, by use of the long term mean runoff as shown in Table A.10. In general, if the deforestation progresses in the basin, runoff in the rainy season becomes larger, while that in the dry season becomes smaller due to decline of basin storage capacity in the upstream. The below figure shows the long term tendency in the rainy and dry seasons from 1901 to 2005 although 12 years data are not available:



As far as the long term runoff is concerned, long term tendency of runoff seems to be stable and definite influence by deforestation in the basin can not be found.

A-3.4 Observation Plan and Manual

A-3.4.1 Rainfall and Water Level Data Downloading

The operation method and procedure for configuration of data logger and downloading the recorded data from the data logger on rainfall and water level are provided by the equipment maker. The operation and procedure for arrangement of the downloaded files on rainfall are presented in the manual that is submitted to MOWRAM separately. Regarding the downloading the rainfall and water level data from the data logger, it is suggested that the frequency of downloading be conducted at least once in 3 months in consideration of data file size in the logger and the arrangement procedure. During the rainy season, it is suggested that the downloading be conducted at least once in two months since the rainfall amount is expected to be more than 100mm per day in some cases. It should be kept in mind that the downloading can not be done in the field during rain and or thunderstorm. Accordingly the planning of data downloading should be prepared deliberately.

A-3.4.2 Discharge Measurement

The operation and procedure for discharge measurement are presented in the manual on discharge measurement. The manuals are submitted to MOWRAM separately. Discharge rating curve at high flow is very important from the view point of preparation of flood runoff model, flood forecasting and warning, and for preparation flood control plan if any. Accordingly the discharge measurement at high flow is very important. It is strongly suggested that the discharge measurement during high flow be conducted often. Therefore, when a high flow occurs, the caretaker of water level gauging station should inform the situation soon to the responsible agency for discharge measurement and the measurement team should rush to the site and conduct the measurement not only once but also as many times as possible during a high flow.

Referrence

1	Prek Thnot Multipurpose Project Reappraisal Report, Volume 5.2, Annexes I-V
2	Hydrological Observation Book ~ Gauge Height in Meters (1994~1999) & (2000~2002) Provincial Department of Water Resources and Meteorology, Kampong Speu Province
3	Stung Prek Thnoat River Basin: Preliminary Water Use Study Partners for Research and Sustainable Development PRD (Water and Environment)
4	PART II Hydrological Network Improvement and Gap-Filling/Monitoring Vol. I Main Report, WUP-JICA, Dec. 2003
5	THE STUDY ON THE REHABILITATION AND RECONSTRUCTION OF AGRICULTURAL PRODUCTION SYSTEM IN THE SLAKOU RIVER BASIN, VOLUME-II APPENDICES March 2002, Nippon Koei etc.
6	Emergency Flood Rehabilitation Project, Prek Thnot Relief Channel, MOWRAM, Sep. 2001
7	M/P Study on the Integrated Agricultural and Rural Development Project in the Suburbs of Phnom Penh, Vol. III ANNEXES, Feb. 1995, JICA
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9	Irrigation Rehabilitation Study in Cambodia, Final Report Annex A-Hydrology, June 1994, Sir William Halcrow et al, UNDP Grant
10	Flood Control Planning For Development of the Mekong Delta, Vol. 1 to 3, Sep. 2000, Korea Water Resources Corporation etc., KOICA

Tables

Table A.1 Temperature

Mean

Unit: °C

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	27.1	27.7	29.3	30.7	30.5	28.8	28.0	27.7	28.1	26.9	26.2	26.3	28.1
1992	25.7	28.1	29.8	n	31.5	29.2	28.5	27.8	27.3	26.2	25.3	25.8	27.7
1993	25.9	26.7	28.5	29.9	29.5	28.0	27.9	27.4	27.5	26.9	26.2	25.6	27.5
1994	26.4	28.7	28.7	30.0	29.8	29.0	28.3	28.7	27.4	27.5	26.2	27.0	28.1
1995	25.4	25.9	28.8	30.2	29.2	28.8	28.4	28.7	27.0	27.4	26.6	25.9	27.7
1996	25.7	26.9	28.4	30.0	29.1	28.7	27.7	27.8	28.0	27.7	27.7	25.4	27.7
1997	25.8	28.0	29.0	30.1	30.3	30.2	28.5	28.8	28.3	28.1	27.7	27.6	28.5
1998	27.1	28.6	30.6	30.4	30.2	29.1	28.7	28.8	28.4	27.1	25.7	24.8	28.3
1999	26.7	27.6	30.5	29.8	29.1	28.6	28.4	28.5	28.6	27.6	27.0	23.9	28.0
2000	27.3	27.7	29.3	29.7	29.7	28.8	28.3	28.5	28.3	27.1	26.8	26.8	28.2
2001	27.1	27.6	28.8	30.5	30.1	29.1	29.1	39.8	28.2	27.6	25.5	26.4	29.2
2002	27.6	28.5	30.8	32.4	31.7	31.5	31.0	29.9	29.4	29.4	28.6	28.7	30.0
2003	25.6	28.1	29.8	30.8	30.0	30.1	28.6	29.2	28.7	28.0	27.8	25.6	28.5
2004	27.2	27.9	30.5	31.5	30.6	29.1	29.5	29.0	28.3	27.6	28.0	26.0	28.8
2005	26.7	28.7	29.2	30.9	31.6	31.2	29.2	29.6					29.6
Mean	26.5	27.8	29.4	30.5	30.2	29.3	28.7	29.3	28.1	27.5	26.8	26.1	28.4

The mean temperature is the average of max. and min. monthly averages shown below.

Maximum

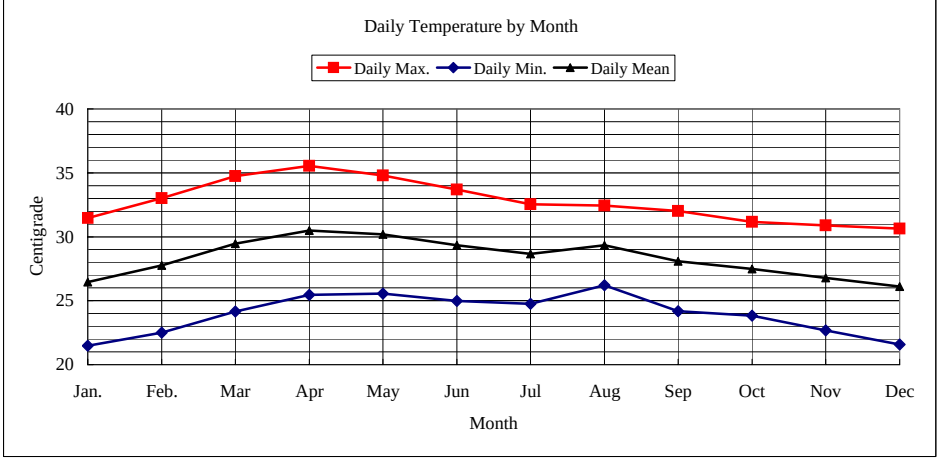
Unit: °C

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	32.3	33.2	34.7	35.7	35.1	32.8	31.3	30.8	31.4	30.1	30	30.8	32.4
1992	30.7	33.3	35.5	n	36.7	33.5	32.2	31.4	32.4	29.8	29.7	30.8	32.4
1993	29.9	31.9	33.3	34.9	33.3	31.2	30.8	30.3	30.6	30.6	31.6	30.2	31.6
1994	32.2	34.4	33.8	34.8	34.3	33.2	32.1	32.9	31.1	31.6	31.6	31.7	32.8
1995	29.7	30.2	33.5	34.7	33.6	32.8	32.2	32.7	31.3	31.8	31.7	31.3	32.1
1996	30.3	32.0	33.2	34.7	33.1	32.4	31.0	30.7	31.1	31.2	31.5	29.9	31.8
1997	30.9	32.6	34.4	35.3	35.0	35.1	32.3	32.7	32.0	31.5	31.1	32.1	32.9
1998	32.2	33.6	35.9	35.1	34.7	33.3	32.6	32.4	32.2	30.1	28.9	29.6	32.6
1999	31.5	32.7	36.3	34.6	33.2	32.7	32.1	32.6	32.6	30.9	30.2	27.3	32.2
2000	31.7	32.6	34.2	34.2	34.1	32.9	32.3	32.1	32.0	30.4	30.1	30.2	32.2
2001	31.1	32.6	33.4	35.4	34.5	33.4	33.3	32.3	32.5	31.5	29.3	30.7	32.5
2002	33.9	34.9	37.3	39.3	37.5	37.5	36.4	35.3	34.0	34.3	33.0	33.1	35.5
2003	30.9	33.5	34.8	35.8	34.5	34.7	32.4	33.2	32.7	31.4	32.0	30.1	33.0
2004	32.3	33.4	36.2	36.9	35.4	33.3	33.7	33.0	32.3	31.1	31.8	31.2	33.4
2005	32.3	34.4	34.5	36.0	37.0	36.4	33.4	34.2					
Mean	31.5	33.0	34.7	35.5	34.8	33.7	32.5	32.4	32.0	31.2	30.9	30.6	32.7

Minimum

Unit: °C

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	21.9	22.1	23.9	25.6	25.8	24.7	24.6	24.6	24.7	23.6	22.4	21.8	23.8
1992	20.6	22.9	24.0	25.8	26.3	24.9	24.7	24.1	22.1	22.6	20.9	20.8	23.3
1993	21.9	21.5	23.6	24.8	25.7	24.7	24.9	24.4	24.3	23.1	20.7	20.9	23.4
1994	20.5	22.9	23.6	25.2	25.3	24.8	24.5	24.4	23.7	23.4	20.7	22.2	23.4
1995	21.0	21.5	24.1	25.7	24.7	24.8	24.5	24.6	22.7	23.0	21.4	20.4	23.2
1996	21.0	21.8	23.5	25.3	25.0	24.9	24.4	24.8	24.8	24.2	23.8	20.8	23.7
1997	20.6	23.3	23.6	24.9	25.6	25.3	24.7	24.9	24.5	24.6	24.2	23.0	24.1
1998	22.0	23.6	25.2	25.6	25.6	24.9	24.7	25.1	24.6	24.0	22.5	20.0	24.0
1999	21.9	22.4	24.7	25.0	24.9	24.5	24.7	24.4	24.5	24.2	23.8	20.5	23.8
2000	22.8	22.7	24.3	25.1	25.3	24.7	24.2	24.8	24.5	23.8	23.4	23.4	24.1
2001	23.1	22.6	24.2	25.6	25.7	24.9	24.9	47.3	23.9	23.8	21.8	22.0	25.8
2002	21.3	22.2	24.4	25.5	25.8	25.6	25.7	24.5	24.8	24.6	24.2	24.2	24.4
2003	20.4	22.8	24.7	25.9	25.6	25.4	24.7	25.1	24.8	24.6	23.7	21.1	24.1
2004	22.0	22.3	24.8	26.0	25.9	24.9	25.3	25.0	24.4	24.2	24.1	20.8	24.1
2005	21.0	22.9	23.8	25.8	26.2	25.9	25.0	25.1					
Mean	21.5	22.5	24.2	25.5	25.6	25.0	24.8	26.2	24.2	23.8	22.7	21.6	23.9

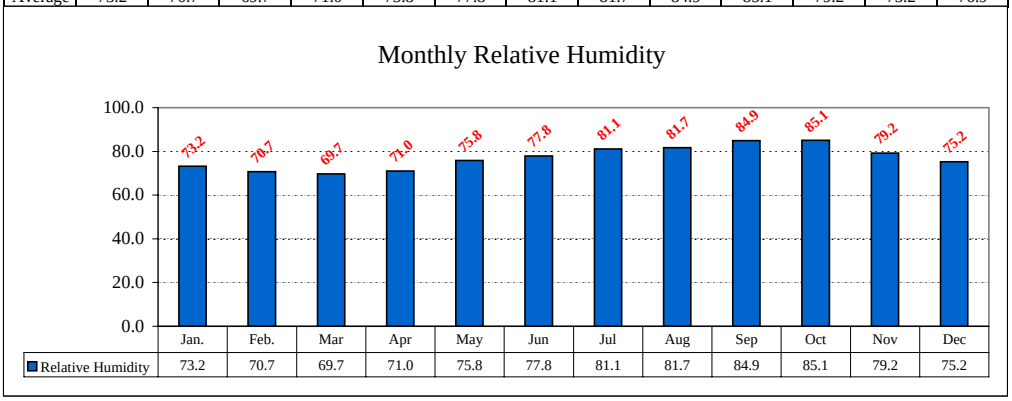


Source: Pochentong Observatory, Department of Meteorology

Table A.2 Relative Humidity

Unit: %

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	72.0	68.0	66.6	68.0	74.8	80.7	84.9	84.6	86.8	86.6	78.3	74.9	77.2
1992	71.7	68.7	68.3	71.3	75.3	78.1	81.8	84.3	85.0	85.0	76.3	76.5	76.9
1993	72.7	68.4	70.7	67.6	77.5	79.1	83.4	83.1	85.0	82.7	77.1	77.3	77.1
1994	76.4	75.0	77.0	72.2	74.8	77.4	85.9	82.0	88.7	86.7	80.4	83.8	80.0
1995	71.4	69.3	68.7	68.2	75.3	78.9	80.5	83.7	85.4	85.0	79.8	75.1	76.8
1996	72.1	67.1	65.7	75.3	78.7	78.9	89.5	90.0	89.7	88.8	82.5	72.4	79.2
1997	72.6	74.4	73.1	72.9	73.6	73.1	80.6	80.8	83.5	84.5	80.3	n	77.2
1998	75.1	74.8	68.0	70.6	73.6	73.1	80.6	80.8	83.5	84.5	80.3	68.1	76.1
1999	72.9	70.7	74.9	71.7	82.5	80.4	81.8	81.8	85.7	86.3	79.3	72.6	78.4
2000	72.0	68.5	73.0	76.0	78.0	88.0	74.0	78.0	82.0	89.5	82.0	76.0	78.1
2001	-	-	-	-	-	-	-	-	-	-	-	-	
2002	73.0	73.0	70.0	72.0	75.0	76.0	73.0	82.0	82.0	83.0	81.0	82.0	76.8
2003	74.3	70.7	68.7	71.3	78.1	76.8	83.4	80.0	83.0	83.6	76.3	71.6	76.5
2004	73.9	69.5	65.7	68.1	71.8	78.2	77.8	77.9	83.3	80.0	75.8	72.5	74.5
2005	74.3	71.9	65.0	68.8	72.2	71.0	78.4	75.4					72.1
Average	73.2	70.7	69.7	71.0	75.8	77.8	81.1	81.7	84.9	85.1	79.2	75.2	76.9



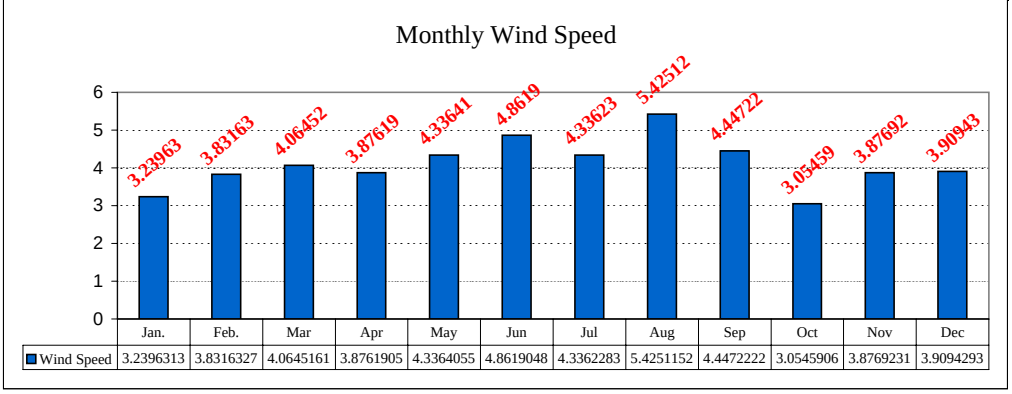
Source: Pochentong Observatory, Department of Meteorology

Table A.3 Monthly Wind Speed

at 12 m above ground surface

Unit: m/sec

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	2.0	4.0	2.0	2.0	3.0	6.0	2.0	4.0	2.0	3.0	2.0	1.5	2.8
1992	2.0	4.0	3.0	3.0	3.0	5.0	2.0	3.0	n	3.0	4.0	3.0	3.2
1993	2.0	4.0	5.0	3.0	3.0	2.0	3.5	4.5	4.5	3.5	4.5	3.5	3.6
1994	4.0	1.5	3.0	4.0	4.0	4.5	3.5	3.0	2.5	2.5	4.0	2.0	3.2
1995	1.5	3.0	3.0	2.0	6.0	4.0	3.0	2.0	1.0	1.5	4.0	5.0	3.0
1996	2.5	3.4	3.2	3.1	2.7	2.7	3.3	3.4	2.5	1.2	2.4	3.0	2.8
1997	2.5	3.0	5.0	6.5	4.5	4.0	5.0	6.0	5.0	2.5	3.0	4.0	4.3
1998	5.5	4.0	5.0	5.0	4.5	4.0	5.0	6.0	5.0	2.5	3.0	4.0	4.5
1999	5.0	4.0	6.0	7.0	7.0	7.0	6.5	9.0	8.0	5.5	7.0	8.0	6.7
2000	3.5	8.0	6.0	2.0	3.0	7.0	5.0	9.0	8.0	2.0	2.0	2.5	4.8
2001	-	-	-	-	-	-	-	-	-	-	-	-	
2002	2.9	2.4	2.4	3.9	2.4	4.1	-	4.4	4.5	3.9	4.3	3.7	3.5
2003	4.0	4.3	4.5	4.4	5.6	6.2	5.1	6.3	4.8	4.1	4.3	5.3	4.9
2004	4.0	4.1	4.3	4.4	5.5	6.1	6.0	6.9	5.6	4.4	5.9	5.3	5.2
2005	4.0	4.0	4.5	4.0	6.4	5.5	6.5	8.5					
Average	3.2	3.8	4.1	3.9	4.3	4.9	4.3	5.4	4.4	3.1	3.9	3.9	4.0

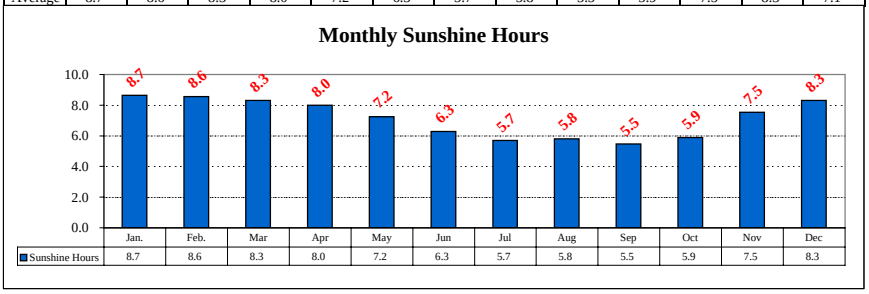


Source: Pochentong Observatory, Department of Meteorology

Table A.4 Monthly Mean Sunshine Hours

Unit: hrs/day

Year	Jan.	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1991	-	-	-	-	8.5	5.5	5.4	5.5	5.2	4.3	-	-	5.7
1992	8.1	8.9	9.2	8.4	7.7	5.1	6.0	3.6	n	6.7	8.5	7.7	7.3
1993	8.3	8.7	7.9	7.8	7.1	5.1	5.8	5.2	4.9	5.7	8.0	7.4	6.8
1994	8.5	8.4	7.1	8.9	7.1	4.7	3.7	5.2	5.0	6.9	9.0	7.4	6.8
1995	8.4	9.7	7.9	9.8	7.6	7.1	6.3	6.6	4.9	6.1	5.8	7.7	7.3
1996	8.8	8.6	9.5	7.2	6.2	7.1	5.0	6.5	4.4	5.2	6.0	n	6.8
1997	9.0	7.0	9.0	6.8	6.2	7.2	4.6	5.1	5.6	6.5	7.9	9.5	7.0
1998	9.9	9.3	10.2	9.1	8.0	6.8	8.0	7.9	7.7	5.3	6.9	9.7	8.2
1999	10.0	9.5	10.2	9.4	8.8	6.1	7.0	7.0	7.5	5.7	7.0	9.4	8.1
2000	7.5	7.6	6.2	7.3	6.3	6.3	6.0	6.5	5.6	5.5	7.4	8.2	6.7
2001	-	-	-	-	-	-	-	-	-	-	-	-	
2002	8.6	7.8	7.0	5.6	6.6	7.7	6.1	4.1	4.3	5.5	7.4	8.3	6.6
2003	9.4	8.9	8.8	8.7	7.1	7.0	6.2	6.8	4.9	5.4	8.4	7.3	7.4
2004	8.1	7.9	8.0	7.3	6.8	5.5	5.8	5.5	5.6	7.7	8.1	8.8	7.1
2005	7.9	9.0	7.1	7.5	7.4	6.7	3.8	5.6					
Average	8.7	8.6	8.3	8.0	7.2	6.3	5.7	5.8	5.5	5.9	7.5	8.3	7.1



Source: Pochentong Observatory, Department of Meteorology

Table A.5 Monthly Mean Evaporation

Station: Pochentong

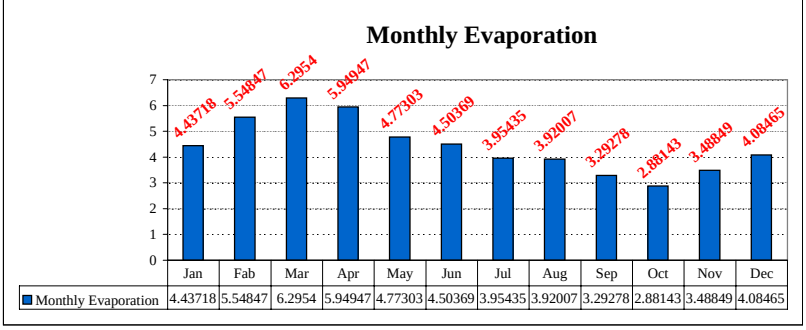
Latitude:11°33N

Longitute:104°50E

Altitute 10m

Unit: mm/d

Month	Jan	Fab	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	6.1	7.2	9.2	8.6	4.9	6.1	5.3	4.7	3.6	3.6	3.5	5.3
1982	5.5	6.3	8.3	5.1	5.1	4.0	4.6	4.1	3.7	3.2	3.6	5.2
1983	5.9	6.7	8.7	8.7	5.0	7.4	4.6	3.4	3.2	3.0	4.0	4.9
1984	5.5	7.4	8.6	7.8	5.5	4.7	4.3	6.2	2.7	2.2	4.2	5.4
1985	6.1	7.7	8.6	6.8	6.1	4.4	4.4	5.1	3.0	2.7	3.0	4.1
1986	5.3	5.5	7.8	6.3	4.1	4.1	4.4	3.6	2.4	2.6	3.4	3.7
1987	4.7	5.5	7.5	7.1	7.0	4.8	5.0	3.7	2.9	2.2	2.2	2.2
1988	4.3	5.1	6.9	4.7	4.2	3.9	3.1	2.9	2.6	2.5	3.6	4.7
1989	4.5	5.6	5.2	6.0	4.4	4.7	3.8	4.4	2.8	2.7	3.7	4.3
1990	4.6	6.2	6.1	7.5	4.5	5.5	4.6	3.9	2.7	2.8	3.3	4.3
1991	4.2	5.6	6.7	7.3	5.5	3.8	2.7	3.2	2.4	2.3	3.9	5.0
1992	5.4	6.0	7.5	7.5	6.7	4.4	3.7	4.1	3.4	2.6	4.6	4.1
1993	4.7	5.5	5.8	6.6	6.3	6.2	7.4	8.0	6.6	5.7	5.2	4.3
1994	2.6	3.8	4.5	5.3	4.0	4.1	3.2	3.0	4.2	2.8	2.9	3.1
1995	4.8	6.9	5.5	6.5	4.3	2.7	2.1	2.7	2.3	1.8	3.5	4.4
1996	5.2	5.0	7.6	4.8	3.1	2.1	1.3	1.7	2.2	1.8	2.1	3.6
1997	2.4	3.6	4.5	5.3	3.8	4.1	3.0	2.9	4.2	2.9	2.4	3.0
1998	3.8	5.6	4.8	4.2	4.9	6.1	5.3	4.7	3.6	3.6	3.5	5.3
1999	1.8	3.3	3.7	2.2	2.3	1.9	1.6	1.5	1.4	1.1	1.3	2.4
2000	4.7	6.9	4.8	4.6	4.1	4.2	4.1	4.1	3.5	3.0	3.8	3.5
2001	1.4	3.6	2.7	3.6	3.1	3.0	1.5	2.2	2.4	1.7	1.7	2.0
2002	4.3	4.1	5.0	5.4	4.7	4.6	4.9	2.7	3.4	3.4	4.9	3.7
2003	3.6	4.7	5.1	5.0	4.0	5.3	5.4	5.4	5.2	4.2	4.5	4.8
2004	4.9	5.6	7.0	6.8	6.3	5.6	5.1	5.3	4.6	4.7	5.0	4.8
2005	4.6	5.2	5.3	5.2	5.2	4.9	3.6	4.5				
Mean	4.4	5.5	6.3	5.9	4.8	4.5	4.0	3.9	3.3	2.9	3.5	4.1
Min	1.4	3.3	2.7	2.2	2.3	1.9	1.3	1.5	1.4	1.1	1.3	2.0
Max	6.1	7.7	9.2	8.7	7.0	7.4	7.4	8.0	6.6	5.7	5.2	5.4



Source: Pochentong Observatory, Department of Meteorology

Table A.6 Monthly Rainfall at Pochentong in Phnom Penh

Unit: mm

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1901	0.5	28.2	3.9	8.7	108.5	228.5	122.6	110.5	146.4	302.3	170.3	52.9	1,283
1902	0.0	33.3	16.2	0.3	67.2	167.4	126.4	136.7	203.8	195.1	77.2	81.1	1,105
1903	0.6	0.0	0.0	24.0	129.6	169.5	176.1	278.0	292.1	141.4	123.6	136.5	1,471
1904	0.0	0.0	3.9	142.0	238.0	52.0	54.0	143.8	176.5	336.3	270.8	0.0	1,417
1905	0.0	0.5	0.0	0.0	113.8	118.1	212.6	288.3	209.7	386.6	50.3	0.0	1,380
1906	0.0	0.0	0.2	22.8	163.0	231.5	108.0	129.6	256.9	247.1	49.8	3.2	1,212
1907	0.3	0.0	26.6	55.3	100.3	82.9	181.2	105.5	270.6	219.2	270.1	78.3	1,390
1908	4.0	0.0	0.0	51.4	103.6	183.1	194.0	194.4	144.0	402.0	110.9	36.0	1,423
1909	15.4	19.6	4.3	2.1	227.0	192.0	182.1	194.7	195.8	182.9	145.9	51.8	1,414
1910	28.0	19.0	192.9	31.3	135.2	103.2	142.2	153.5	153.8	182.1	82.2	51.3	1,275
1911	0.0	0.0	2.2	111.3	119.1	134.6	272.7	146.3	265.4	114.6	1.6	42.7	1,211
1912	16.3	1.5	0.0	72.3	30.4	77.7	247.1	114.1	218.2	105.3	80.8	4.8	969
1913	0.0	0.0	5.6	48.6	317.5	26.9	242.7	135.4	160.1	390.9	74.4	47.0	1,449
1914	0.0	6.4	1.8	105.9	61.6	90.4	148.8	115.8	154.3	308.3	158.1	67.4	1,219
1915	0.0	0.0	91.8	42.4	58.9	264.8	214.0	100.0	325.6	278.8	106.0	18.2	1,501
1916	0.0	0.0	119.2	12.6	201.1	177.3	358.9	339.7	241.1	649.7	183.3	26.8	2,310
1917	0.0	2.2	1.6	0.0	125.4	261.2	140.6	379.9	443.3	510.1	297.5	55.9	2,218
1918	0.0	0.0	33.8	58.0	141.6	192.3	58.2	140.0	140.1	308.8	95.7	21.5	1,190
1919	0.0	0.0	0.0	143.3	142.4	130.6	144.3	91.0	272.1	172.9	155.0	0.0	1,252
1920	0.0	127.4	50.2	56.7	77.2	135.4	108.7	151.9	93.2	78.1	274.7	123.2	1,277
1921	0.0	0.0	126.7	55.5	84.5	143.9	251.3	143.7	244.7	280.3	96.6	4.5	1,432
1922	0.0	0.0	181.8	23.6	50.6	85.0	135.8	75.5	241.3	439.6	293.7	59.7	1,587
1923	0.5	0.0	13.3	359.2	166.6	92.4	132.7	65.8	210.8	115.6	177.8	2.4	1,337
1924	0.0	0.0	15.0	171.2	162.5	295.5	115.5	179.8	217.0	198.5	95.0	52.6	1,503
1925	18.3	0.0	70.7	51.0	125.5	103.9	195.1	143.3	183.2	133.3	73.7	28.4	1,126
1926	0.0	0.0	0.0	25.8	140.3	156.8	258.8	298.5	239.1	386.9	107.5	176.3	1,790
1927	28.9	0.0	38.8	57.5	133.3	392.8	188.6	133.0	149.6	194.3	29.9	64.9	1,412
1928	14.7	18.8	0.0	229.1	170.5	107.2	162.9	219.4	332.1	242.5	48.5	0.0	1,546
1929	11.0	98.2	40.2	88.4	99.7	139.7	54.6	220.1	223.0	112.0	47.2	14.0	1,148
1930	10.7	2.7	88.0	51.6	214.1	185.4	77.5	164.8	223.6	170.7	160.2	145.4	1,495
1931	0.0	0.0	17.9	25.0	126.6	71.4	133.6	133.5	332.8	268.9	52.9	67.3	1,230
1932	0.0	0.0	2.6	160.0	112.8	73.1	208.5	86.6	218.3	371.1	177.5	43.2	1,454
1933	11.2	0.0	0.0	54.6	135.2	123.3	81.2	157.0	181.0	243.0	65.6	0.0	1,052
1934	0.0	65.1	54.3	93.0	140.9	82.1	138.6	219.1	177.9	243.6	67.1	21.3	1,303
1935	0.0	0.0	0.9	18.6	192.2	270.8	183.1	70.8	241.2	326.5	235.5	93.6	1,633
1936	50.9	6.5	9.3	12.9	83.7	192.8	141.1	187.6	162.7	62.7	50.6	16.6	977
1937	24.6	10.9	15.5	42.0	146.0	97.0	227.3	150.6	252.0	181.5	110.4	18.5	1,276
1938	0.0	0.0	77.5	144.4	172.8	287.3	139.4	117.6	237.7	340.9	132.5	16.1	1,666
1939	15.6	0.0	11.7	42.4	174.1	143.2	108.2	79.2	357.2	141.3	243.9	8.0	1,325
1940	0.0	0.0	1.1	22.2	81.5	38.9	104.0	160.5	203.5	77.6	165.4	80.0	935
1941	0.0	44.0	83.5	82.4	104.4	72.9	98.0	140.6	177.8	377.8	283.7	98.0	1,563
1942	57.3	0.0	52.6	125.3	205.4	135.3	105.3	191.3	315.0	321.2	274.0	8.9	1,792
1943	0.0	0.9	32.4	177.2	235.1	78.6	46.6	161.1	248.8	315.8	135.5	10.6	1,443
1944	57.4	14.0	23.0	81.6	154.5	164.0	88.8	320.8	131.9	362.6	141.4	105.2	1,645
1945	0.0	0.0	17.9	25.0	126.6	71.4	133.6	133.5	332.8	288.9	52.9	67.3	1,250
1946	9.6	10.2	39.1	78.6	395.1	124.3	121.8	44.4	164.5	215.4	101.0	6.3	1,310
1947	0.0	0.0	57.8	177.2	145.5	135.1	145.5	219.2	246.1	311.2	112.7	40.3	1,591
1948	0.0	20.2	29.2	143.5	46.4	115.4	98.7	130.6	406.3	200.4	139.9	0.0	1,331
1949	0.0	14.0	2.8	77.0	150.7	144.7	120.1	90.4	128.2	275.5	191.8	58.6	1,254
1950	16.1	5.3	3.3	39.0	136.0	127.4	120.4	98.2	332.1	173.0	79.9	34.9	1,166
1951	0.8	0.0	0.2	56.4	178.9	130.5	204.8	191.3	186.8	131.0	228.1	7.2	1,316
1952	4.9	1.0	2.0	43.5	107.8	150.1	67.3	198.0	259.0	429.3	137.2	6.5	1,407
1953	1.2	5.6	18.9	26.2	96.3	79.4	139.7	120.9	194.0	212.0	121.2	6.0	1,021
1954	7.5	0.0	73.5	77.5	122.5	133.4	180.1	107.0	171.5	107.7	31.8	87.4	1,100
1955	4.2	0.0	12.0	55.8	127.2	162.5	147.2	97.9	235.1	321.5	276.4	0.0	1,440
1956	2.8	0.4	0.0	106.3	260.3	346.5	128.0	126.4	205.4	129.6	116.3	90.8	1,513
1957	11.6	24.4	80.1	79.0	53.0	37.5	126.9	261.7	400.8	361.6	87.1	0.0	1,524
1958	0.0	9.0	8.3	50.3	197.8	96.5	145.6	135.7	133.8	293.7	3.6	0.2	1,075
1959	0.0	0.0	94.1	70.8	63.7	92.0	101.2	161.8	152.0	227.8	85.1	67.7	1,116
1960	2.4	4.2	14.9	15.2	267.5	94.3	84.4	117.4	128.4	212.3	102.2	3.7	1,047
1961	7.8	15.8	10.5	30.6	113.1	226.5	37.3	71.2	142.3	271.6	116.5	28.8	1,072
1962	1.5	0.0	0.6	45.3	206.2	44.3	87.4	102.1	402.0	428.0	95.3	0.0	1,413
1963	0.5	0.0	58.5	0.0	199.2	111.6	135.3	149.7	271.6	222.9	164.9	2.5	1,317
1964	0.0	0.6	0.0	9.1	263.1	121.5	201.8	110.2	227.6	200.8	175.7	23.3	1,334
1965	0.7	17.3	10.4	57.4	150.7	86.1	148.4	189.7	326.5	271.1	103.3	74.7	1,436
1966	2.9	9.8	6.5	24.8	214.1	258.0	205.2	180.5	244.2	281.6	153.7	53.8	1,635
1967	5.4	2.4	0.0	134.6	116.1	327.1	245.8	119.7	308.3	179.2	34.2	0.1	1,473
1968	0.0	0.0	0.0	92.7	113.8	153.8	151.0	85.3	182.5	278.7	17.6	0.0	1,075
1969	18.9	25.8	1.2	18.6	77.0	112.3	49.9	162.0	283.1	344.4	29.3	1.3	1,124
1970	2.3	0.0	7.1	15.4	227.6	105.5	52.3	249.4	119.0	515.6	183.6	186.4	1,664
1971	0.0	1.3	1.3	0.0	123.1	212.4	230.0	377.9	322.0	328.5	48.6	22.3	1,667
1972	0.0	6.3	27.2	126.5	69.9	290.7	108.2	81.2	119.9	205.0	239.9	19.2	1,294
1973													
1981	12.0	11.3	0.0	45.4	143.5	70.9	224.7	126.6	239.2	151.1	264.0	0.0	1,289
1982	0.4	0.5	14.2	181.0	196.8	159.4	74.9	161.1	246.7	218.5	107.5	0.1	1,361
1983	0.0	0.0	0.0	0.0	47.5	55.1	170.1	300.2	174.1	203.1	155.4	3.2	1,109
1984	1.4	1.1	0.0	128.7	62.2	142.6	127.1	106.1	264.3	292.7	51.5	1.1	1,179
1985	0.0	1.1	0.0	157.6	102.7	77.0	117.6	92.5	283.7	260.8	188.7	0.9	1,283
1986	0.0	4.5	4.5	48.7	149.8	90.9	181.3	224.5	301.3	235.1	86.9	23.8	1,351
1987	0.0	0.0	0.0	0.0	24.6	150.2	91.9	183.6	474.3	257.1	323.8	0.0	1,506
1988	0.0	22.9	22.2	96.3	70.2	172.9	152.9	177.8	445.0	137.4	71.4	0.0	1,369
1989	15.0	0.0	54.0	63.2	183.5	38.4	86.6	162.4	397.6	328.6	107.3	0.0	1,437
1990	0.0	0.0	0.0	26.2	227.1	63.8	166.8	174.6	246.6	98.3	138.7	0.0	1,142
1991													
1995	0.0	0.0	18.0	94.3	234.6	146.8	156.4	208.9	277.1	243.6	22.4	11.2	1,413
1996	14.9	0.0	5.2	103.6	173.9	151.8	99.5	150.3	343.3	213.3	345.6	15.0	1,616
1997	0.0	26.0	7.4	19.2	108.6	157.9	212.9	98.1	340.1	337.1	94.6	6.0	1,408
1998	0.0	0.0	0.0	74.2	73.4	225.9	217.2	180.0	247.6	219.4	269.7	25.1	1,533
1999	45.5	23.3	20.3	165.3	119.5	159.3	274.4	185.2	274.0	194.9	136.7	60.3	1,659
2000	56.5	8.3	52	190.8	206.2	240.3	234.4	147.3	124.7	442.5	124.7	301.1	2,129
2001	74.4	0.0	171	55	104.7	139.2	110.6	245.8	254	410.4	40.5	9.2	1,615
2002	0.0	0.0	0.4	20.3	80.2	144.7	99.4	178.9	236.1	302.3	165.8	58.2	1,286
2003	0.0	0.4	7.5	42.8	174.6	188.0	287.5	98.7	255	193.3	42.8	13.4	1,304
2004	0.4	0.0	0.0	94.8	116.1	164.2	91.1	101.1	203.4	201.7	118.8	0.0	1,092
2005	0.0	0.0	0.0	74.3	74.8	51.9	125.6	217.2					
Average	7.4	8.3	26.5	70.3	140.8	144.5	148.7	160.3	240.4	258.5	131.9	37.5	1,377
Max	74.4	127.4	192.9	359.2	395.1	392.8	358.9	379.9	474.3	649.7	345.6	301.1	2,310
Min.	0.0	0.0	0.0	0.0	24.6	26.9	37.3	44.4	93.2	62.7	1.6	0.0	935
10%	0.0	0.0	0.0	9.8	64.4	71.0	78.2	90.5	142.5	129.7	43.2	0.0	1,092.4
20%	0.0	0.0	0.0	22.4	82.4	82.4	99.0	103.5	165.9	174.2	55.4	0.3	1,168.2
30%	0.0	0.0	1.3	28.8	106.6	96.8	109.8	118.9	189.0	199.1	83.1	4.6	1,260.1

92.0

Source: *1901-1990* *Prek Thnot Multipurpose Project, Reappraisal Report Volume 5.2 - Annexe I, Australian Catholic Relief by Euroconsultant, December 1991*

1995-2005 *Department of Meteorology, MOWRAM*

Table A.7 Annual Rainfall of Prek Thnot River Basin

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Year	Total Basin	Phum Chum	Trapeang Chor	Aoral/ Oral	Prey Kahiech	Pochentong	Ou Taroth	Kirirom	Church	Srae Klong	Kong Pisei	Peam Khley	Thnal Toteung	Thpong	Krang Ampil	Phnum Sruoch	Kompong Speu	Prey Pdau	Roleang Chrey	Sdok
C.A. (km2)	5740	789	630	607	326	514	249	291	190	347	242	153	94	127	115	159	30	239	246	391
Thiessen	100%	13.7%	11.0%	10.6%	5.7%	8.9%	4.3%	5.1%	3.3%	6.0%	4.2%	2.7%	1.6%	2.2%	2.0%	2.8%	0.5%	4.2%	4.3%	6.8%
1961						1072														
1962						1413														
1963						1317														
1964						1334														
1965						1436														
1966						1635		1926								1681	1349			
1967						1473		1695								1419	1039			
1968						1075		1960								1292	1011			
1969						1124		1919								1317	1235			
1970						1664														
1981						1289														
1982						1361														
1983						1109							1443			907	1401			
1984						1179					720		1194			843	1193			
1985						1283					1230		1922			1171	1482			
1986						1351					999		985			1076	1072			
1987						1506					725		736	608		724	767			
1988						1369					911		1155	1022		672	988			
1989						1437					826		1466	1166		1105	975			
1990						1142							651	1254		709	802			
1991											940		1287	1241		1269	1073			
1992											844		1116	859		874	874			
1993											1334		1000	876		992	952			
1994											1004		1143	1160		801	1181			
1995						1413					1160		1139	1460		972	1122			
1996						1616					1315		1388	1356		1197	1390			
1997				673		1408					941		950	1306		654	1151	1175		
1998				1115		1533					1280		1255	1428		1213	1452	1404		
1999				1447		1659					1381		1406	1652		1529	1757	1155		
2000				1392		2129					1387		1299	1457		1582	1817	1552		
2001	1529	(1377)	1243	1444	(1883)	1615	1458	2275	(1752)	1490	1407	1283	1343	1616	1237	1574	1723	1639	(1503)	1622
2002	1092	(996)	1197	896	(1195)	1286	1015	1158	(1207)	1231	1062	1161	730	1036	999	1137	937	882	(1049)	1170
2003	1294	(1433)	1230	1535	(1329)	1304	1208	1343	(1325)	1316	1102	1329	741	1421	897	1272	883	1096	(1106)	1276
2004	984	(1058)	1062	1056	(1060)	1092	785	1203	(1012)	917	885	808	632	1078	371	826	949	882	(878)	964
Mean	1225	(1216)	1183	1195	(1367)	1387	1117	1685	(1324)	1239	1073	1145	1135	1222	876	1108	1176	1223	(1134)	1258

Source: MOWRAM

Table A.8 Annual Maximum Daily Rainfall of Prek Thnot River Basin

		1	1	2	4	3	4	5	6	7	8	9	10	11	12	13	14	15	18	16
Year	Total Basin	Phum Chum	Trapeang Chor	Aoral/ Oral	Prey Kahiech	Pochentong	Ou Taroth	Kirirom	Church	Srae Klong	Kong Pisei	Peam Khley	Thnal Toteung	Thpong	Krang Ampil	Phnum Sruoch	Kompong Speu	Prey Pdau	Roleang Chrey	Sdok
C.A. (km2)	5740	789	630	607	326	514	249	291	190	347	242	153	94	127	115	159	30	239	246	391
Thiessen	100%	13.7%	11.0%	10.6%	5.7%	8.9%	4.3%	5.1%	3.3%	6.0%	4.2%	2.7%	1.6%	2.2%	2.0%	2.8%	0.5%	4.2%	4.3%	6.8%
2001	58		40	85		80	75	124		65	82	154	98	141	55	101	83	67		72
2002	72		86	90		111	97	43		83	150	206	78	137	73	79	112	92		110
2003	62		94	127		87	83	64		68	75	84	56	68	61	69	76	64		80
2004	57		86	67		119	64	56		54	94	63	47	95	33	89	95	67		82

Source: JICA Study Team

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (1/9)

40103 STUNG PREK THNOT-PEAM KHLEY, CAMBODIA

C.A.= 3662.3 km2 GAUGE HEIGHT IN METTRES, HYDROLOOGIC YEAR 1997

Discharge in m3/s, HYDROLOOGIC YEAR 1997

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.44	0.95	1.03	0.94	(1.62)	(1.52)	0.95	2.76	2.56	4.10	2.83	1.15
2	1.43	0.94	1.04	0.94	(1.65)	(1.48)	1.00	2.82	2.45	3.50	2.66	1.14
3	1.42	1.18	1.04	0.97	(1.66)	(1.39)	1.00	5.55	2.25	3.31	2.25	1.14
4	1.41	1.20	1.04	1.00	(1.58)	(1.39)	1.10	7.35	2.15	4.59	1.75	1.13
5	1.40	1.21	1.05	0.97	(1.54)	(1.47)	1.10	7.05	2.25	4.29	2.12	1.12
01-5	1.42	1.10	1.04	0.96	1.61	1.45	1.03	5.11	2.33	3.96	2.32	1.14
6	1.39	1.20	1.05	0.96	(1.52)	(1.57)	1.00	6.65	2.39	3.60	2.37	1.12
7	1.38	1.18	1.05	0.98	(1.47)	(1.62)	1.02	5.75	2.34	3.43	2.09	1.11
8	1.37	1.16	1.09	1.00	(1.54)	(1.62)	1.45	4.20	2.30	3.15	1.83	1.10
9	1.36	1.14	1.11	0.99	(1.55)	(1.50)	1.15	3.25	2.30	2.92	1.80	1.10
10	1.35	1.14	1.03	0.99	(1.52)	(1.56)	1.15	3.15	2.21	2.71	1.77	1.11
06-10	1.37	1.16	1.07	0.98	1.52	1.57	1.15	4.60	2.31	3.16	1.97	1.11
11	1.34	1.17	1.01	0.97	(1.45)	(1.55)	1.28	2.90	2.18	2.61	1.74	1.11
12	1.33	1.26	0.99	0.97	(1.43)	(1.55)	1.43	2.80	2.13	2.56	1.67	1.10
13	1.32	1.29	0.98	1.09	(1.44)	(1.46)	1.45	2.30	2.49	2.53	1.59	1.10
14	1.31	1.32	1.00	1.03	(1.44)	(1.41)	1.50	2.20	2.69	2.49	1.53	1.10
15	1.30	1.46	1.07	1.00	(1.43)	(1.43)	1.40	2.10	2.55	2.32	1.49	1.10
11-15	1.32	1.30	1.01	1.01	1.44	1.48	1.41	2.46	2.41	2.50	1.60	1.10
16	1.29	1.44	1.13	0.98	(1.44)	(1.43)	1.66	2.00	2.24	3.05	1.45	1.08
17	1.28	1.32	1.32	0.97	(1.45)	(1.35)	1.80	1.90	3.30	3.21	1.39	1.06
18	1.27	1.25	1.50	0.97	(1.43)	(1.29)	1.90	1.90	3.20	3.25	1.35	1.07
19	1.26	1.22	1.16	0.96	(1.50)	(1.35)	1.60	1.90	3.10	3.02	1.31	1.07
20	1.25	1.15	1.08	0.95	(1.46)	(1.33)	1.30	1.84	3.10	2.75	1.27	1.08
16-20	1.27	1.28	1.24	0.97	1.46	1.35	1.65	1.91	2.99	3.06	1.35	1.07
21	1.24	1.13	1.09	0.94	(1.45)	(1.33)	1.21	1.88	3.20	2.35	1.25	1.08
22	1.23	1.10	1.08	0.97	(1.47)	(1.33)	2.00	2.00	3.22	2.31	1.23	1.07
23	1.22	1.11	1.06	1.04	(1.45)	0.93	2.26	2.10	3.25	2.30	1.22	1.06
24	1.21	1.12	1.03	1.02	(1.41)	0.94	2.55	2.40	4.00	2.63	1.20	1.05
25	1.20	1.13	1.01	1.00	(1.39)	0.92	3.10	3.30	4.55	2.52	1.22	1.04
21-25	1.22	1.12	1.05	0.99	1.44	1.09	2.22	2.34	3.64	2.42	1.22	1.06
26	1.19	1.10	1.01	1.45	(1.53)	0.90	2.90	3.95	4.70	2.49	1.20	1.05
27	1.18	1.05	0.99	1.10	(1.55)	0.90	3.00	4.00	4.80	2.45	1.19	1.06
28	1.17	1.04	0.96	0.97	(1.56)	0.89	2.90	3.94	5.27	2.41	1.18	1.05
29	1.16		0.96	0.95	(1.54)	0.92	2.80	4.05	5.74	2.37	1.16	1.04
30	1.10		0.96	0.00	(1.56)	0.95	2.60	3.75	5.00	2.33	1.15	1.03
31	0.96		0.95		(1.56)		2.58	2.70		2.10		1.02
26-end	1.13	1.06	0.97	0.89	1.55	0.91	2.80	3.73	5.10	2.36	1.18	1.04
Mean	1.28	1.18	1.06	0.97	1.50	1.31	1.75	3.37	3.13	2.89	1.61	1.09
Max.	1.44	1.46	1.50	1.45	1.66	1.62	3.10	**7.35**	5.74	4.59	2.83	1.15
Min.	0.96	0.94	0.95	0.00	1.39	0.89	0.95	1.84	2.13	2.10	1.15	1.02

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	8.56	1.04	1.85	0.96	(12.89)	(10.28)	1.04	64.47	51.28	195.95	69.48	3.37
2	8.34	0.96	1.96	0.96	(13.74)	(9.55)	1.53	68.76	44.74	127.80	57.67	3.23
3	8.13	3.81	1.96	1.23	(14.02)	(7.53)	1.53	422.74	34.46	109.36	34.46	3.23
4	7.92	4.11	1.96	1.53	(11.81)	(7.53)	2.69	826.48	30.36	262.76	16.49	3.09
5	7.71	4.27	2.08	1.23	(10.78)	(9.32)	2.69	749.79	34.46	220.67	29.17	2.95
01-5	8.13	2.64	1.96	1.17	12.62	8.81	1.85	343.96	38.29	178.46	37.77	3.17
6	7.51	4.11	2.08	1.14	(10.28)	(11.55)	1.53	653.38	41.39	138.12	40.30	2.95
7	7.31	3.81	2.08	1.33	(9.32)	(12.89)	1.74	460.91	38.71	120.83	28.01	2.82
8	7.11	3.51	2.56	1.53	(10.78)	(12.89)	8.78	208.77	36.61	95.00	18.93	2.69
9	6.91	3.23	2.82	1.43	(11.03)	(9.79)	3.37	103.85	36.61	76.23	18.00	2.69
10	6.72	3.23	1.85	1.43	(10.28)	(11.29)	3.37	95.00	32.79	61.02	17.08	2.82
06-10	7.11	3.57	2.27	1.37	10.33	11.66	3.43	264.23	37.04	96.04	23.68	2.80
11	6.53	3.66	1.63	1.23	(8.85)	(11.03)	5.43	74.70	31.56	54.42	16.19	2.82
12	6.34	5.08	1.43	1.23	(8.40)	(11.03)	8.34	67.31	29.56	51.28	14.21	2.69
13	6.15	5.61	1.33	2.56	(8.62)	(9.08)	8.78	36.61	47.06	49.45	12.09	2.69
14	5.97	6.15	1.53	1.85	(8.62)	(7.96)	9.90	32.38	59.67	47.06	10.61	2.69
15	5.78	9.00	2.32	1.53	(8.40)	(8.40)	7.71	28.40	50.67	37.66	9.67	2.69
11-15	6.15	5.78	1.63	1.66	8.58	9.46	7.96	45.32	42.38	47.77	12.45	2.72
16	5.61	8.56	3.09	1.33	(8.62)	(8.40)	13.93	24.67	34.04	86.57	8.78	2.44
17	5.43	6.15	6.15	1.23	(8.85)	(6.70)	18.00	21.21	108.43	100.26	7.51	2.20
18	5.25	4.92	9.90	1.23	(8.40)	(5.55)	21.21	21.21	99.37	103.85	6.72	2.32
19	5.08	4.42	3.51	1.14	(9.79)	(6.70)	12.34	21.21	90.73	84.12	5.97	2.32
20	4.92	3.37	2.44	1.04	(9.08)	(6.31)	5.78	19.25	90.73	63.77	5.25	2.44
16-20	5.25	5.36	4.72	1.19	8.94	6.70	13.71	21.48	81.55	87.06	6.79	2.34
21	4.75	3.09	2.56	0.96	(8.85)	(6.31)	4.27	20.55	99.37	39.23	4.92	2.44
22	4.59	2.69	2.44	1.23	(9.32)	(6.31)	24.67	24.67	101.15	37.15	4.59	2.32
23	4.42	2.82	2.20	1.96	(8.85)	0.87	34.89	28.40	103.85	36.61	4.42	2.20
24	4.27	2.95	1.85	1.74	(7.96)	0.96	50.67	41.94	183.55	55.71	4.11	2.08
25	4.11	3.09	1.63	1.53	(7.53)	0.78	90.73	108.43	256.93	48.85	4.42	1.96
21-25	4.42	2.93	2.13	1.47	8.49	2.56	33.37	38.50	142.79	43.16	4.49	2.20
26	3.96	2.69	1.63	8.78	(10.53)	0.62	74.70	177.50	279.14	47.06	4.11	2.08
27	3.81	2.08	1.43	2.69	(11.03)	0.62	82.51	183.55	294.47	44.74	3.96	2.20
28	3.66	1.96	1.14	1.23	(11.29)	0.55	74.70	176.31	372.10	42.49	3.81	2.08
29	3.51	3.99	1.14	1.04	(10.78)	0.78	67.31	189.70	458.96	40.30	3.51	1.96
30	2.69	3.99	1.14	3.99	(11.29)	1.04	53.79	154.37	326.37	38.18	3.37	1.85
31	1.14	3.99	1.04	3.99	(11.29)	3.99	52.53	60.34	3.99	28.40	3.99	1.74
26-end	3.04	2.24	1.25	0.58	11.03	0.72	67.07	152.33	343.29	39.68	3.75	1.98
Mean	5.47	3.76	2.20	1.22	(9.98)	(5.95)	16.38	114.93	93.31	74.09	12.57	2.50
Max.	8.56	9.00	9.90	8.78	(14.02)	(12.89)	90.73	**826.48**	458.96	262.76	69.48	3.37
Min.	1.14	0.96	1.04	3.99	(7.53)	(0.55)	1.04	19.25	29.56	28.40	3.37	1.74

Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (2/9)

STUNG PREK THNOT-PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOOGIC YEAR 1998

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.01	0.9	1.16	0.86	(1.11)	0.84	0.91	1.97	2.19	5.3	2.63	(2.00)
2	1	0.92	1.03	0.86	(1.11)	0.94	0.9	1.79	2.11	5.58	2.66	(2.03)
3	1	0.93	1.04	0.87	(1.10)	0.99	0.95	1.7	2	5.7	2.69	2.22
4	0.99	0.92	1.01	0.88	(1.10)	1.01	0.98	1.61	2.58	5.23	3.12	2.19
5	0.99	0.9	0.99	0.88	(1.10)	1.07	1.06	1.61	2.7	5.98	3	2.15
01-5	1.00	0.91	1.05	0.87	1.10	0.97	0.96	1.74	2.32	5.56	2.82	2.12
6	1.01	0.9	0.98	0.85	(1.10)	1.01	1.29	2.09	2.83	5.6	3	2.11
7	1.01	0.89	1.02	0.83	(1.10)	0.99	1.35	1.92	2.9	4.44	3.28	1.95
8	1	0.88	1.01	0.82	(1.10)	0.97	1.15	1.6	2.79	4.3	3.31	1.89
9	1	0.9	1.02	0.8	(1.11)	0.96	1.07	1.47	2.63	4.31	3.37	1.85
10	1	0.88	0.99	0.8	(1.11)	0.93	1.02	1.4	2.75	4.45	3.17	1.81
06-10	1.00	0.89	1.00	0.82	1.10	0.97	1.18	1.70	2.78	4.62	3.23	1.92
11	0.98	0.86	0.97	0.9	(1.11)	0.89	0.97	1.33	2.76	4.41	2.87	1.75
12	0.96	0.85	0.94	0.95	(1.11)	0.86	0.98	1.37	2.44	4.28	2.69	1.71
13	1	0.86	0.91	0.92	(1.11)	0.85	1.14	1.51	2.8	4.33	2.47	1.69
14	0.98	0.85	0.9	0.9	(1.13)	0.89	1.14	1.5	2.56	3.95	2.25	1.44
15	0.98	0.84	0.95	0.9	(1.13)	0.91	1.08	1.63	2.57	3.94	2.19	1.45
11-15	0.98	0.85	0.93	0.91	1.12	0.88	1.06	1.47	2.63	4.18	2.49	1.61
16	0.96	0.82	0.94	0.88	(1.11)	1.06	1.08	1.25	3.38	3.65	2.49	1.42
17	0.98	0.82	0.9	0.86	(1.12)	1.02	1.16	1.97	3	3.45	3.11	1.4
18	1	0.82	0.92	0.85	(1.11)	1.02	1.13	1.74	3.05	3.2	3.37	1.37
19	1.01	0.84	0.93	0.83	(1.11)	1	1.9	2.11	3.53	3.03	3.47	1.36
20	1	0.86	0.89	0.88	(1.13)	0.99	1.86	2.18	3.51	2.85	3.16	1.34
16-20	0.99	0.83	0.92	0.86	1.12	1.02	1.43	1.85	3.29	3.24	3.12	1.38
21	0.98	1	0.89	1.22	(1.22)	0.97	1.15	1.98	3.15	2.69	2.85	1.33
22	0.99	0.98	0.86	1.21	(1.31)	0.96	1.13	2.05	2.74	2.58	2.54	1.32
23	1	1.12	0.84	1.04	(1.30)	0.99	1.09	2.1	2.75	2.44	2.39	1.31
24	1	1.04	0.82	1.02	(1.30)	0.97	1.08	1.87	2.83	2.3	2.3	1.3
25	0.98	1.05	0.81	1	(1.29)	1.03	1.15	2.11	2.75	2.39	2.15	1.28
21-25	0.99	1.04	0.84	1.10	1.28	0.98	1.12	2.02	2.84	2.48	2.45	1.31
26	0.98	1.04	0.82	1	(1.22)	1.02	1.21	2.61	3.5	2.64	2.09	1.27
27	0.96	1.49	0.84	1	(1.22)	0.98	1.18	2.55	4.5	3	2.03	1.26
28	0.94	1.26	0.85	0.98	(1.12)	0.95	1.35	2.16	4.81	2.9	2.02	1.24
29	0.93		0.85	0.97	(1.20)	0.93	1.26	(1.60)	4.95	2.61	1.91	1.23
30	0.92		0.85	0.94	(1.21)	0.92	1.73	(1.55)	4.95	2.6		1.22
31	0.88		0.85		(1.22)		2	(1.48)		2.62		1.22
26-end	0.94	1.26	0.84	0.98	1.20	0.96	1.46	1.99	4.54	2.73	2.01	1.24
Mean	0.98	0.94	0.93	0.92	(1.16)	0.96	1.21	1.80	3.07	3.77	2.71	1.58
Max.	1.01	1.49	1.16	1.22	(1.31)	1.07	2.00	2.61	4.95	**5.98**	3.47	2.22
Min.	0.88	0.82	0.81	0.80	(1.10)	0.84	0.90	1.25	2.00	2.30	1.91	1.22

Discharge in m3/s, HYDROLOOGIC YEAR 1998

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.63	0.62	3.51	0.33	(2.83)	0.20	0.70	23.61	31.97	377.37	55.71	(24.74)
2	1.53	0.78	1.85	0.33	(2.83)	0.96	0.62	17.69	28.78	428.36	57.67	(25.90)
3	1.53	0.87	1.96	0.40	(2.69)	1.43	1.04	15.04	24.67	451.21	59.67	33.20
4	1.43	0.78	1.63	0.47	(2.69)	1.63	1.33	12.60	52.53	365.13	92.43	31.97
5	1.43	0.62	1.43	0.47	(2.69)	2.32	2.20	12.60	60.34	506.88	82.51	30.36
01-5	1.51	0.74	2.03	0.40	2.75	1.23	1.14	16.08	37.46	424.23	68.76	29.14
6	1.63	0.62	1.33	0.27	(2.69)	1.63	5.61	28.01	69.48	432.12	82.51	28.78
7	1.63	0.55	1.74	0.14	(2.69)	1.43	6.72	21.88	74.70	241.24	106.59	22.91
8	1.53	0.47	1.63	0.08	(2.69)	1.23	3.37	12.34	66.60	222.01	109.36	20.88
9	1.53	0.62	1.74	-0.03	(2.83)	1.14	2.32	9.22	55.71	223.36	115.02	19.57
10	1.53	0.47	1.43	-0.03	(2.83)	0.87	1.74	7.71	63.77	242.65	96.74	18.31
06-10	1.57	0.55	1.57	0.08	2.75	1.25	3.75	14.93	65.88	267.18	101.69	21.95
11	1.33	0.33	1.23	0.62	(2.83)	0.55	1.23	6.34	64.47	237.05	72.44	16.49
12	1.14	0.27	0.96	1.04	(2.83)	0.33	1.33	7.11	44.17	219.33	59.67	15.33
13	1.53	0.33	0.70	0.78	(2.83)	0.27	3.23	10.13	67.31	226.06	45.89	14.76
14	1.33	0.27	0.62	0.62	(3.11)	0.55	3.23	9.90	51.28	177.50	34.46	8.56
15	1.33	0.20	1.04	0.62	(3.11)	0.70	2.44	13.13	51.90	176.31	31.97	8.78
11-15	1.33	0.28	0.90	0.74	2.94	0.47	2.22	9.17	55.45	206.43	47.30	12.55
16	1.14	0.08	0.96	0.47	(2.83)	2.20	2.44	4.92	115.98	143.43	47.06	8.13
17	1.33	0.08	0.62	0.33	(2.97)	1.74	3.51	23.61	82.51	122.80	91.58	7.71
18	1.53	0.08	0.78	0.27	(2.83)	1.74	3.09	16.19	86.57	99.37	115.02	7.11
19	1.63	0.20	0.87	0.14	(2.83)	1.53	21.21	28.78	130.85	84.93	124.79	6.91
20	1.53	0.33	0.55	0.47	(3.11)	1.43	19.89	31.56	128.82	70.95	95.87	6.53
16-20	1.43	0.15	0.75	0.33	2.91	1.72	8.26	19.57	107.88	102.59	92.43	7.27
21	1.33	1.53	0.55	4.42	(4.50)	1.23	3.37	23.96	95.00	59.67	70.95	6.34
22	1.43	1.33	0.33	4.27	(5.92)	1.14	3.09	26.50	63.08	52.53	50.06	6.15
23	1.53	2.95	0.20	1.96	(5.73)	1.43	2.56	28.40	63.77	44.17	41.39	5.97
24	1.53	1.96	0.08	1.74	(5.73)	1.23	2.44	20.22	69.48	36.61	36.61	5.78
25	1.33	2.08	0.03	1.53	(5.55)	1.85	3.37	28.78	63.77	41.39	30.36	5.43
21-25	1.43	1.94	0.23	2.67	5.47	1.37	2.95	25.47	70.51	46.48	44.51	5.93
26	1.33	1.96	0.08	1.53	(4.50)	1.74	4.27	54.42	127.80	56.36	28.01	5.25
27	1.14	9.67	0.20	1.53	(4.50)	1.33	3.81	50.67	249.74	82.51	25.76	5.08
28	0.96	5.08	0.27	1.33	(2.97)	1.04	6.72	30.75	296.02	74.70	25.40	4.75
29	0.87	3.99	0.27	1.23	(4.17)	0.87	(5.08)	12.35	318.24	54.42	21.54	4.59
30	0.78	3.99	0.27	0.96	(4.33)	0.78	(15.90)	11.03	318.24	53.79	3.99	4.42
31	0.47	3.99	0.27	3.99	(4.50)	3.99	(24.67)	9.55	3.99	55.06	3.99	4.42
26-end	0.91	5.14	0.22	1.31	4.14	1.14	8.89	24.39	255.77	62.27	25.13	4.75
Mean	1.34	0.99	0.85	0.81	(3.46)	1.17	(4.24)	18.01	87.97	156.17	61.00	11.94
Max.	1.63	9.67	3.51	4.42	(5.92)	2.32	(24.67)	54.42	318.24	**506.88**	124.79	33.20
Min.	0.47	0.08	0.03	-0.03	(2.69)	0.20	(0.62)	4.92	24.67	36.61	21.54	4.42

Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (3/9)

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 1999

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.22	1.01	1.02	0.86	2.03	2.55	3.15	3.5	3.37	2.2	7.24	3.37
2	1.2	1	1.02	0.94	2.15	2.47	3.43	3.1	4.26	2.44	7.21	4.36
3	1.21	1.01	1.01	1.05	2.4	2.73	4.51	2.86	4.41	2.50	7.13	4.41
4	1.25	1.04	1.02	1.11	3.02	2.93	4.43	3.88	4.91	2.61	6.84	4.91
5	1.7	1.02	1.04	1.37	3	2.22	4.49	4.34	5.34	3.01	7.08	5.34
01-5	1.32	1.02	1.02	1.07	2.52	2.58	4.00	3.54	4.46	2.55	7.10	4.48
6	2.21	1	1.02	1.68	2.87	3.36	4.39	5.69	5.43	3.25	7.18	5.43
7	2.2	1.13	1.04	1.66	2.41	4.18	4.29	5.66	5.19	3.42	6.59	5.19
8	1.3	1.14	1.1	1.48	2.33	4.13	2.2	5.26	4.63	3.46	5.6	4.67
9	1.31	1.12	1.05	1.51	1.99	4	1.95	4.89	4.42	4.28	5.75	4.37
10	1.34	1.11	1.1	1.6	2	3.15	1.98	4.85	4.55	4.62	5.73	4.66
06-10	1.67	1.10	1.06	1.59	2.32	3.76	2.96	5.27	4.84	3.81	6.17	4.86
11	1.22	1.12	1.11	1.6	1.93	2.97	2.16	3.75	3.57	4.41	4.91	(2.03)
12	1.21	1.1	1.12	2.09	2	2.87	2.1	3.37	3.33	4.64	4.88	(1.99)
13	1.2	1.1	1.05	2.09	2.02	2.8	2.12	3.13	2.97	4.85	4.83	(2.13)
14	1.29	1.06	1.01	2.17	2.03	2.75	2.11	2.11	2.92	5.24	4.86	(1.94)
15	1.25	1.04	1.01	1.81	2.05	2.58	2.06	2.06	2.88	5.44	3.87	(1.92)
11-15	1.23	1.08	1.06	1.95	2.01	2.79	2.11	2.88	3.13	4.92	4.67	2.00
16	1.21	1.04	1	1.66	2.4	2.51	2.1	2.26	2.86	5.62	3.81	(1.77)
17	1.2	1.03	1	1.52	3.08	2.21	2.14	2.41	2.84	5.68	3.35	(1.38)
18	1.25	1.02	0.98	1.45	4.61	2.22	1.92	2.73	2.81	5.74	3.28	(1.43)
19	1.25	1.02	0.97	1.39	3.55	2.68	1.9	2.99	2.96	5.86	3.15	(1.45)
20	1.17	1.03	0.96	1.35	3.56	2.98	1.9	2.95	3.2	5.88	3.4	(1.72)
16-20	1.22	1.03	0.98	1.47	3.44	2.52	1.99	2.67	2.93	5.76	3.40	1.55
21	1.15	1.02	0.95	1.39	3.4	3.09	1.8	3.06	3.42	5.98	3.79	(2.00)
22	1.12	1.05	0.94	1.57	3.43	3.09	1.77	3.1	3.46	6.05	2.65	(2.00)
23	1.11	1	0.94	1.75	4.9	2.99	1.7	2.99	3.56	6.04	2.62	(1.91)
24	1.1	1.01	0.94	1.89	5.66	2.96	1.63	2.97	3.46	5.98	2.55	(2.24)
25	1.1	1.01	1	2.05	5.61	3.25	1.59	2.93	2.97	5.96	2.52	(1.81)
21-25	1.12	1.02	0.95	1.73	4.60	3.08	1.70	3.01	3.37	6.00	2.83	1.99
26	1.08	1	0.98	2.38	2.81	3.05	2.61	3.01	2.64	6.13	2.44	(1.83)
27	1.06	1.02	0.97	2.38	2.86	2.99	2.83	3.2	2.51	6.21	2.35	(1.81)
28	1.04	1	0.92	2.37	2.1	2.97	3.53	3.11	2.44	6.24	2.27	(1.83)
29	1.02	1.01	0.88	2.4	2.45	2.93	3.6	3.21	2.34	6.06	2.23	(1.83)
30	1.01		0.86	2.36	2.47	3.08	3.61	3.25	2.21	6.53	2.21	(2.04)
31	1.02		0.86		2.43		3.63	3.21		7.02		(2.51)
26-end	1.04	1.01	0.91	2.38	2.52	3.00	3.30	3.17	2.43	6.37	2.30	1.98
Mean	1.26	1.04	1.00	1.70	2.89	2.96	2.70	3.41	3.53	4.95	4.41	2.81
Max.	2.21	1.14	1.12	2.40	5.66	4.18	4.51	5.69	5.43	7.02	**7.24**	5.43
Min.	1.01	1.00	0.86	0.86	1.93	2.21	1.59	2.06	2.21	2.20	2.21	1.38

Discharge in m3/s, HYDROLOOGIC YEAR 1999

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	4.42	1.63	1.74	0.33	25.76	50.67	95.00	127.80	115.02	32.38	797.92	115.02
2	4.11	1.53	1.74	0.96	30.36	45.89	120.83	90.73	216.66	44.17	790.22	230.15
3	4.27	1.63	1.63	2.08	41.94	62.39	251.17	71.69	237.05	47.65	769.87	237.05
4	4.92	1.96	1.74	2.82	84.12	77.00	239.84	169.22	311.81	54.42	698.34	311.81
5	15.04	1.74	1.96	7.11	82.51	33.20	248.31	227.42	384.45	83.31	757.29	384.45
01-5	6.55	1.70	1.76	2.27	48.85	52.53	183.79	131.47	243.78	50.79	762.31	246.61
6	32.79	1.53	1.74	14.48	72.44	114.07	234.28	449.28	400.63	103.85	782.56	400.63
7	32.38	3.09	1.96	13.93	42.49	206.17	220.67	443.53	358.23	119.86	639.50	358.23
8	5.78	3.23	2.69	9.44	38.18	199.75	32.38	370.35	268.66	123.80	432.12	274.62
9	5.97	2.95	2.08	10.13	24.32	183.55	22.91	308.62	238.45	219.33	460.91	231.52
10	6.53	2.82	2.69	12.34	24.67	95.00	23.96	302.29	256.93	267.18	457.02	273.13
06-10	14.26	2.69	2.22	11.99	37.66	155.94	79.49	372.10	301.34	160.68	546.52	304.50
11	4.42	2.95	2.82	12.34	22.22	80.12	30.75	154.37	134.98	237.05	311.81	(25.90)
12	4.27	2.69	2.95	28.01	24.67	72.44	28.40	115.02	111.23	270.14	307.03	(24.36)
13	4.11	2.69	2.08	28.01	25.40	67.31	29.17	93.28	80.12	302.29	299.15	(29.56)
14	5.61	2.20	1.63	31.16	25.76	63.77	28.78	28.78	76.23	366.87	303.86	(22.50)
15	4.92	1.96	1.63	18.31	26.50	52.53	26.88	26.88	73.19	402.45	168.05	(21.77)
11-15	4.65	2.49	2.20	22.98	24.89	66.88	28.78	73.49	93.62	312.77	274.62	24.74
16	4.27	1.96	1.53	13.93	41.94	48.25	28.40	34.89	71.69	435.91	161.14	(17.04)
17	4.11	1.85	1.53	10.37	89.05	32.79	29.96	42.49	70.22	447.36	113.12	(7.32)
18	4.92	1.74	1.33	8.78	265.70	33.20	21.88	62.39	68.03	458.96	106.59	(8.40)
19	4.92	1.74	1.23	7.51	132.91	59.00	21.21	81.71	79.33	482.62	95.00	(8.85)
20	3.66	1.85	1.14	6.72	133.94	80.91	21.21	78.55	99.37	486.62	117.91	(15.50)
16-20	4.36	1.83	1.35	9.31	121.82	48.85	24.39	58.20	77.31	462.08	117.72	11.10
21	3.37	1.74	1.04	7.51	117.91	89.89	18.00	87.39	119.86	506.88	158.86	(24.74)
22	2.95	2.08	0.96	11.58	120.83	89.89	17.08	90.73	123.80	521.31	57.01	(24.74)
23	2.82	1.53	0.96	16.49	310.21	81.71	15.04	81.71	133.94	519.23	55.06	(21.42)
24	2.69	1.63	0.96	20.88	443.53	79.33	13.13	80.12	123.80	506.88	50.67	(33.90)
25	2.69	1.63	1.53	26.50	434.01	103.85	12.09	77.00	80.12	502.79	48.85	(18.34)
21-25	2.90	1.72	1.08	15.90	264.23	88.72	14.99	83.31	115.40	511.39	69.19	24.37
26	2.44	1.53	1.33	40.84	68.03	86.57	54.42	83.31	56.36	538.05	44.17	(19.00)
27	2.20	1.74	1.23	40.84	71.69	81.71	69.48	99.37	48.25	555.06	39.23	(18.34)
28	1.96	1.53	0.78	40.30	28.40	80.12	130.85	91.58	44.17	561.50	35.31	(19.00)
29	1.74	1.63	0.47	41.94	44.74	77.00	138.12	100.26	38.71	523.39	33.62	(19.00)
30	1.63	3.99	0.33	39.77	45.89	89.05	139.17	103.85	32.79	625.76	32.79	(26.30)
31	1.74	3.99	0.33	3.99	43.61	3.99	141.29	100.26	3.99	742.32	3.99	(47.99)
26-end	1.94	1.61	0.72	40.73	48.85	82.83	108.59	96.30	43.49	588.77	36.61	23.83
Mean	5.05	2.00	1.49	14.98	73.84	79.05	60.19	119.26	130.72	317.72	237.15	(68.06)
Max.	32.79	3.23	2.95	41.94	443.53	206.17	251.17	449.28	400.63	742.32	**797.92**	(400.63)
Min.	1.63	1.53	0.33	0.33	22.22	32.79	12.09	26.88	32.79	32.38	32.79	(7.32)

Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (4/9)

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 2000

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.95	1.32	1.51	1.12	1.67	1.65	2.54	2.23	3.24	3.55	5.24	2.08
2	1.92	1.31	1.50	1.10	1.68	1.70	2.28	2.22	3.32	3.70	4.27	1.99
3	1.88	1.29	1.50	1.12	2.11	2.19	2.29	2.32	3.29	3.55	3.72	1.95
4	1.86	1.28	1.58	1.14	2.63	2.87	2.24	2.25	2.99	3.05	3.67	1.83
5	1.84	1.27	1.64	1.16	2.63	3.17	2.07	2.68	2.75	2.75	2.99	1.75
01-5	1.89	1.29	1.55	1.13	2.14	2.32	2.28	2.34	3.12	3.32	3.98	1.92
6	1.82	1.26	1.66	1.15	2.56	3.31	2.59	1.95	2.56	3.53	2.77	1.71
7	1.78	1.24	1.69	1.17	2.42	3.13	2.85	1.95	2.36	3.55	2.59	1.67
8	1.76	1.22	1.68	1.20	2.33	2.89	2.81	2.12	2.36	3.35	2.46	1.64
9	1.74	1.21	1.65	1.24	1.83	2.79	2.48	2.09	2.38	2.86	2.32	1.62
10	1.72	1.20	1.62	1.20	1.74	2.83	2.33	2.06	2.58	2.79	2.22	1.61
06-10	1.76	1.23	1.66	1.19	2.18	2.99	2.61	2.03	2.45	3.22	2.47	1.65
11	1.68	1.19	1.68	1.17	1.73	2.50	2.73	1.99	2.48	2.75	2.17	1.61
12	1.66	1.16	1.66	1.20	1.83	2.22	3.30	2.15	2.44	3.40	2.12	1.56
13	1.64	1.14	1.72	1.24	1.97	2.06	3.41	2.12	2.72	4.30	2.08	1.54
14	1.62	1.12	1.74	1.28	2.67	1.94	3.19	2.03	2.77	5.25	2.08	1.53
15	1.58	1.11	1.35	1.30	2.63	1.82	3.17	2.19	2.64	8.52	2.06	1.55
11-15	1.64	1.14	1.63	1.24	2.17	2.11	3.16	2.10	2.61	4.84	2.10	1.56
16	1.56	1.10	1.73	1.32	1.93	1.73	3.73	2.02	2.71	8.88	2.08	1.53
17	1.55	1.14	1.68	2.11	1.77	1.82	3.86	2.05	2.43	8.71	2.29	1.50
18	1.53	1.16	1.91	2.88	1.77	1.83	3.78	2.23	2.59	8.31	3.44	1.49
19	1.50	1.18	1.66	2.96	1.73	2.38	4.13	2.21	2.59	6.67	3.65	1.46
20	1.47	1.18	1.44	2.85	1.67	2.81	4.37	2.57	2.66	6.30	3.77	1.42
16-20	1.52	1.15	1.68	2.42	1.77	2.11	3.97	2.22	2.60	7.77	3.05	1.48
21	1.45	1.26	1.34	2.78	1.64	2.57	3.37	2.90	2.66	4.49	3.32	2.28
22	1.43	1.29	1.25	3.05	1.62	2.29	2.98	3.03	2.81	4.31	2.87	3.11
23	1.41	1.29	1.16	3.54	1.65	2.25	2.78	3.44	2.89	4.24	2.63	2.99
24	1.40	1.52	1.16	3.12	1.64	2.18	2.59	3.46	3.27	4.38	2.38	2.93
25	1.66	1.53	1.16	2.79	1.76	2.13	2.71	3.49	3.24	5.08	2.26	2.13
21-25	1.47	1.38	1.21	3.06	1.66	2.28	2.89	3.26	2.97	4.50	2.69	2.69
26	1.63	1.54	1.18	2.84	1.83	2.13	2.71	3.99	3.04	4.23	2.20	2.77
27	1.56	1.54	1.16	2.67	2.00	2.23	3.13	3.92	2.85	3.60	2.21	2.19
28	1.49	1.51	1.15	2.63	1.89	2.23	3.46	3.62	2.99	3.28	2.25	1.59
29	1.45	1.50	1.13	1.95	1.89	2.63	2.84	3.52	3.62	3.62	2.15	1.54
30	1.46		1.10	1.80	1.94	2.55	2.58	3.27	3.76	4.53	2.07	1.50
31	1.41		1.12		1.94		2.29	3.19		5.23		1.49
26-end	1.50	1.52	1.14	2.38	1.92	2.35	2.84	3.59	3.25	4.08	2.18	1.85
Mean	1.63	1.28	1.47	1.90	1.97	2.36	2.95	2.62	2.83	4.61	2.74	1.86
Max.	1.95	1.54	1.91	3.54	2.67	3.31	4.37	3.99	3.76	**8.88**	5.24	3.11
Min.	1.40	1.10	1.10	1.10	1.62	1.65	2.07	1.95	2.36	2.75	2.06	1.42

Discharge in m3/s, HYDROLOOGIC YEAR 2000

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	22.91	6.15	10.13	2.95	14.21	13.66	50.06	33.62	102.95	132.91	366.87	27.63
2	21.88	5.97	9.90	2.69	14.48	15.04	35.74	33.20	110.29	148.85	217.99	24.32
3	20.55	5.61	9.90	2.95	28.78	31.97	36.18	37.66	107.51	132.91	151.05	22.91
4	19.89	5.43	11.83	3.23	55.71	72.44	34.04	34.46	81.71	86.57	145.59	18.93
5	19.25	5.25	13.39	3.51	55.71	96.74	27.25	59.00	63.77	63.77	81.71	16.49
01-5	20.90	5.68	10.99	3.06	30.12	37.46	35.92	38.71	92.25	110.29	180.88	21.88
6	18.62	5.08	13.93	3.37	51.28	109.36	53.16	22.91	51.28	130.85	65.18	15.33
7	17.39	4.75	14.76	3.66	43.05	93.28	70.95	22.91	39.77	132.91	53.16	14.21
8	16.78	4.42	14.48	4.11	38.18	73.94	68.03	29.17	39.77	113.12	45.32	13.39
9	16.19	4.27	13.66	4.75	18.93	66.60	46.48	28.01	40.84	71.69	37.66	12.86
10	15.61	4.11	12.86	4.11	16.19	69.48	38.18	26.88	52.53	66.60	33.20	12.60
06-10	16.90	4.52	13.93	3.99	31.40	81.71	54.55	25.91	44.63	100.79	46.01	13.66
11	14.48	3.96	14.48	3.66	15.90	47.65	62.39	24.32	46.48	63.77	31.16	12.60
12	13.93	3.51	13.93	4.11	18.93	33.20	108.43	30.36	44.17	117.91	29.17	11.34
13	13.39	3.23	15.61	4.75	23.61	26.88	118.88	29.17	61.70	222.01	27.63	10.85
14	12.86	2.95	16.19	5.43	58.33	22.56	98.49	25.76	65.18	368.61	27.63	10.61
15	11.83	2.82	6.72	5.78	55.71	18.62	96.74	31.97	56.36	1161.50	26.88	11.09
11-15	13.29	3.28	13.13	4.72	31.00	28.71	95.87	28.24	54.42	301.34	28.47	11.29
16	11.34	2.69	15.90	6.15	22.22	15.90	152.15	25.40	61.02	1276.09	27.63	10.61
17	11.09	3.23	14.48	28.78	17.08	18.62	166.89	26.50	43.61	1221.31	36.18	9.90
18	10.61	3.51	21.54	73.19	17.08	18.93	157.73	33.62	53.16	1097.16	121.82	9.67
19	9.90	3.81	13.93	79.33	15.90	40.84	199.75	32.79	53.16	658.04	143.43	9.00
20	9.22	3.81	8.56	70.95	14.21	68.03	231.52	51.90	57.67	574.51	156.61	8.13
16-20	10.42	3.40	14.59	43.27	17.20	28.94	180.39	33.04	53.53	941.28	86.24	9.44
21	8.78	5.08	6.53	65.88	13.39	51.90	115.02	74.70	57.67	248.31	110.29	35.74
22	8.34	5.61	4.92	86.57	12.86	36.18	80.91	84.93	68.03	223.36	72.44	91.58
23	7.92	5.61	3.51	131.88	13.66	34.46	65.88	121.82	73.94	214.02	55.71	81.71
24	7.71	10.37	3.51	92.43	13.39	31.56	53.16	123.80	105.67	232.90	40.84	77.00
25	13.93	10.61	3.51	66.60	16.78	29.56	61.02	126.80	102.95	339.60	34.89	29.56
21-25	9.22	7.27	4.33	87.06	13.99	35.92	73.64	105.12	80.44	249.74	59.80	59.53
26	13.13	10.85	3.81	70.22	18.93	29.56	61.02	182.33	85.75	212.70	32.38	65.18
27	11.34	10.85	3.51	58.33	24.67	33.62	93.28	173.93	70.95	138.12	32.79	31.97
28	9.67	10.13	3.37	55.71	20.88	33.62	123.80	140.23	81.71	106.59	34.46	12.09
29	8.78	9.90	3.09	22.91	20.88	55.71	70.22	129.83	140.23	140.23	30.36	10.85
30	9.00	3.99	2.69	18.00	22.56	50.67	52.53	105.67	155.49	254.04	27.25	9.90
31	7.92	3.99	2.95	3.99	22.56	3.99	36.18	98.49	3.99	365.13	3.99	9.67
26-end	9.90	10.43	3.23	40.73	21.71	39.45	69.85	136.54	104.03	193.65	31.40	19.46
Mean	13.02	5.39	9.17	21.30	23.64	39.82	78.90	55.15	69.70	264.99	63.38	19.79
Max.	22.91	10.85	21.54	131.88	58.33	109.36	231.52	182.33	155.49	**1276.09**	366.87	91.58
Min.	7.71	2.69	2.69	2.69	12.86	13.66	27.25	22.91	39.77	63.77	26.88	8.13

Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (5/9)

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 2001

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.47	1.36	0.97	1.50	1.14	1.04	2.78	1.43	3.82	5.33	3.14	1.45
2	1.43	1.32	1.08	1.71	1.00	0.98	2.38	1.41	3.67	4.84	3.35	1.44
3	1.40	1.27	1.03	1.74	0.97	0.97	2.34	1.46	3.28	5.19	3.19	1.44
4	1.35	1.27	1.02	1.68	0.96	0.99	3.24	1.51	3.13	5.79	3.05	1.44
5	1.33	1.25	0.98	1.41	1.02	1.61	4.37	1.42	3.03	5.50	3.30	1.44
01-5	1.40	1.29	1.02	1.61	1.02	1.12	3.02	1.45	3.39	5.33	3.21	1.44
6	1.40	1.25	0.96	1.29	1.00	1.11	5.03	1.54	2.79	4.96	2.95	1.33
7	1.49	1.25	0.98	1.22	0.98	1.12	6.32	2.03	2.53	5.18	2.81	1.33
8	1.45	1.24	0.98	1.20	0.96	1.88	7.16	2.10	2.30	5.38	2.50	1.32
9	1.41	1.22	0.98	1.16	1.03	1.59	6.87	1.99	2.13	5.71	2.39	1.30
10	1.38	1.18	0.97	1.11	1.13	1.37	4.65	1.82	2.10	6.86	2.27	1.28
06-10	1.43	1.23	0.97	1.20	1.02	1.41	6.01	1.90	2.37	5.62	2.58	1.31
11	1.37	1.16	0.95	1.09	1.01	1.58	3.94	1.87	2.09	7.50	2.15	1.28
12	1.37	1.18	1.00	1.08	0.98	1.47	3.60	2.78	2.05	7.26	2.04	1.28
13	1.40	1.15	1.00	1.06	0.95	1.33	3.52	3.38	1.97	6.76	2.02	1.31
14	2.55	1.13	0.99	1.04	0.95	1.23	3.17	3.57	1.91	5.48	2.02	1.65
15	3.09	1.12	0.95	1.04	1.01	1.17	2.52	3.02	2.28	4.82	2.02	1.56
11-15	1.96	1.15	0.98	1.06	0.98	1.36	3.35	2.92	2.06	6.36	2.05	1.42
16	3.03	1.11	1.01	1.00	1.05	1.20	2.38	2.91	2.29	5.40	2.00	1.56
17	2.26	1.12	1.25	0.98	1.05	1.17	2.33	2.75	2.46	4.03	1.97	1.40
18	1.99	1.10	1.55	0.98	1.06	1.16	2.25	2.82	2.71	3.43	1.94	1.36
19	1.76	1.09	1.56	0.97	1.15	1.18	2.09	2.97	3.18	3.18	1.74	1.34
20	1.69	1.08	2.09	0.98	1.20	1.23	1.93	3.19	3.10	3.25	1.72	1.32
16-20	2.15	1.10	1.49	0.98	1.10	1.19	2.20	2.93	2.75	3.86	1.87	1.40
21	1.64	1.04	2.18	0.98	1.18	1.45	1.81	3.12	3.12	3.38	1.67	1.32
22	1.62	1.00	2.08	0.97	1.16	1.31	1.70	3.22	3.19	3.46	1.63	1.22
23	1.65	1.05	2.03	0.96	1.17	1.24	1.58	3.51	3.26	4.02	1.62	1.52
24	1.55	1.08	1.69	0.96	1.12	1.22	1.96	3.59	4.11	4.72	1.62	1.21
25	1.47	1.07	1.51	0.96	1.11	1.40	1.79	3.55	4.41	5.08	1.56	1.21
21-25	1.59	1.05	1.90	0.97	1.15	1.32	1.77	3.40	3.62	4.13	1.62	1.30
26	1.41	1.01	1.46	0.95	0.98	1.79	1.78	2.82	4.54	4.80	1.54	1.21
27	1.36	0.98	1.33	0.95	0.96	1.71	1.74	2.58	4.67	3.95	1.52	1.20
28	1.33	0.98	1.24	1.05	0.96	2.91	1.69	2.45	4.61	3.38	1.50	1.19
29	1.34		1.18	1.15	0.92	2.83	1.59	2.68	4.76	3.13	1.48	1.18
30	1.34		1.19	1.16	0.91	2.89	1.57	3.20	5.28	2.99	1.46	1.16
31	1.37		1.69		1.03		1.47	3.78		2.89		1.14
26-end	1.36	0.99	1.35	1.05	0.96	2.43	1.64	2.92	4.77	3.52	1.50	1.18
Mean	1.64	1.15	1.29	1.14	1.04	1.47	2.95	2.60	3.16	4.76	2.14	1.34
Max.	3.09	1.36	2.18	1.74	1.20	2.91	7.16	3.78	5.28	**7.50**	3.35	1.65
Min.	1.33	0.98	0.95	0.95	0.91	0.97	1.47	1.41	1.91	2.89	1.46	1.14

Discharge in m3/s, HYDROLOOGIC YEAR 2001

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	9.22	6.91	1.23	9.90	3.23	1.96	65.88	8.34	162.28	382.68	94.14	8.78
2	8.34	6.15	2.44	15.33	1.53	1.33	40.84	7.92	145.59	300.71	113.12	8.56
3	7.71	5.25	1.85	16.19	1.23	1.23	38.71	9.00	106.59	358.23	98.49	8.56
4	6.72	5.25	1.74	14.48	1.14	1.43	102.95	10.13	93.28	468.75	86.57	8.56
5	6.34	4.92	1.33	7.92	1.74	12.60	231.52	8.13	84.93	413.45	108.43	8.56
01-5	7.67	5.68	1.70	12.55	1.72	2.93	84.28	8.69	116.56	382.68	99.90	8.60
6	7.71	4.92	1.14	5.61	1.53	2.82	331.30	10.85	66.60	319.86	78.55	6.34
7	9.67	4.92	1.33	4.42	1.33	2.95	578.88	25.76	49.45	356.52	68.03	6.34
8	8.78	4.75	1.33	4.11	1.14	20.55	777.47	28.40	36.61	391.60	47.65	6.15
9	7.92	4.42	1.33	3.51	1.85	12.09	705.58	24.32	29.56	453.14	41.39	5.78
10	7.31	3.81	1.23	2.82	3.09	7.11	271.63	18.62	28.40	703.16	35.31	5.43
06-10	8.26	4.55	1.27	4.05	1.74	8.01	512.21	21.07	40.30	435.53	52.78	6.00
11	7.11	3.51	1.04	2.56	1.63	11.83	176.31	20.22	28.01	866.23	30.36	5.43
12	7.11	3.81	1.53	2.44	1.33	9.22	138.12	65.88	26.50	803.08	26.13	5.43
13	7.71	3.37	1.53	2.20	1.04	6.34	129.83	115.98	23.61	679.23	25.40	5.97
14	50.67	3.09	1.43	1.96	1.04	4.59	96.74	134.98	21.54	409.77	25.40	13.66
15	89.89	2.95	1.04	1.96	1.63	3.66	48.85	84.12	35.74	297.58	25.40	11.34
11-15	23.12	3.34	1.31	2.22	1.33	6.83	113.12	76.54	26.88	588.55	26.50	8.05
16	84.93	2.82	1.63	1.53	2.08	4.11	40.84	75.46	36.18	395.20	24.67	11.34
17	34.89	2.95	4.92	1.33	2.08	3.66	38.18	63.77	45.32	187.23	23.61	7.71
18	24.32	2.69	11.09	1.33	2.20	3.51	34.46	68.76	61.02	120.83	22.56	6.91
19	16.78	2.56	11.34	1.23	3.37	3.81	28.01	80.12	97.61	97.61	16.19	6.53
20	14.76	2.44	28.01	1.33	4.11	4.59	22.22	98.49	90.73	103.85	15.61	6.15
16-20	30.20	2.69	9.72	1.35	2.72	3.93	32.21	76.84	63.63	166.66	20.35	7.63
21	13.39	1.96	31.56	1.33	3.81	8.78	18.31	92.43	92.43	115.98	14.21	6.15
22	12.86	1.53	27.63	1.23	3.51	5.97	15.04	101.15	98.49	123.80	13.13	4.42
23	13.66	2.08	25.76	1.14	3.66	4.75	11.83	128.82	104.76	186.00	12.86	10.37
24	11.09	2.44	14.76	1.14	2.95	4.42	23.26	137.07	197.21	282.17	12.86	4.27
25	9.22	2.32	10.13	1.14	2.82	7.71	17.69	132.91	237.05	339.60	11.34	4.27
21-25	11.99	2.06	21.14	1.19	3.34	6.22	17.02	117.72	140.02	200.01	12.86	5.71
26	7.92	1.63	9.00	1.04	1.33	17.69	17.39	68.76	255.49	294.47	10.85	4.27
27	6.91	1.33	6.34	1.04	1.14	15.33	16.19	52.53	274.62	177.50	10.37	4.11
28	6.34	1.33	4.75	2.08	1.14	75.46	14.76	44.74	265.70	115.98	9.90	3.96
29	6.53	3.99	3.81	3.37	0.78	69.48	12.09	59.00	288.29	93.28	9.44	3.81
30	6.53	3.99	3.96	3.51	0.70	73.94	11.58	99.37	373.85	81.71	9.00	3.51
31	7.11	3.99	14.76	3.99	1.85	3.99	9.22	157.73	3.99	73.94	3.99	3.23
26-end	6.88	1.43	6.69	2.10	1.14	43.38	13.39	76.10	290.13	130.17	9.90	3.81
Mean	13.27	3.30	5.54	3.29	1.91	9.24	78.80	53.52	95.78	288.73	29.92	6.43
Max.	89.89	6.91	31.56	16.19	4.11	75.46	777.47	157.73	373.85	**866.23**	113.12	13.66
Min.	6.34	1.33	1.04	1.04	0.70	1.23	9.22	7.92	21.54	73.94	9.00	3.23

Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (6/9)

STATION:Peam KHLEY
LONGITUDE:
LATITUDE:
ALTITUDE:

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 2002

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.14	0.92	0.8	0.94	1.24	0.94	1.22	1.19	2.48	2.76	2.26	2.03
2	1.12	0.92	0.8	0.92	1.18	0.98	1.15	1.09	2.84	2.78	2.42	2.7
3	1.12	0.92	0.8	0.92	1.09	0.87	1.14	1.05	3.02	2.76	2.68	2.32
4	1.1	0.92	0.8	0.88	0.99	0.86	1.12	1.03	2.99	2.68	2.56	2.08
5	1.1	0.92	0.8	0.86	0.96	0.86	1.16	1	2.87	2.88	2.35	2.07
01-5	1.12	0.92	0.80	0.90	1.09	0.90	1.16	1.07	2.84	2.77	2.45	2.24
6	1.1	0.92	0.8	0.84	0.94	0.84	1.14	1	2.56	2.79	2.22	1.99
7	1.08	0.92	0.76	0.8	0.96	0.85	1.11	1.3	2.41	3.2	1.88	1.94
8	1.04	0.93	0.76	0.8	0.99	0.84	1.1	1.15	2.13	3.4	1.65	1.82
9	1.02	0.93	0.76	0.79	1.02	0.84	1.75	1.56	2.03	3.35	1.6	1.9
10	1.02	0.94	0.76	0.78	0.98	0.83	1.61	1.5	2.02	2.98	1.6	2.16
06-10	1.05	0.93	0.77	0.80	0.98	0.84	1.34	1.30	2.23	3.14	1.79	1.96
11	1	0.94	0.75	0.76	1.01	0.83	1.42	1.4	2.14	2.47	1.7	2.07
12	1	0.92	0.75	1.15	1.02	0.86	1.29	1.37	2.18	2.62	1.69	1.86
13	1.02	0.92	0.75	1.22	1.04	0.88	1.27	1.29	2.04	2.74	1.66	1.68
14	1.02	0.92	0.9	1.26	1.18	1.03	1.15	1.39	2.03	2.58	1.79	1.58
15	1.02	0.92	0.85	1.07	1.16	1.08	1.23	1.58	1.9	2.59	1.76	1.47
11-15	1.01	0.92	0.80	1.09	1.08	0.94	1.27	1.41	2.06	2.60	1.72	1.73
16	1.02	0.92	0.8	1.07	1.11	1.06	1.14	2.06	1.79	2.26	1.65	1.44
17	1.02	0.92	0.8	1.12	1.11	1.04	1.11	2.2	1.67	1.98	1.83	1.4
18	1.02	0.92	0.8	1.17	1.07	1.08	1.23	2.01	1.58	1.85	1.6	1.37
19	1.02	0.92	0.8	1.03	1.04	1.14	1.27	2.48	1.71	1.79	2.12	1.3
20	1.02	0.92	0.78	1.01	1.05	1.1	1.23	2.8	2.36	1.62	2.18	1.3
16-20	1.02	0.92	0.80	1.08	1.08	1.08	1.20	2.31	1.82	1.90	1.88	1.36
21	1.02	0.92	0.78	0.99	1.01	1.08	1.17	3.08	2.39	1.53	2.08	1.3
22	1.02	0.92	0.82	0.97	1	1.06	1.09	3.54	2.41	1.5	2.07	1.3
23	1.02	0.91	0.84	1.02	1	1.05	1.04	3.31	2.6	1.45	1.99	1.48
24	1.02	0.91	0.84	1	0.98	1.02	1.02	3.08	2.58	1.43	1.85	1.46
25	1.02	0.91	0.86	1.04	0.99	1.02	0.91	3.05	2.59	1.52	1.74	1.33
21-25	1.02	0.91	0.83	1.00	1.00	1.05	1.05	3.21	2.51	1.49	1.95	1.37
26	1	0.91	0.88	1.12	1	1.14	0.95	2.81	2.97	2.34	1.74	1.3
27	1	0.91	0.98	1	1	1.18	1.03	2.52	2.77	2.89	1.63	1.26
28	1	0.91	1	0.97	0.98	2.08	1.03	2.47	2.44	2.94	1.53	1.22
29	1		1.17	0.96	0.94	1.63	1.02	2.3	2.44	2.51	1.47	1.18
30	0.92		1.06	1.04	0.94	1.39	1.03	2.36	2.4	2.31	1.44	1.18
31	0.92		1.02		0.94		1.25	2.46		2.22		1.17
26-end	0.97	0.91	1.02	1.02	0.97	1.48	1.05	2.49	2.60	2.54	1.56	1.22
Mean	1.03	0.94	1.17	1.26	1.24	2.08	1.75	**3.54**	3.02	3.4	2.68	2.7
Max.	1.03	0.92	0.84	0.98	1.03	1.04	1.18	1.96	2.34	2.41	1.90	1.65
Min.	0.92	0.91	0.75	0.76	0.94	0.83	0.91	1	1.58	1.43	1.44	1.17

Discharge in m3/s, HYDROLOOGIC YEAR 2002

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.23	0.78	-0.03	0.96	(4.75)	(0.96)	4.42	3.96	46.48	64.47	34.89	25.76
2	2.95	0.78	-0.03	0.78	(3.81)	(1.33)	3.37	2.56	70.22	65.88	43.05	60.34
3	2.95	0.78	-0.03	0.78	(2.56)	(0.40)	3.23	2.08	84.12	64.47	59.00	37.66
4	2.69	0.78	-0.03	0.47	(1.43)	(0.33)	2.95	1.85	81.71	59.00	51.28	27.63
5	2.69	0.78	-0.03	0.33	(1.14)	(0.33)	3.51	1.53	72.44	73.19	39.23	27.25
01-5	2.90	0.78	-0.03	0.66	2.59	0.64	3.48	2.34	70.22	65.32	44.97	34.04
6	2.69	0.78	-0.03	0.20	(0.96)	(0.20)	3.23	1.53	51.28	66.60	33.20	24.32
7	2.44	0.78	-0.21	-0.03	(1.14)	(0.27)	2.82	5.78	42.49	99.37	20.55	22.56
8	1.96	0.87	-0.21	-0.03	(1.43)	(0.20)	2.69	3.37	29.56	117.91	13.66	18.62
9	1.74	0.87	-0.21	-0.08	(1.74)	(0.20)	16.49	11.34	25.76	113.12	12.34	21.21
10	1.74	0.96	-0.21	-0.13	(1.33)	(0.14)	12.60	9.90	25.40	80.91	12.34	30.75
06-10	2.10	0.85	-0.18	-0.02	1.31	0.20	6.56	5.82	33.62	94.48	17.69	23.33
11	1.53	0.96	-0.25	-0.21	(1.63)	(0.14)	8.13	7.71	29.96	45.89	15.04	27.25
12	1.53	0.78	-0.25	3.37	(1.74)	(0.33)	5.61	7.11	31.56	55.06	14.76	19.89
13	1.74	0.78	-0.25	4.42	(1.96)	(0.47)	5.25	5.61	26.13	63.08	13.93	14.48
14	1.74	0.78	0.62	5.08	(3.81)	(1.85)	3.37	7.51	25.76	52.53	17.69	11.83
15	1.74	0.78	0.27	2.32	(3.51)	(2.44)	4.59	11.83	21.21	53.16	16.78	9.22
11-15	1.66	0.82	-0.03	2.59	2.46	0.92	5.29	7.84	26.80	53.79	15.61	15.96
16	1.74	0.78	-0.03	2.32	(2.82)	(2.20)	3.23	26.88	17.69	34.89	13.66	8.56
17	1.74	0.78	-0.03	2.95	(2.82)	(1.96)	2.82	32.38	14.21	23.96	18.93	7.71
18	1.74	0.78	-0.03	3.66	(2.32)	(2.44)	4.59	25.04	11.83	19.57	12.34	7.11
19	1.74	0.78	-0.03	1.85	(1.96)	(3.23)	5.25	46.48	15.33	17.69	29.17	5.78
20	1.74	0.78	-0.13	1.63	(2.08)	(2.69)	4.59	67.31	39.77	12.86	31.56	5.78
16-20	1.74	0.78	-0.05	2.44	2.39	2.49	4.05	37.15	18.68	21.21	20.41	6.95
21	1.74	0.78	-0.13	1.43	(1.63)	(2.44)	3.66	89.05	41.39	10.61	27.63	5.78
22	1.74	0.78	0.08	1.23	(1.53)	(2.20)	2.56	131.88	42.49	9.90	27.25	5.78
23	1.74	0.70	0.20	1.74	(1.53)	2.08	1.96	109.36	53.79	8.78	24.32	9.44
24	1.74	0.70	0.20	1.53	(1.33)	1.74	1.74	89.05	52.53	8.34	19.57	9.00
25	1.74	0.70	0.33	1.96	(1.43)	1.74	0.70	86.57	53.16	10.37	16.19	6.34
21-25	1.74	0.74	0.13	1.57	1.49	2.03	2.03	100.44	48.49	9.58	22.77	7.19
26	1.53	0.70	0.47	2.95	(1.53)	3.23	1.04	68.03	80.12	38.71	16.19	5.78
27	1.53	0.70	1.33	1.53	(1.53)	3.81	1.85	48.85	65.18	73.94	13.13	5.08
28	1.53	0.70	1.53	1.23	(1.33)	27.63	1.85	45.89	44.17	77.77	10.61	4.42
29	1.53	3.99	3.66	1.14	(0.96)	13.13	1.74	36.61	44.17	48.25	9.22	3.81
30	0.78	3.99	2.20	1.96	(0.96)	7.51	1.85	39.77	41.94	37.15	8.56	3.81
31	0.78	3.99	1.74	3.99	(0.96)	3.99	4.92	45.32	3.99	33.20	3.99	3.66
26-end	1.26	0.70	1.72	1.72	1.20	9.53	2.10	46.87	54.04	49.75	11.39	4.40
Max.	1.86	0.96	3.66	5.08	(4.75)	(27.63)	16.49	**131.88**	84.12	117.91	59.00	60.34
Avg.	1.88	0.79	0.17	1.35	(1.87)	(1.92)	3.77	23.42	38.56	42.28	21.23	13.61
Min.	0.78	0.70	-0.25	-0.21	(0.96)	(0.14)	0.70	1.53	11.83	8.34	8.56	3.66

Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (7/9)

STATION:Peam KHLEY
LONGITUDE:
LATITUDE:
ALTITUDE:

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 2003

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.14	0.86	0.97	1.18	1.41	1.21	1.97	2.85	3.58	3.8	2.75	1.74
2	1.12	0.85	0.91	1.32	1.14	1.35	1.77	2.55	3.21	4.53	2.45	1.72
3	1.1	0.86	0.89	1.18	1.06	1.4	1.78	2.57	2.67	5.62	2.29	1.72
4	1.11	0.86	0.85	1.04	1.13	1.37	1.79	2.46	2.48	5.68	2.15	1.72
5	1	0.86	0.84	1.15	1.22	1.42	2.33	2.98	2.32	4.96	2.07	1.72
01-5	1.09	0.86	0.89	1.17	1.19	1.35	1.93	2.68	2.85	4.92	2.34	1.72
6	1.08	0.9	0.82	1.1	1.17	1.36	2.55	3.52	2.26	4.77	1.99	1.74
7	1.08	0.92	0.82	1.45	1.06	1.32	2.13	3.23	2.3	5.17	1.93	1.73
8	1.08	0.86	0.78	1.04	1.03	1.2	2	3.17	2.77	5.64	1.85	1.72
9	1.05	0.84	0.82	1.05	1.04	1.17	1.86	2.94	2.21	5.29	1.84	1.74
10	1.02	0.82	0.82	1.05	1.02	1.12	1.77	2.77	2.46	4.5	1.84	1.74
06-10	1.06	0.87	0.81	1.14	1.06	1.23	2.06	3.13	2.40	5.07	1.89	1.73
11	0.99	0.83	1.12	1.1	0.97	1.08	1.86	2.58	2.84	4.04	1.85	1.72
12	0.98	0.82	1.62	0.98	0.97	0.99	2.64	2.15	2.68	3.51	1.89	1.72
13	1.01	0.79	1.85	0.96	1.05	0.99	2.62	2	2.46	3.53	1.89	1.72
14	1.01	0.77	1.59	0.94	1.07	0.99	3.4	2	2.38	3.2	1.88	1.72
15	1	0.76	1.36	0.92	1.06	0.97	3.55	1.98	2.46	3.36	1.87	1.74
11-15	1.00	0.79	1.51	0.98	1.02	1.00	2.81	2.14	2.56	3.53	1.88	1.72
16	0.99	0.76	1.12	0.92	1.14	0.97	3.68	2.04	2.4	4.37	1.86	1.74
17	0.98	0.78	1.1	0.9	1.18	1.05	3.72	2.03	2.44	5.18	1.85	1.74
18	0.98	0.78	1.09	0.9	1.3	1.08	3.72	2.04	2.51	5.21	1.82	1.74
19	0.98	0.79	1.07	0.94	1.24	1.02	2.31	2.01	2.83	4.58	1.8	1.72
20	0.98	0.8	1.24	0.88	1.22	1	2.57	2.03	3.08	3.96	1.8	1.72
16-20	0.98	0.78	1.12	0.91	1.22	1.02	3.20	2.03	2.65	4.66	1.83	1.73
21	0.96	0.8	1.31	0.88	1.24	0.99	2.24	2.19	3.72	3.67	1.78	1.72
22	0.92	0.8	1.22	0.86	1.33	0.98	2.1	2.37	3.85	3.5	1.76	1.72
23	0.92	0.82	1.22	0.88	1.47	0.99	2.4	2.33	2.98	3.37	1.8	1.74
24	0.9	0.87	1.15	0.87	1.49	1.05	4.49	2.31	2.84	3.93	1.8	1.72
25	0.89	0.85	1.22	0.86	1.48	1.22	5.92	2.12	2.75	5.15	1.76	1.72
21-25	0.92	0.83	1.22	0.87	1.40	1.05	3.43	2.26	3.23	3.92	1.78	1.72
26	0.8	0.86	1.46	0.92	1.32	1.26	7.72	2.39	2.63	6.3	1.76	1.72
27	0.83	0.9	2.1	0.89	1.2	1.28	7.14	2.35	3.28	5.63	1.74	1.72
28	0.86	0.9	1.74	1.03	1.15	1.59	6.07	2.3	3.23	4.11	1.74	1.72
29	0.87		1.43	1.16	1.23	1.69	4.72	2.27	3.29	3.42	1.74	1.72
30	0.9		1.31	1.5	1.32	1.81	4.21	2.31	3.28	3.07	1.74	1.72
31	0.89		1.24		1.25		3.32	2.49		2.89		1.72
26-end	0.86	0.89	1.55	1.10	1.25	1.53	5.53	2.35	3.14	4.24	1.74	1.72
Mean	1.14	0.92	2.1	1.5	1.49	1.81	**7.72**	3.52	3.85	6.3	2.75	1.74
Max.	0.99	0.83	1.18	1.03	1.19	1.19	3.16	2.43	2.80	4.39	1.91	1.73
Min.	0.8	0.76	0.78	0.86	0.97	0.97	1.77	1.98	2.21	2.89	1.74	1.72

Discharge in m3/s, HYDROLOOGIC YEAR 2003

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.23	0.33	1.23	3.81	(7.92)	(4.27)	23.61	70.95	136.02	160.00	63.77	16.19
2	2.95	0.27	0.70	6.15	(3.23)	(6.72)	17.08	50.67	100.26	254.04	44.74	15.61
3	2.69	0.33	0.55	3.81	(2.20)	(7.71)	17.39	51.90	58.33	435.91	36.18	15.61
4	2.82	0.33	0.27	1.96	(3.09)	(7.11)	17.69	45.32	46.48	447.36	30.36	15.61
5	1.53	0.33	0.20	3.37	(4.42)	(8.13)	38.18	80.91	37.66	319.86	27.25	15.61
01-5	2.65	0.32	0.56	3.72	3.99	6.72	22.15	59.13	71.10	313.09	38.81	15.73
6	2.44	0.62	0.08	2.69	(3.66)	(6.91)	50.67	129.83	34.89	289.82	24.32	16.19
7	2.44	0.78	0.08	8.78	(2.20)	(6.15)	29.56	102.05	36.61	354.81	22.22	15.90
8	2.44	0.33	-0.13	1.96	(1.85)	(4.11)	24.67	96.74	65.18	439.71	19.57	15.61
9	2.08	0.20	0.08	2.08	(1.96)	(3.66)	19.89	77.77	32.79	375.61	19.25	16.19
10	1.74	0.08	0.08	2.08	(1.74)	(2.95)	17.08	65.18	45.32	249.74	19.25	16.19
06-10	2.22	0.39	0.04	3.20	2.24	4.65	26.95	92.94	41.94	338.60	20.88	16.02
11	1.43	0.14	2.95	2.69	(1.23)	(2.44)	19.89	52.53	70.22	188.46	19.57	15.61
12	1.33	0.08	12.86	1.33	(1.23)	(1.43)	56.36	30.36	59.00	128.82	20.88	15.61
13	1.63	-0.08	19.57	1.14	(2.08)	(1.43)	55.06	24.67	45.32	130.85	20.88	15.61
14	1.63	-0.17	12.09	0.96	(2.32)	(1.43)	117.91	24.67	40.84	99.37	20.55	15.61
15	1.53	-0.21	6.91	0.78	(2.20)	(1.23)	132.91	23.96	45.32	114.07	20.22	16.19
11-15	1.51	-0.06	10.09	1.33	1.79	1.57	68.32	30.04	51.53	130.65	20.41	15.73
16	1.43	-0.21	2.95	0.78	(3.23)	(1.23)	146.67	26.13	41.94	231.52	19.89	16.19
17	1.33	-0.13	2.69	0.62	(3.81)	(2.08)	151.05	25.76	44.17	356.52	19.57	16.19
18	1.33	-0.13	2.56	0.62	(5.78)	(2.44)	151.05	26.13	48.25	361.68	18.62	16.19
19	1.33	-0.08	2.32	0.96	(4.75)	(1.74)	37.15	25.04	69.48	261.30	18.00	15.61
20	1.33	-0.03	4.75	0.47	(4.42)	(1.53)	51.90	25.76	89.05	178.71	18.00	15.61
16-20	1.35	-0.12	3.01	0.69	4.36	1.79	99.37	25.76	57.14	273.13	18.81	15.96
21	1.14	-0.03	5.97	0.47	(4.75)	(1.43)	34.04	31.97	151.05	145.59	17.39	15.61
22	0.78	-0.03	4.42	0.33	(6.34)	(1.33)	28.40	40.30	165.73	127.80	16.78	15.61
23	0.78	0.08	4.42	0.47	(9.22)	1.43	41.94	38.18	80.91	115.02	18.00	16.19
24	0.62	0.40	3.37	0.40	(9.67)	2.08	248.31	37.15	70.22	175.12	18.00	15.61
25	0.55	0.27	4.42	0.33	(9.44)	4.42	494.67	29.17	63.77	351.40	16.78	15.61
21-25	0.77	0.13	4.49	0.40	7.76	2.03	120.83	35.06	101.87	174.40	17.39	15.73
26	-0.03	0.33	9.00	0.78	(6.15)	5.08	926.24	41.39	55.71	574.51	16.78	15.61
27	0.14	0.62	28.40	0.55	(4.11)	5.43	772.40	39.23	106.59	437.81	16.19	15.61
28	0.33	0.62	16.19	1.85	(3.37)	12.09	525.47	36.61	102.05	197.21	16.19	15.61
29	0.40	3.99	8.34	3.51	(4.59)	14.76	282.17	35.31	107.51	119.86	16.19	15.61
30	0.62	3.99	5.97	9.90	(6.15)	18.31	210.08	37.15	106.59	88.22	16.19	15.61
31	0.55	3.99	4.75	3.99	(4.92)	3.99	110.29	47.06	3.99	73.94	3.99	15.61
26-end	0.32	0.52	11.01	2.69	4.83	10.51	419.01	39.32	94.31	213.58	16.31	15.61
Max.	3.23	0.78	28.40	9.90	(9.67)	(18.31)	**926.24**	129.83	165.73	574.51	63.77	16.19
Avg.	1.38	0.15	3.87	1.81	(3.96)	(3.93)	95.92	43.75	67.08	234.30	21.69	15.80
Min.	-0.03	-0.21	-0.13	0.33	(1.23)	(1.23)	17.08	23.96	32.79	73.94	16.19	15.61

Note: ' - ' = no data
Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (8/9)

STATION:Peam KHLEY
LONGITUDE:
LATITUDE:
ALTITUDE:

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 2004

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.74	1.48	1.2	1.1	1.14	1.1	1.52	1.98	1.6	1.88	1.51	1.26
2	1.74	1.48	1.2	1.1	1.14	1.09	1.5	2.33	1.67	2.06	1.45	1.26
3	1.72	1.48	1.18	1.1	1.16	1.11	1.52	2.64	1.62	2.38	1.4	1.24
4	1.72	1.48	1.18	1.12	1.14	1.14	1.63	2.48	1.64	2.23	1.38	1.22
5	1.74	1.46	1.16	1.12	1.12	1.16	1.59	1.47	1.63	2.55	1.36	1.2
01-5	1.73	1.48	1.18	1.11	1.14	1.12	1.55	2.18	1.63	2.22	1.42	1.24
6	1.74	1.46	1.16	1.12	1.1	1.18	1.55	1.88	1.54	3.58	1.32	1.18
7	1.72	1.44	1.14	1.12	1.1	1.18	1.52	1.81	1.5	4.24	1.32	1.16
8	1.72	1.44	1.14	1.12	1.12	1.21	1.5	1.72	1.48	3.78	1.28	1.14
9	1.74	1.46	1.14	1.14	1.12	1.37	1.46	1.72	1.46	3.34	1.24	1.44
10	1.74	1.44	1.12	1.14	1.15	1.41	1.44	1.66	1.46	2.95	1.22	1.12
06-10	1.73	1.45	1.14	1.13	1.12	1.27	1.49	1.76	1.49	3.58	1.28	1.21
11	1.74	1.44	1.12	1.12	1.18	1.41	1.42	1.59	1.47	2.42	1.22	1.12
12	1.74	1.42	1.12	1.12	1.17	1.44	1.38	1.84	1.53	2.45	1.2	1.1
13	1.72	1.4	1.12	1.12	1.16	1.43	1.36	2.29	1.58	3	1.2	1.1
14	1.72	1.4	1.12	1.12	1.15	1.46	1.37	2.59	1.65	3.6	1.18	1.08
15	1.72	1.38	1.12	1.1	1.2	1.54	1.35	2.45	2.14	2.93	1.19	1.08
11-15	1.73	1.41	1.12	1.12	1.17	1.46	1.38	2.15	1.67	2.88	1.20	1.10
16	1.72	1.36	1.12	1.12	1.21	2.43	1.37	2.24	2.34	2.32	1.22	1.08
17	1.6	1.36	1.12	1.12	1.21	3.24	1.36	1.99	2.16	2.15	1.21	1.09
18	1.6	1.34	1.12	1.12	1.24	2.65	1.42	1.98	2.76	2.1	1.2	1.09
19	1.6	1.32	1.12	1.14	1.25	2.03	1.47	1.84	3.06	1.85	1.18	1.1
20	1.62	1.3	1.1	1.14	1.23	2.14	1.42	1.88	3.22	1.8	1.18	1.1
16-20	1.63	1.34	1.12	1.13	1.23	2.50	1.41	1.99	2.71	2.04	1.20	1.09
21	1.6	1.3	1.1	1.14	1.2	1.92	1.38	1.95	3.38	1.9	1.16	1.1
22	1.58	1.28	1.1	1.14	1.18	1.88	1.37	2.1	2.99	1.88	1.16	1.09
23	1.58	1.28	1.1	1.12	1.18	1.86	1.72	2.14	2.69	1.86	1.14	1.09
24	1.54	1.26	1.1	1.12	1.16	1.86	2.03	2.07	2.42	1.8	1.12	1.08
25	1.54	1.26	1.1	1.12	1.14	1.84	1.82	2.06	2.13	1.74	1.1	1.08
21-25	1.57	1.28	1.10	1.13	1.17	1.87	1.66	2.06	2.72	1.84	1.14	1.09
26	1.52	1.24	1.1	1.12	1.13	1.61	1.75	1.98	1.99	1.72	1.11	1.08
27	1.5	1.24	1.08	1.12	1.12	1.47	1.7	1.94	1.97	1.69	1.12	1.06
28	1.48	1.22	1.08	1.12	1.12	1.42	1.76	1.89	2.05	1.64	1.18	1.06
29	1.48	1.22	1.08	1.14	1.12	1.42	2.03	1.82	1.9	1.62	1.12	1.05
30	1.48		1.08	1.14	1.1	1.44	2.04	1.62	3.94	1.6	1.24	1.06
31	1.48		1.08		1.1		2.06	1.56		1.57		1.08
26-end	1.49	1.23	1.08	1.13	1.12	1.47	1.89	1.80	2.37	1.64	1.15	1.07
Mean	1.74	1.48	1.2	1.14	1.25	3.24	2.06	2.64	3.94	**4.24**	1.51	1.44
Max.	1.65	1.37	1.12	1.12	1.16	1.62	1.56	1.99	2.09	2.37	1.23	1.13
Min.	1.48	1.22	1.08	1.1	1.1	1.09	1.35	1.47	1.46	1.57	1.1	1.05

Discharge in m3/s, HYDROLOOGIC YEAR 2004

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	16.19	9.44	4.11	2.69	(3.23)	(2.69)	10.37	23.96	12.34	20.55	10.13	5.08
2	16.19	9.44	4.11	2.69	(3.23)	(2.56)	9.90	38.18	14.21	26.88	8.78	5.08
3	15.61	9.44	3.81	2.69	(3.51)	(2.82)	10.37	56.36	12.86	40.84	7.71	4.75
4	15.61	9.44	3.81	2.95	(3.23)	(3.23)	13.13	46.48	13.39	33.62	7.31	4.42
5	16.19	9.00	3.51	2.95	(2.95)	(3.51)	12.09	9.22	13.13	50.67	6.91	4.11
01-5	15.96	9.35	3.87	2.80	3.23	2.95	11.14	31.56	13.18	33.20	8.13	4.68
6	16.19	9.00	3.51	2.95	(2.69)	(3.81)	11.09	20.55	10.85	136.02	6.15	3.81
7	15.61	8.56	3.23	2.95	(2.69)	(3.81)	10.37	18.31	9.90	214.02	6.15	3.51
8	15.61	8.56	3.23	2.95	(2.95)	(4.27)	9.90	15.61	9.44	157.73	5.43	3.23
9	16.19	9.00	3.23	3.23	(2.95)	(7.11)	9.00	15.61	9.00	112.17	4.75	8.56
10	16.19	8.56	2.95	3.23	(3.37)	(7.92)	8.56	13.93	9.00	78.55	4.42	2.95
06-10	15.96	8.73	3.23	3.06	2.93	5.25	9.76	16.72	9.63	135.81	5.36	4.23
11	16.19	8.56	2.95	2.95	(3.81)	(7.92)	8.13	12.09	9.22	43.05	4.42	2.95
12	16.19	8.13	2.95	2.95	(3.66)	(8.56)	7.31	19.25	10.61	44.74	4.11	2.69
13	15.61	7.71	2.95	2.95	(3.51)	(8.34)	6.91	36.18	11.83	82.51	4.11	2.69
14	15.61	7.71	2.95	2.95	(3.37)	(9.00)	7.11	53.16	13.66	138.12	3.81	2.44
15	15.61	7.31	2.95	2.69	(4.11)	(10.85)	6.72	44.74	29.96	77.00	3.96	2.44
11-15	15.84	7.88	2.95	2.90	3.69	8.91	7.23	30.43	14.32	73.19	4.08	2.64
16	15.61	6.91	2.95	2.95	(4.27)	(43.61)	7.11	34.04	38.71	37.66	4.42	2.44
17	12.34	6.91	2.95	2.95	(4.27)	(102.95)	6.91	24.32	30.75	30.36	4.27	2.56
18	12.34	6.53	2.95	2.95	(4.75)	(57.01)	8.13	23.96	64.47	28.40	4.11	2.56
19	12.34	6.15	2.95	3.23	(4.92)	(25.76)	9.22	19.25	87.39	19.57	3.81	2.69
20	12.86	5.78	2.69	3.23	(4.59)	(29.96)	8.13	20.55	101.15	18.00	3.81	2.69
16-20	13.07	6.45	2.90	3.06	4.55	47.53	7.88	24.17	60.88	26.28	4.08	2.59
21	12.34	5.78	2.69	3.23	(4.11)	(21.88)	7.31	22.91	115.98	21.21	3.51	2.69
22	11.83	5.43	2.69	3.23	(3.81)	(20.55)	7.11	28.40	81.71	20.55	3.51	2.56
23	11.83	5.43	2.69	2.95	(3.81)	19.89	15.61	29.96	59.67	19.89	3.23	2.56
24	10.85	5.08	2.69	2.95	(3.51)	19.89	25.76	27.25	43.05	18.00	2.95	2.44
25	10.85	5.08	2.69	2.95	(3.23)	19.25	18.62	26.88	29.56	16.19	2.69	2.44
21-25	11.53	5.36	2.69	3.06	3.69	20.28	14.04	27.03	61.84	19.12	3.17	2.54
26	10.37	4.75	2.69	2.95	(3.09)	12.60	16.49	23.96	24.32	15.61	2.82	2.44
27	9.90	4.75	2.44	2.95	(2.95)	9.22	15.04	22.56	23.61	14.76	2.95	2.20
28	9.44	4.42	2.44	2.95	(2.95)	8.13	16.78	20.88	26.50	13.39	3.81	2.20
29	9.44	4.42	2.44	3.23	(2.95)	8.13	25.76	18.62	21.21	12.86	2.95	2.08
30	9.44	3.99	2.44	3.23	(2.69)	8.56	26.13	12.86	176.31	12.34	4.75	2.20
31	9.44	3.99	2.44	3.99	(2.69)	3.99	26.88	11.34	3.99	11.58	3.99	2.44
26-end	9.67	4.59	2.48	3.06	2.89	9.26	20.88	18.05	40.30	13.39	3.43	2.26
Max.	16.19	9.44	4.11	3.23	(4.92)	(102.95)	26.88	56.36	176.31	**214.02**	10.13	8.56
Avg.	13.56	7.11	3.01	2.99	(3.48)	(12.83)	11.43	24.33	28.06	40.10	4.63	3.10
Min.	9.44	4.42	2.44	2.69	(2.69)	(2.56)	6.72	9.22	9.00	11.58	2.69	2.08

Note: ' - ' = no data
Source: MOWRAM

Table A.9 Daily Discharge and 5-day Discharge at Peam Khley (9/9)

STUNG PREK THNOT- PEAM KHLEY, CAMBODIA
GAUGE HEIGHT IN METTRES, HYDROLOGIC YEAR 2005

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.08	1.06	1.06	1.01	1.12	1.08	1.04	3.61	-	-	-	-
2	1.06	1.06	1.05	1.01	1.12	1.08	1.05	4.48	-	-	-	-
3	1.06	1.06	1.05	1.01	1.11	1.07	1.05	4.7	-	-	-	-
4	1.06	1.06	1.06	1.1	1.1	1.06	1.15	3.23	-	-	-	-
5	1.05	1.06	1.06	1.12	1.1	1.06	1.16	3.23	-	-	-	-
01-5	1.06	1.06	1.06	1.05	1.11	1.07	1.09	3.85	-	-	-	-
6	1.05	1.07	1.06	1.22	1.1	1.06	1.16	3.51	-	-	-	-
7	1.08	1.07	1.06	1.21	1.85	1.04	1.16	2.82	-	-	-	-
8	1.08	1.07	1.05	1.18	1.09	1.07	1.16	2.91	-	-	-	-
9	1.08	1.06	1.05	1.16	1.08	1.11	1.18	3.03	-	-	-	-
10	1.09	1.06	1.05	1.44	1.08	1.13	1.39	2.91	-	-	-	-
06-10	1.08	1.07	1.05	1.24	1.24	1.08	1.21	3.04	-	-	-	-
11	1.09	1.06	1.04	1.12	1.08	1.11	1.74	2.87	-	-	-	-
12	1.08	1.07	1.04	1.12	1.08	1.12	1.82	2.82	-	-	-	-
13	1.09	1.07	1.03	1.1	1.06	1.12	1.82	2.83	-	-	-	-
14	1.09	1.08	1.03	1.1	1.06	1.14	1.72	2.93	-	-	-	-
15	1.09	1.08	1.03	1.1	1.06	1.14	1.61	2.98	-	-	-	-
11-15	1.09	1.07	1.03	1.11	1.07	1.13	1.74	2.89	-	-	-	-
16	1.09	1.08	1.03	1.08	1.06	1.12	1.57	2.98	-	-	-	-
17	1.09	1.08	1.02	1.08	1.06	1.12	1.46	2.88	-	-	-	-
18	1.09	1.07	1.02	1.09	1.08	1.1	1.44	2.31	-	-	-	-
19	1.09	1.07	1.02	1.09	1.08	1.1	1.42	2.26	-	-	-	-
20	1.1	1.06	1.02	1.1	1.08	1.1	1.42	2.15	-	-	-	-
16-20	1.09	1.07	1.02	1.09	1.07	1.11	1.46	2.52	-	-	-	-
21	1.1	1.06	1.02	1.1	1.06	1.08	1.42	1.98	-	-	-	-
22	1.1	1.06	1.01	1.08	1.06	1.08	1.45	1.9	-	-	-	-
23	1.09	1.06	1.01	1.08	1.04	1.06	1.4	1.88	-	-	-	-
24	1.09	1.06	1.02	1.1	1.15	1.06	1.44	1.88	-	-	-	-
25	1.09	1.07	1.02	1.12	1.08	1.08	1.45	1.96	-	-	-	-
21-25	1.09	1.06	1.02	1.10	1.08	1.07	1.43	1.92	-	-	-	-
26	1.08	1.07	1.02	1.1	1.07	1.08	1.99	1.94	-	-	-	-
27	1.08	1.07	1.02	1.12	1.08	1.06	1.88	1.91	-	-	-	-
28	1.08	1.06	1.01	1.11	1.06	1.06	2.38	1.88	-	-	-	-
29	1.08		1.01	1.15	1.06	1.06	2.25	1.85	-	-	-	-
30	1.06		1	1.15	1.08	1.05	2.35	1.83	-	-	-	-
31	1.06		1		1.08		3.55	1.85	-	-	-	-
26-end	1.07	1.07	1.01	1.13	1.07	1.06	2.40	1.88	-	-	-	-
Mean	1.1	1.08	1.06	1.44	1.85	1.14	3.55	4.7	-	-	-	-
Max.	1.08	1.07	1.03	1.12	1.11	1.09	1.56	2.68	-	-	-	-
Min.	1.05	1.06	1	1.01	1.04	1.04	1.04	1.83	-	-	-	-

Discharge in m3/s, HYDROLOOGIC YEAR 2005

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.44	2.20	2.20	1.63	(2.95)	(2.44)	1.96	139.17	-	-	-	-
2	2.20	2.20	2.08	1.63	(2.95)	(2.44)	2.08	246.89	-	-	-	-
3	2.20	2.20	2.08	1.63	(2.82)	(2.32)	2.08	279.14	-	-	-	-
4	2.20	2.20	2.20	2.69	(2.69)	(2.20)	3.37	102.05	-	-	-	-
5	2.08	2.20	2.20	2.95	(2.69)	(2.20)	3.51	102.05	-	-	-	-
01-5	2.22	2.20	2.15	2.08	2.82	2.32	2.56	165.73	-	-	-	-
6	2.08	2.32	2.20	4.42	(2.69)	(2.20)	3.51	128.82	-	-	-	-
7	2.44	2.32	2.20	4.27	(19.57)	(1.96)	3.51	68.76	-	-	-	-
8	2.44	2.32	2.08	3.81	(2.56)	(2.32)	3.51	75.46	-	-	-	-
9	2.44	2.20	2.08	3.51	(2.44)	(2.82)	3.81	84.93	-	-	-	-
10	2.56	2.20	2.08	8.56	(2.44)	(3.09)	7.51	75.46	-	-	-	-
06-10	2.39	2.27	2.13	4.78	4.75	2.46	4.27	85.42	-	-	-	-
11	2.56	2.20	1.96	2.95	(2.44)	(2.82)	16.19	72.44	-	-	-	-
12	2.44	2.32	1.96	2.95	(2.44)	(2.95)	18.62	68.76	-	-	-	-
13	2.56	2.32	1.85	2.69	(2.20)	(2.95)	18.62	69.48	-	-	-	-
14	2.56	2.44	1.85	2.69	(2.20)	(3.23)	15.61	77.00	-	-	-	-
15	2.56	2.44	1.85	2.69	(2.20)	(3.23)	12.60	80.91	-	-	-	-
11-15	2.54	2.34	1.90	2.80	2.29	3.04	16.25	73.64	-	-	-	-
16	2.56	2.44	1.85	2.44	(2.20)	(2.95)	11.58	80.91	-	-	-	-
17	2.56	2.44	1.74	2.44	(2.20)	(2.95)	9.00	73.19	-	-	-	-
18	2.56	2.32	1.74	2.56	(2.44)	(2.69)	8.56	37.15	-	-	-	-
19	2.56	2.32	1.74	2.56	(2.44)	(2.69)	8.13	34.89	-	-	-	-
20	2.69	2.20	1.74	2.69	(2.44)	(2.69)	8.13	30.36	-	-	-	-
16-20	2.59	2.34	1.76	2.54	2.34	2.80	9.04	48.61	-	-	-	-
21	2.69	2.20	1.74	2.69	(2.20)	(2.44)	8.13	23.96	-	-	-	-
22	2.69	2.20	1.63	2.44	(2.20)	(2.44)	8.78	21.21	-	-	-	-
23	2.56	2.20	1.63	2.44	(1.96)	2.20	7.71	20.55	-	-	-	-
24	2.56	2.20	1.74	2.69	(3.37)	2.20	8.56	20.55	-	-	-	-
25	2.56	2.32	1.74	2.95	(2.44)	2.44	8.78	23.26	-	-	-	-
21-25	2.61	2.22	1.70	2.64	2.41	2.34	8.39	21.88	-	-	-	-
26	2.44	2.32	1.74	2.69	(2.32)	2.44	24.32	22.56	-	-	-	-
27	2.44	2.32	1.74	2.95	(2.44)	2.20	20.55	21.54	-	-	-	-
28	2.44	2.20	1.63	2.82	(2.20)	2.20	40.84	20.55	-	-	-	-
29	2.44	3.99	1.63	3.37	(2.20)	2.20	34.46	19.57	-	-	-	-
30	2.20	3.99	1.53	3.37	(2.44)	2.08	39.23	18.93	-	-	-	-
31	2.20	3.99	1.53	3.99	(2.44)	3.99	132.91	19.57	-	-	-	-
26-end	2.36	2.28	1.63	3.04	2.34	2.22	41.94	20.44	-	-	-	-
Max.	2.69	2.44	2.20	8.56	(19.57)	(3.23)	132.91	279.14	-	-	-	-
Avg.	2.45	2.27	1.87	2.93	(2.78)	(2.53)	11.24	**59.05**	-	-	-	-
Min.	2.08	2.20	1.53	1.63	(1.96)	(1.96)	1.96	18.93	-	-	-	-

Note: ' - ' = no data
Source: MOWRAM

Table A.10 Monthly Discharge at Peam Khley

Peam Khley Unit: MCM

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1901	19.0	8.7	4.2	10.3	35.3	59.1	129.6	166.7	199.8	447.3	192.5	24.3	1,296.8
1902	9.1	3.1	4.2	10.3	35.3	48.6	18.5	49.1	196.5	225.6	273.1	18.9	892.3
1903	12.6	7.2	2.4	2.3	3.7	46.2	118.3	161.4	280.8	291.7	93.5	82.4	1,102.5
1904	17.8	8.0	4.2	23.3	345.6	131.9	298.2	252.9	309.8	333.8	535.2	45.2	2,305.9
1905	4.3	3.9	3.7	2.3	8.0	60.3	120.0	118.6	285.7	258.1	89.7	18.3	972.9
1906	8.3	2.6	4.2	10.3	35.3	59.7	213.7	146.9	270.5	227.4	32.8	22.9	1,034.6
1907	8.9	3.0	4.2	10.3	35.3	40.9	113.7	159.2	268.3	357.1	393.6	32.8	1,427.3
1908	10.4	3.8	4.2	10.3	35.3	50.9	122.5	163.3	198.8	555.5	134.1	22.9	1,312.0
1909	8.9	3.0	4.2	10.3	35.3	52.3	123.7	163.9	224.6	322.1	128.3	24.1	1,100.7
1910	9.1	3.1	53.3	10.3	35.3	42.1	114.7	159.7	202.9	321.5	64.1	24.0	1,040.1
1911	9.1	3.1	4.2	12.2	35.6	44.8	117.1	160.8	265.2	277.5	42.1	23.0	994.7
1912	9.0	3.0	4.2	10.5	35.4	40.7	113.5	159.2	237.7	273.6	53.5	22.9	963.2
1913	8.9	3.0	4.2	10.3	35.3	40.0	112.9	158.9	205.8	543.5	105.2	23.4	1,251.4
1914	9.0	3.0	4.2	11.9	35.5	41.4	114.1	159.4	203.2	453.8	173.5	28.2	1,237.2
1915	9.7	3.4	4.2	10.3	35.3	66.7	136.3	169.8	300.4	421.8	102.2	22.9	1,283.0
1916	8.9	3.0	4.2	10.3	35.3	50.1	121.7	163.0	251.0	824.4	293.3	22.9	1,788.1
1917	8.9	3.0	4.2	10.3	35.3	65.9	135.7	169.5	369.2	672.9	521.8	24.9	2,021.6
1918	9.2	3.2	4.2	10.3	35.3	52.4	123.8	164.0	200.9	454.4	100.3	22.9	1,180.9
1919	8.9	3.0	4.2	14.6	35.9	44.6	116.9	160.7	269.2	313.9	140.1	22.9	1,134.9
1920	8.9	12.7	4.2	10.3	35.3	44.8	117.1	160.8	183.1	265.1	385.6	67.4	1,295.3
1921	15.5	6.8	4.2	7.3	38.1	47.3	149.3	248.9	365.0	667.0	249.2	29.8	1,828.4
1922													
1923	10.1	3.7	4.2	54.7	40.5	44.3	116.6	160.6	233.3	278.0	171.5	22.9	1,140.4
1924	8.9	3.0	4.2	5.8	46.3	92.7	161.6	182.1	296.4	770.0	339.8	40.6	1,951.4
1925	11.6	4.5	4.2	10.3	35.3	42.1	114.8	159.7	217.4	287.0	52.5	22.9	962.3
1926	19.0	17.0	16.7	15.5	9.3	7.0	16.3	63.0	116.7	528.5	36.7	136.0	981.7
1927	16.6	10.5	2.7	5.5	29.1	54.8	338.0	140.5	108.7	253.0	31.8	7.9	999.1
1928	5.5	2.2	2.4	18.6	16.6	19.5	100.4	48.7	69.8	146.6	20.2	2.4	452.9
1929	2.4	4.1	2.9	7.8	11.2	19.9	38.1	47.7	132.4	453.0	41.7	13.8	775.0
1930	7.7	2.2	24.3	9.3	16.6	5.4	136.3	32.9	260.0	45.6	177.2	10.8	728.3
1931	7.1	2.0	4.2	10.3	11.1	6.3	5.3	292.1	209.4	761.4	18.6	6.2	1,334.0
1932	6.5	1.6	5.2	16.3	6.1	3.9	38.0	12.7	237.7	522.0	232.2	15.5	1,097.7
1933	7.8	2.4	4.2	10.3	7.7	9.4	36.0	95.3	76.4	367.9	72.9	22.9	713.2
1934	8.9	3.8	4.2	11.2	4.9	24.2	72.4	103.7	214.6	383.6	69.4	22.9	923.8
1935	8.9	3.0	4.2	10.3	35.3	5.4	95.2	150.6	251.1	473.6	336.9	41.8	1,416.3
1936	11.7	4.6	4.2	10.3	35.3	52.5	123.9	164.0	207.0	262.2	40.0	22.9	938.6
1937	8.9	3.0	4.2	10.3	35.3	41.7	114.4	159.5	257.4	320.9	85.7	22.9	1,064.2
1938	8.9	3.0	4.2	14.7	35.9	71.7	140.7	171.9	249.0	489.2	144.4	22.9	1,356.5
1939	8.9	3.0	4.2	10.3	35.3	45.6	117.8	161.2	318.9	291.7	319.3	22.9	1,339.1
1940	8.9	3.0	4.2	10.3	35.3	40.0	112.9	158.9	229.1	265.0	146.9	33.7	1,048.2
1941	10.5	3.9	4.2	10.8	35.4	40.6	113.4	159.1	214.5	529.3	460.4	45.0	1,627.1
1942	12.2	4.9	4.2	13.1	35.7	45.0	117.3	160.9	294.2	467.8	425.3	22.9	1,603.5
1943	8.9	3.0	4.2	18.4	36.3	41.3	114.0	159.4	255.5	462.0	142.7	22.9	1,268.6
1944	8.9	3.0	4.2	10.8	35.4	48.2	120.1	162.2	194.2	512.8	160.9	50.6	1,311.3
1945	13.0	5.3	4.2	10.3	35.3	40.5	113.3	159.1	304.6	411.1	70.8	28.1	1,195.6
1946	9.7	3.4	4.2	10.7	35.4	43.8	116.2	160.4	207.8	353.1	84.4	22.9	1,052.0
1947	8.9	3.0	4.2	18.4	36.3	45.3	117.5	161.0	254.0	457.0	115.7	22.9	1,244.2
1948	9.0	3.0	4.2	14.7	35.9	43.3	115.8	160.2	347.6	338.0	123.2	22.9	1,217.8
1949	8.9	3.0	4.2	10.7	35.4	45.8	118.0	161.3	192.9	418.2	227.2	25.5	1,251.1
1950	9.3	3.2	4.2	10.3	35.3	44.0	116.4	160.5	304.2	313.9	61.2	22.9	1,085.4
1951	8.9	3.0	4.2	10.3	35.3	44.3	116.7	160.6	219.4	285.7	281.3	22.9	1,192.6
1952	8.9	3.0	4.2	10.3	35.3	46.4	118.5	161.5	261.5	585.2	170.0	22.9	1,427.7
1953	8.9	3.0	4.2	10.3	35.3	40.8	113.6	159.2	223.5	349.6	102.7	22.9	1,074.0
1954	8.9	3.0	4.2	10.7	35.4	44.6	117.0	160.8	211.3	274.6	41.5	37.8	949.8
1955	11.2	4.3	4.2	10.3	35.3	48.0	119.9	162.1	247.5	468.2	430.9	22.9	1,564.8
1956	8.9	3.0	4.2	11.9	35.5	84.0	151.5	176.9	230.2	284.9	84.3	40.0	1,115.3
1957	11.5	4.4	4.2	10.7	35.4	40.0	112.9	158.9	344.4	511.7	105.9	22.9	1,362.9
1958	8.9	3.0	4.2	10.3	35.3	41.6	114.3	159.5	194.9	438.0	74.8	22.9	1,107.7
1959	8.9	3.0	4.2	10.5	35.4	41.4	114.1	159.4	202.2	366.5	75.0	28.3	1,048.9
1960	9.7	3.5	4.2	10.3	35.3	41.5	66.8	137.3	193.0	349.9	90.4	83.6	1,025.5
1961	13.3	9.6	7.7	12.0	48.9	72.4	167.7	184.5	237.7	414.0	110.8	22.9	1,301.5
1962	8.9	3.7	3.4	5.4	20.8	32.2	354.5	271.9	501.1	583.8	61.1	30.4	1,877.2
1963	20.7	12.5	13.2	12.3	24.2	24.3	23.4	76.4	140.6	156.1	89.6	12.7	606.0
1964	7.4	5.1	0.4	7.3	84.3	45.5	94.1	176.4	332.5	482.0	142.0	26.3	1,403.3
1965	7.5	4.6	4.7	9.5	32.1	96.8	52.3	47.5	458.3	565.7	137.2	34.2	1,450.4
1966	10.6	5.5	4.9	13.3	42.1	82.8	135.7	148.2	174.7	270.9	110.7	48.3	1,047.7
1967	12.0	5.6	3.4	5.4	20.6	88.9	93.7	355.0	228.0	456.0	32.1	14.5	1,315.2
1968	7.6	4.5	3.3	6.0	21.4	29.9	67.1	136.8	85.8	241.2	21.2	7.9	632.7
1969	5.0	3.1	2.0	1.5	14.3	5.4	27.8	65.4	505.8	472.5	189.0	17.8	1,309.6
1970	10.1	7.6	4.5	9.8	19.4	221.6	149.7	373.9	220.0	368.6	288.8	391.5	2,065.5
1971	63.5	34.1	4.2	10.3	35.3	55.9	126.9	165.4	298.3	475.8	83.3	22.9	1,375.9
1972	8.9	3.0	4.2	13.2	35.7	72.3	141.3	172.1	190.2	342.5	320.4	22.9	1,326.7
1973													
1996													
1997	14.7	9.1	5.9	3.2	(26.74)	(15.43)	43.9	307.8	241.9	198.4	32.6	6.7	906.3
1998	3.6	2.4	2.3	2.1	(9.26)	3.0	11.3	48.2	228.0	418.3	158.1	32.0	918.7
1999	13.5	4.8	4.0	38.8	197.8	204.9	161.2	319.4	338.8	851.0	614.7	(182.28)	2,931.2
2000	35.2	12.8	25.2	54.0	63.5	103.2	212.2	142.2	178.4	716.6	167.2	53.0	1,763.7
2001	36.2	8.1	14.7	8.6	5.2	22.4	220.3	141.5	238.0	790.5	79.4	17.5	1,582.5
2002	5.0	1.9	0.5	3.5	5.0	5.0	10.1	62.7	100.0	113.2	55.0	36.4	398.4
2003	3.7	0.4	10.4	4.7	10.6	10.2	256.9	117.2	173.9	627.5	56.2	42.3	1,314.0
2004	36.3	17.2	8.1	7.7	9.3	33.3	30.6	65.2	72.7	107.4	12.0	8.3	408.1
2005	6.6	5.5	5.0	7.6	7.4	6.6	30.1	158.2					
Mean	11.3	5.0	5.7	11.6	36.1	48.2	116.6	155.7	238.2	408.1	158.6	35.0	1232.2
Max	63.5	34.1	53.3	54.7	345.6	221.6	354.5	373.9	505.8	851.0	614.7	391.5	2,931.2
Min.	2.4	0.4	0.4	1.5	3.7	3.0	5.3	12.7	69.8	45.6	12.0	2.4	398.4
10%	6.6	2.6	3.3	5.4	9.1	7.0	30.6	63.0	139.0	238.4	35.9	13.6	868.8
20%	8.8	3.0	4.2	7.8	16.6	24.3	71.3	133.2	193.7	274.2	55.7	22.9	969.0
30%	8.9	3.0	4.2	10.3	31.2	40.6	113.2	155.9	203.0	300.6	74.9	22.9	1,047.9
50%	8.9	3.2	4.2	10.3	35.3	44.3	116.7	160.0	229.1	383.6	110.7	22.9	1,195.6

Source: 1901-1972 *Prek Thnot Multipurpose Project, Reappraisal Report Volume 5.2 - Annexe I, Australian Catholic Relief by Euroconsultant, December 1991*

1997-2004 *Department of Hydrology and River Works, MOWRAM*

Table A.11 Dependable 5-day discharge at Peam Khley

Probable monthly mean discharge at Peam Khley MCM

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
80 % dependability	8.8	3.0	4.2	7.8	16.6	24.3	71.3	133.2	193.7	274.2	55.7	22.9
50 % dependability	8.9	3.2	4.2	10.3	35.3	44.3	116.7	160.0	229.1	383.6	110.7	22.9

Distribution pattern of 5-day mean discharge in every month by actual data between 1997 and 2005

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
01-5	112.5%	109.3%	78.4%	45.4%	75.9%	68.2%	73.9%	132.9%	99.2%	98.1%	231.0%	196.2%
06-10	117.3%	105.7%	83.5%	51.4%	66.4%	159.9%	149.6%	149.8%	83.4%	102.6%	151.6%	211.7%
11-15	116.1%	98.5%	106.9%	66.3%	55.2%	74.8%	73.7%	62.4%	53.1%	108.0%	79.9%	50.5%
16-20	116.7%	86.4%	121.6%	101.5%	116.8%	85.4%	81.0%	57.5%	75.6%	131.0%	68.3%	34.1%
21-25	77.2%	91.5%	118.8%	183.5%	217.1%	94.3%	61.3%	92.4%	110.6%	79.0%	43.6%	66.4%
26-end	60.1%	108.7%	90.7%	151.8%	68.5%	117.4%	160.5%	105.0%	178.0%	81.3%	25.7%	41.0%

80 % Dependable 5-day mean discharge MCM

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
01-5	9.9	3.3	3.3	3.5	12.6	16.6	52.7	177.0	192.2	269.1	128.8	44.9
06-10	10.3	3.2	3.5	4.0	11.0	38.8	106.8	199.5	161.7	281.3	84.5	48.5
11-15	10.2	3.0	4.5	5.2	9.2	18.2	52.5	83.1	102.8	296.1	44.5	11.6
16-20	10.2	2.6	5.1	7.9	19.4	20.7	57.8	76.5	146.5	359.2	38.1	7.8
21-25	6.8	2.7	5.0	14.3	36.0	22.9	43.7	123.0	214.3	216.5	24.3	15.2
26-end	5.3	3.3	3.8	11.8	11.4	28.5	114.5	139.8	344.9	223.0	14.3	9.4

50 % Dependable 5-day mean discharge MCM

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
01-5	10.0	3.4	3.3	4.7	26.8	30.2	86.2	212.6	227.3	376.4	255.7	44.9
06-10	10.4	3.3	3.5	5.3	23.5	70.9	174.6	239.6	191.2	393.6	167.8	48.5
11-15	10.3	3.1	4.5	6.8	19.5	33.1	85.9	99.9	121.6	414.2	88.5	11.6
16-20	10.4	2.7	5.1	10.5	41.2	37.8	94.5	91.9	173.3	502.6	75.6	7.8
21-25	6.9	2.9	5.0	18.9	76.7	41.8	71.5	147.8	253.4	302.9	48.2	15.2
26-end	5.4	3.4	3.8	15.6	24.2	52.0	187.2	167.9	407.9	311.9	28.4	9.4

Table A.12 Dependable 5-day mean discharge at Roleang Chrey

80 % Dependable 5-day mean discharge MCM

5-day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
01-5	10.6	3.5	3.5	3.8	13.5	17.7	56.4	189.4	205.6	287.9	137.8	48.1
06-10	11.0	3.4	3.8	4.3	11.8	41.6	114.2	213.5	173.0	301.0	90.4	51.9
11-15	10.9	3.2	4.8	5.5	9.8	19.4	56.2	89.0	110.0	316.8	47.7	12.4
16-20	11.0	2.8	5.5	8.5	20.7	22.2	61.8	81.9	156.8	384.4	40.7	8.4
21-25	7.3	2.9	5.3	15.3	38.6	24.5	46.8	131.6	229.3	231.7	26.0	16.3
26-end	5.6	3.5	4.1	12.7	12.2	30.5	122.5	149.6	369.0	238.6	15.3	10.1

50 % Dependable 5-day mean discharge MCM

5-day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
01-5	10.7	3.7	3.5	5.0	28.7	32.3	92.3	227.5	243.2	402.8	273.6	48.1
06-10	11.2	3.6	3.8	5.7	25.1	75.8	186.8	256.4	204.6	421.1	179.5	51.9
11-15	11.1	3.3	4.8	7.3	20.8	35.5	91.9	106.9	130.1	443.2	94.7	12.4
16-20	11.1	2.9	5.5	11.2	44.1	40.5	101.1	98.3	185.4	537.7	80.8	8.4
21-25	7.4	3.1	5.3	20.2	82.0	44.7	76.5	158.1	271.1	324.1	51.6	16.3
26-end	5.7	3.7	4.1	16.7	25.9	55.7	200.3	179.7	436.4	333.8	30.4	10.1

Figures

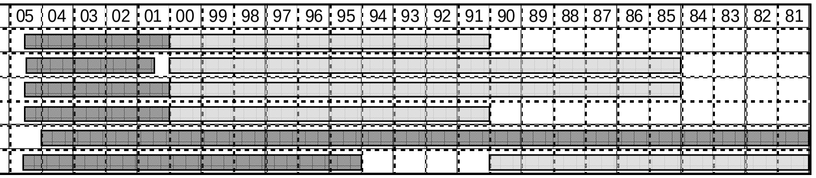
As of 2005/11/4

METEOROLOGICAL OBSERVATORY

STATION: Pochentong, Phnom Penh (HYMOS Code:110403, MD Code:48991)

Department of Meteorology, Ministry of Water Resources and Meteorology

No.	Climatology	Type	Remarks
1	Temperature, Min. and Max.	Auto	monthly data in 1907-09, 19-21, 23-38
2	Relative Humidity	Auto	monthly data in 1931-38
3	Wind Speed	Auto	
4	Sunshine Hours	Auto	monthly data in 1934-38
5	Evaporation	Auto	
6	Rainfall	Auto	monthly data in 1901-72



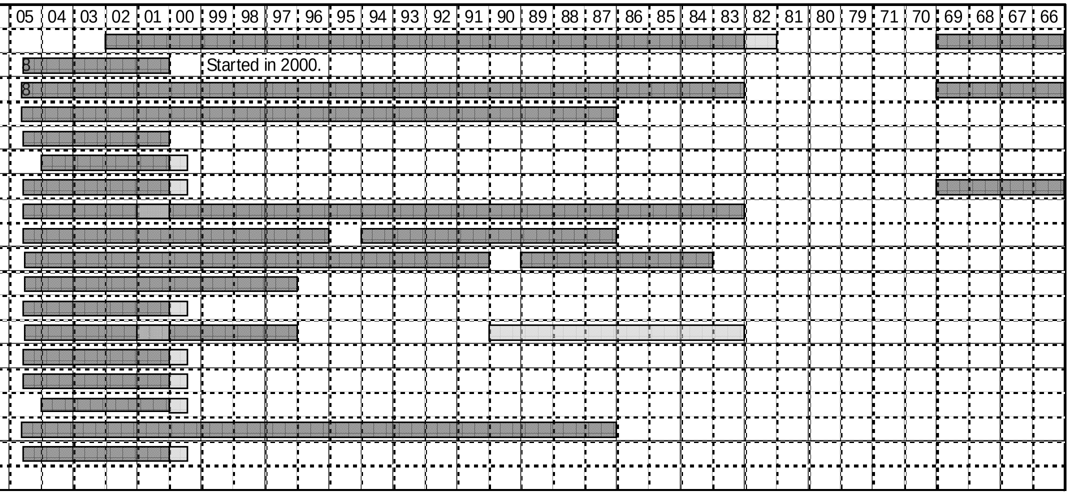
Note : Man = Manual
Auto = Automatic (Data logger)

:Hourly
:Daily
:Monthly

Data loggers were replaced in August 2005. Old log data are not available.

RAINFALL STATION

No.	Name of station	Code	Agency	Type
1	Chbar Mon/Kompong Speu	110404	MOWRAM	Man
2	PDOWRAM Kompong Speu	110404	MOWRAM	**Auto**
3	Phnum Sruoch	110413	MOWRAM	Man
4	Odongk/ U Dong	110415	MOWRAM	Man
5	Srae Klong	110416	MOWRAM	Man
6	Krang Ampil	110419	MOWRAM	Man
7	Kirirom	110421	MOWRAM	Man
8	Thnal Toteung	110423	MOWRAM	Man
9	Basedth	110431	MOWRAM	Man
10	Kong Pisei	110432	MOWRAM	Man
11	Aoral/ Oral	110433	MOWRAM	Man
12	Ou Taroth	110434	MOWRAM	Man
13	Prey Pdau	110435	MOWRAM	Man
14	Prey Dob	110436	MOWRAM	Man
15	Sdok	110437	MOWRAM	Man
16	Trapeang Chor	110445	MOWRAM	Man
17	Thpong	120427	MOWRAM	Man
18	Peam Khley	640103	MOWRAM	Man



Chbar Mon (Kompong Speu) monthly rainfall in 1917-1941 and 1957-1969 are available.

Source: MOWRAM

The Study on Comprehensive Agricultural Development of Prek Thnot River Basin, The Kingdom of Cambodia

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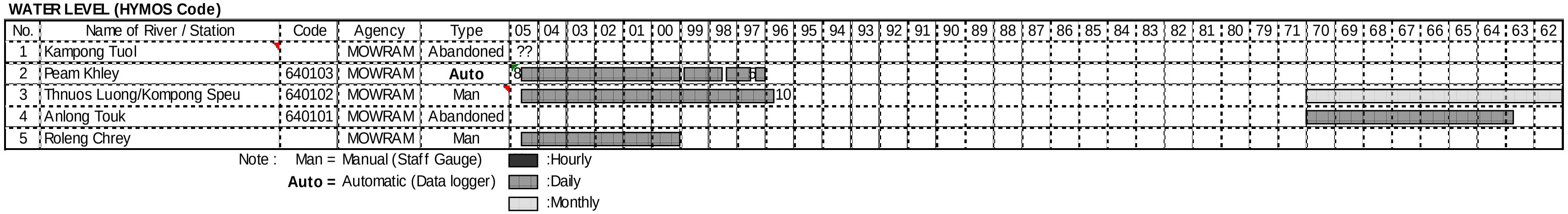
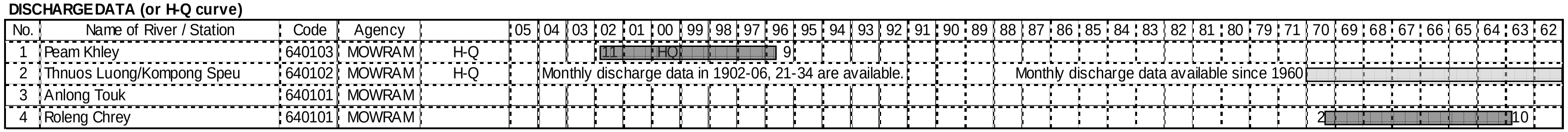
Figure A.1
Hydrometeorological Data Availability in/around Prek Thnot River Basin (1/2)

As of 2005/11/4

WATER LEVEL (HYMOS Code)



DISCHARGE DATA (or H-Q curve)



Flood Hydrograph Records

No.	Name of River / Station	H-Q	Flood Period 1	2	3	4	5	6	7	8	9
1	Kampong Tuol		4/8/1997	5/10/1998	1/11/1999	16/10/2000	11/10/2001	22/8/2002	26/07/2003	7/10/2004	
2	Peam Khley										
3	Thnuos Luong										

*) Aulong Touk station was abandoned during civil war in 1970

Source: MOWRAM

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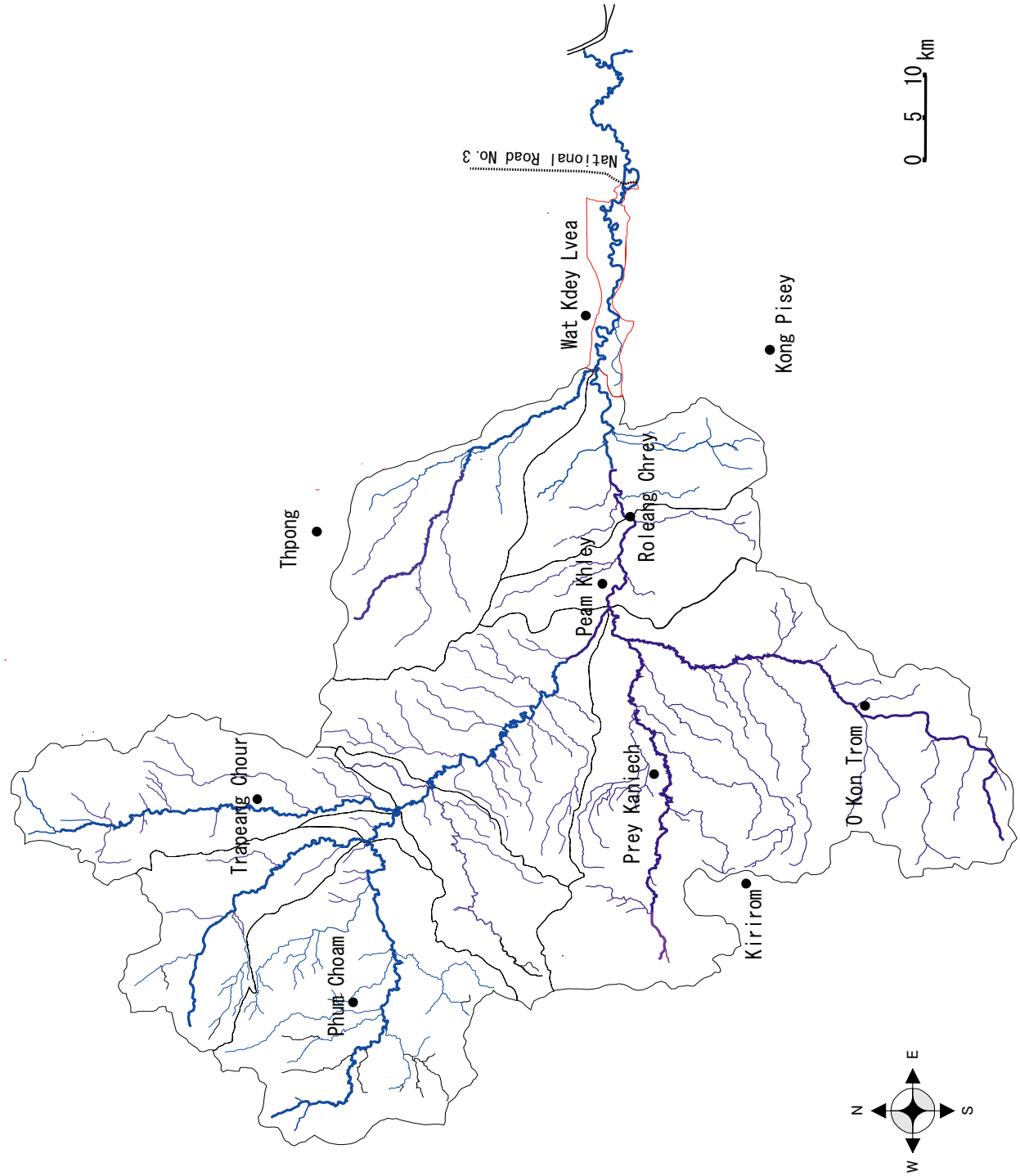
Figure A.1
Hydrometeorological Data Availability in/around Prek Thnot River Basin (2/2)



The Study on Comprehensive Agricultural Development of Prek Thnot River Basin, The Kingdom of Cambodia	**Figure A.2** Location Map of Rainfall Gauging Stations
Japan International Cooperation Agency	

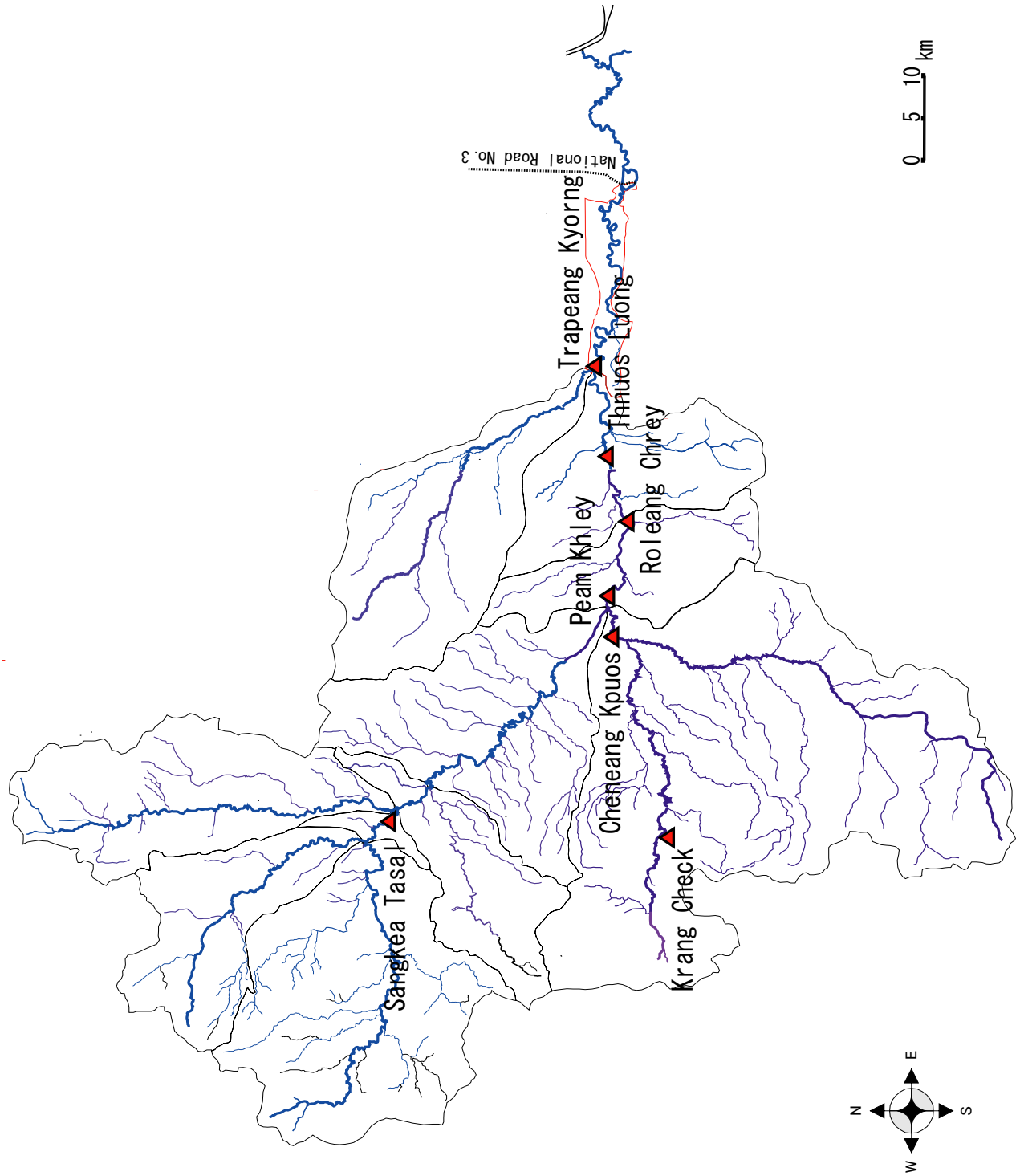


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Figure A.3
Location Map of Water Level Gauging Stations

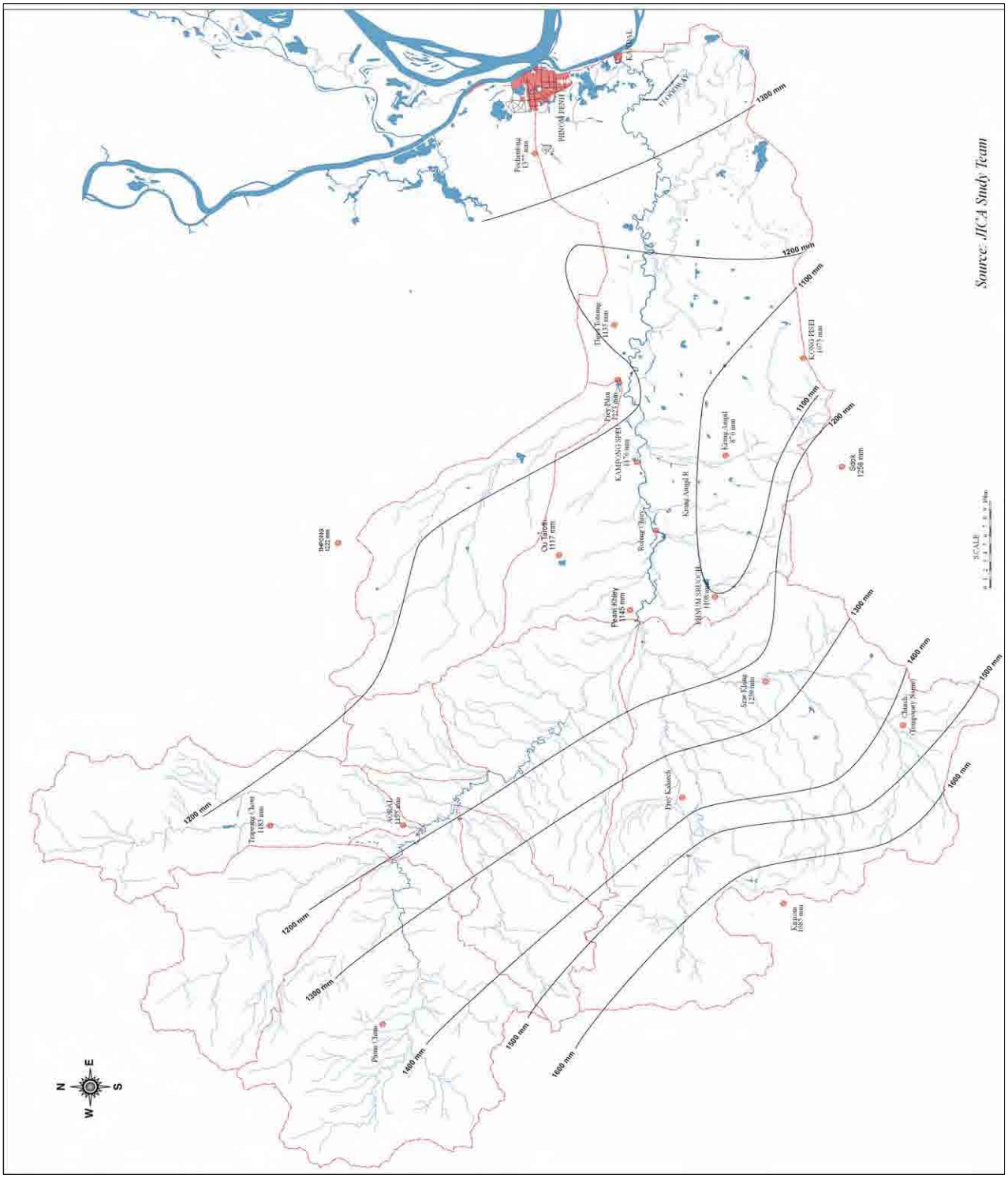

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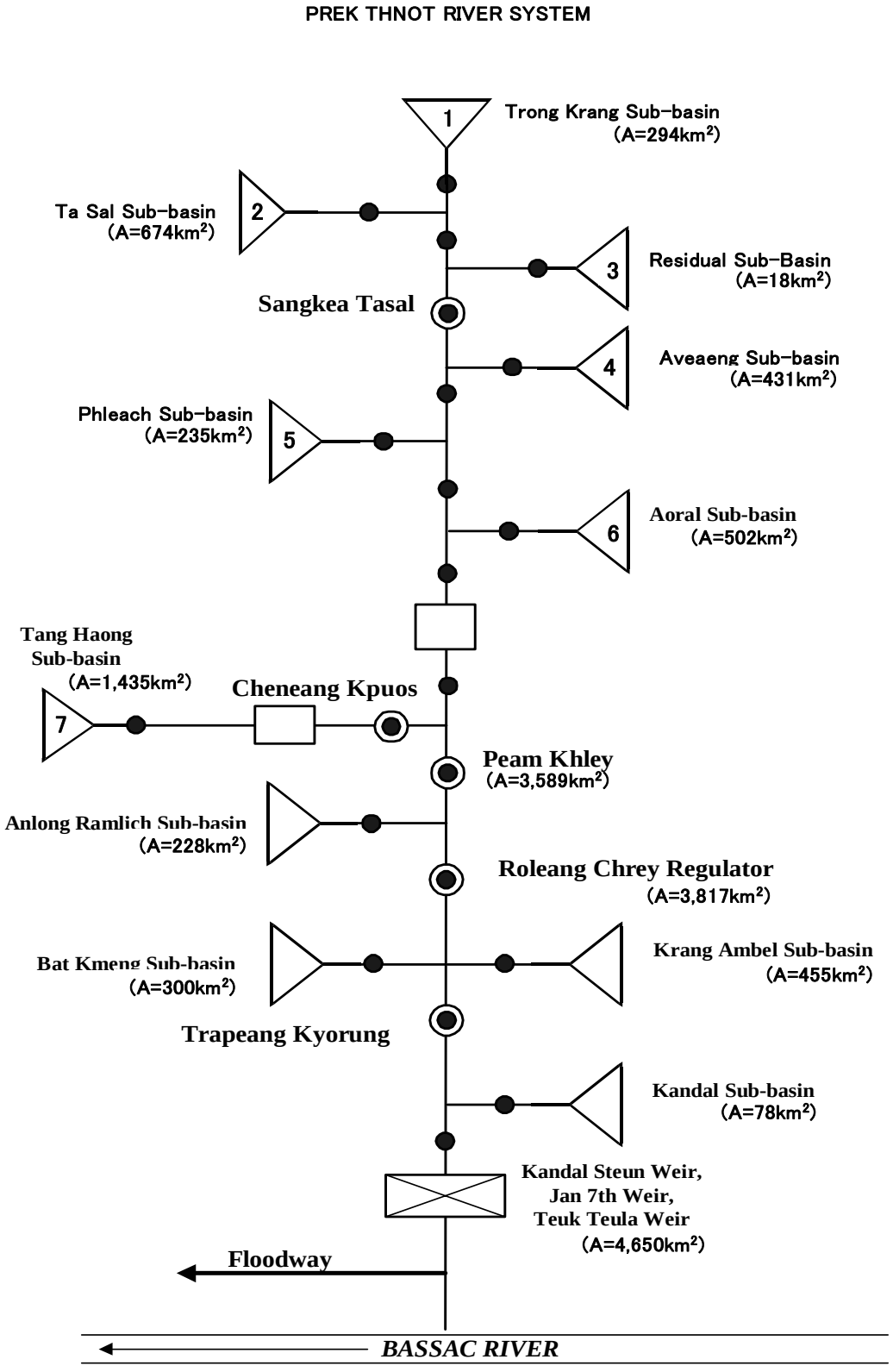
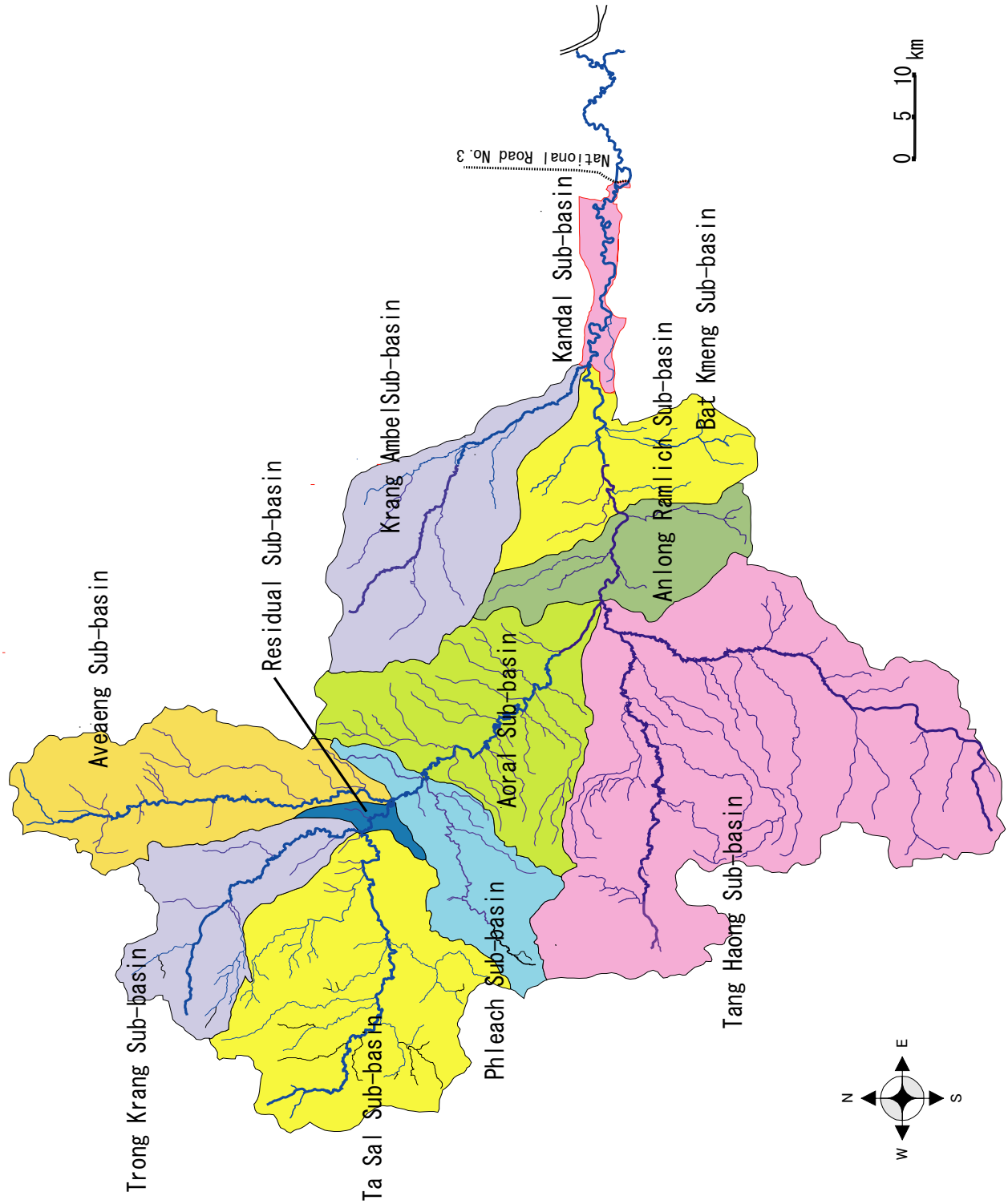
Figure A.4
Iso-hyetal Map of Prek Thnot River Basin



The Study on Comprehensive Agricultural Development of Prek Thnot River Basin, The Kingdom of Cambodia	**Figure A.5** Schematic Diagram of Prek Thnot River System
Japan International Cooperation Agency	



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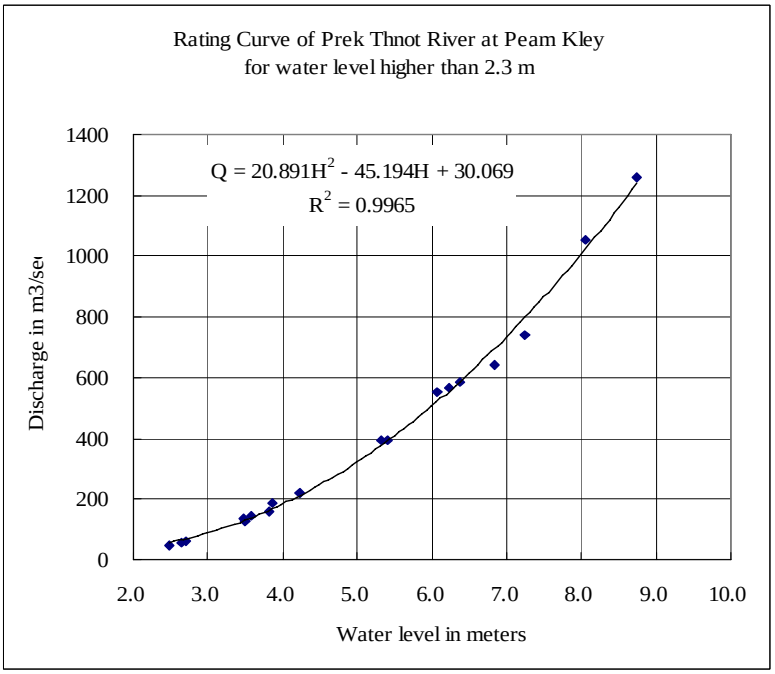
Japan International Cooperation Agency

Figure A.6
Basic Basin Division of Prek Thnot River Basin

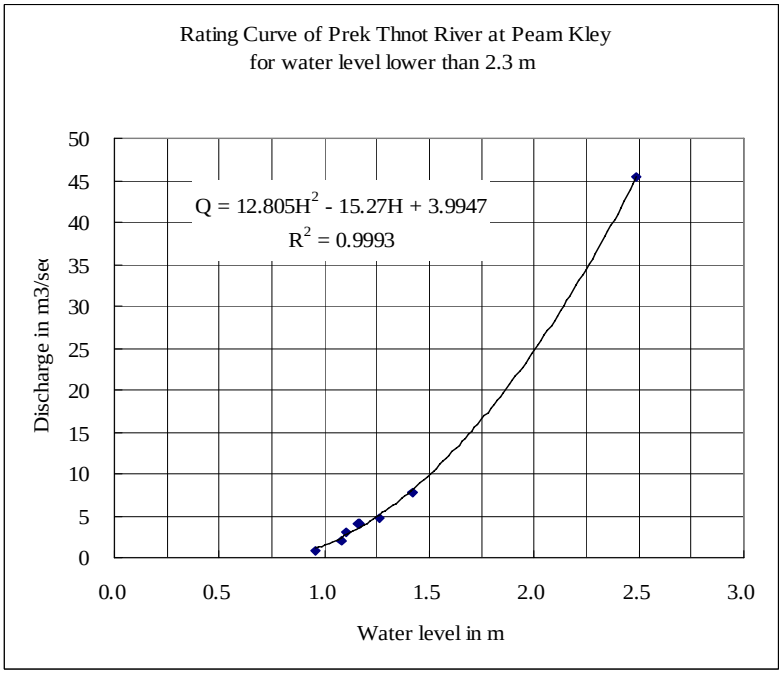
Flow Measurement Records

N	Date	H=m	Q=m3/sec
1	17-Oct-00	8.75	1260.8
2	18-Oct-00	8.06	1054.9
3	2-Nov-99	7.24	739.6
4	4-Nov-99	6.85	639.9
5	5-Nov-96	6.37	583.2
6	28-Oct-99	6.24	567.7
7	29-Oct-99	6.08	551.8
8	7-Apr-96	5.40	395.0
9	7-Nov-96	5.33	394.8
10	24-Oct-96	4.22	217.9
11	9-Sep-96	3.86	186.2
12	18-Oct-96	3.82	159.7
13	10-Sep-96	3.57	147.4
14	12-Sep-96	3.50	126.7
15	16-Oct-96	3.48	136.0
16	4-Dec-96	2.70	58.8
17	2-Sep-96	2.64	56.1
18	30-Aug-96	2.49	45.4
19	1-Mar-97	1.42	7.9
20	15-Jan-97	1.26	4.7
21	28-Jan-97	1.17	4.2
22	21-Feb-97	1.16	4.0
23	15-Dec-97	1.10	3.0
24	28-Feb-01	1.08	2.1
25	16-Jan-98	0.96	0.8



Low Flow Measurement Records

N	Date	H=m	Q=m3/sec
1	30-Aug-96	2.49	45.4
2	1-Mar-97	1.42	7.9
3	15-Jan-97	1.26	4.7
4	28-Jan-97	1.17	4.2
5	21-Feb-97	1.16	4.0
6	15-Dec-97	1.10	3.0
7	28-Feb-01	1.08	2.1
8	16-Jan-98	0.96	0.8



Source: JICA Study on the Rehabilitation and Reconstruction of Agricultural Production System in the Slakou River Basin

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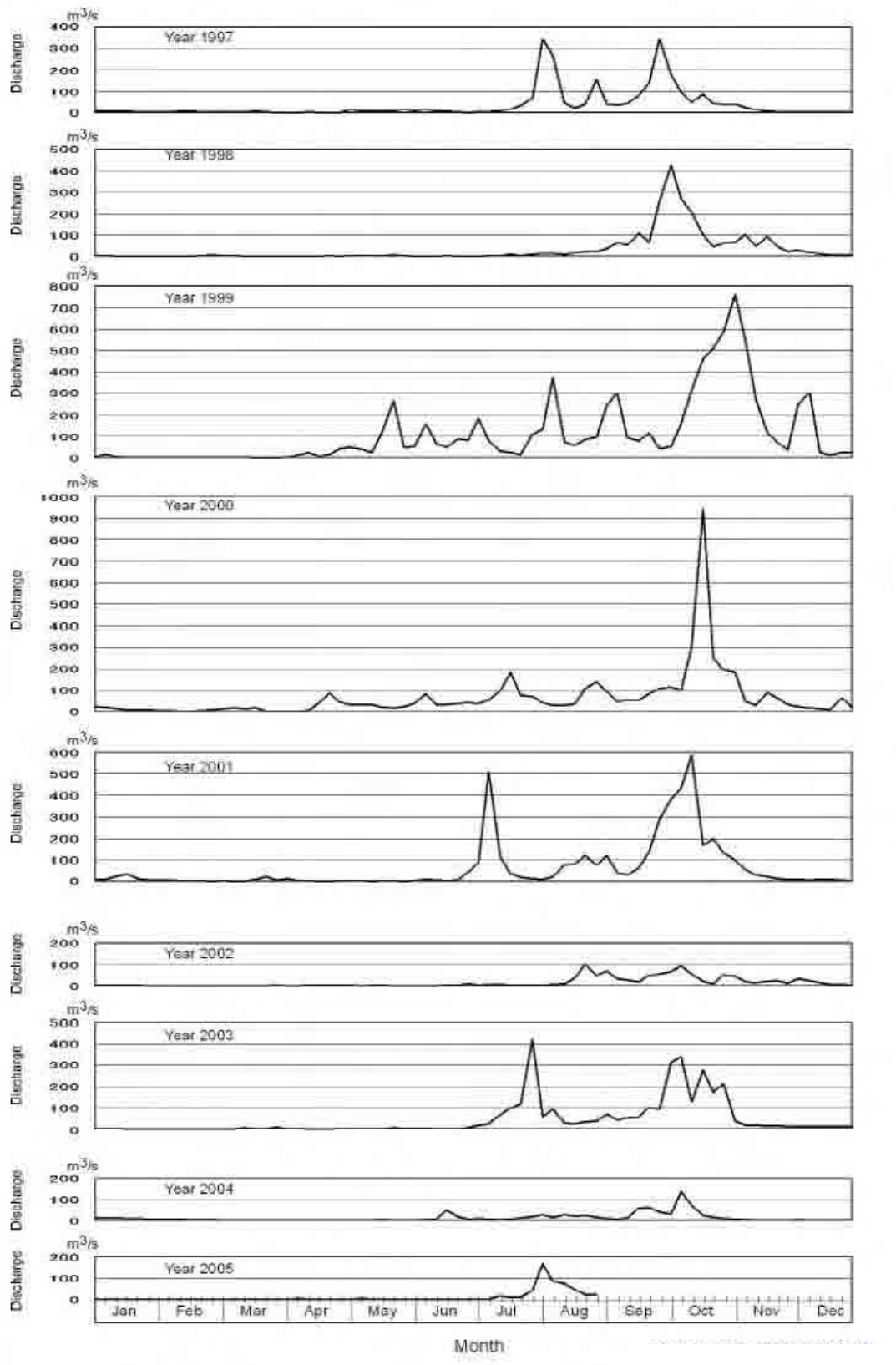
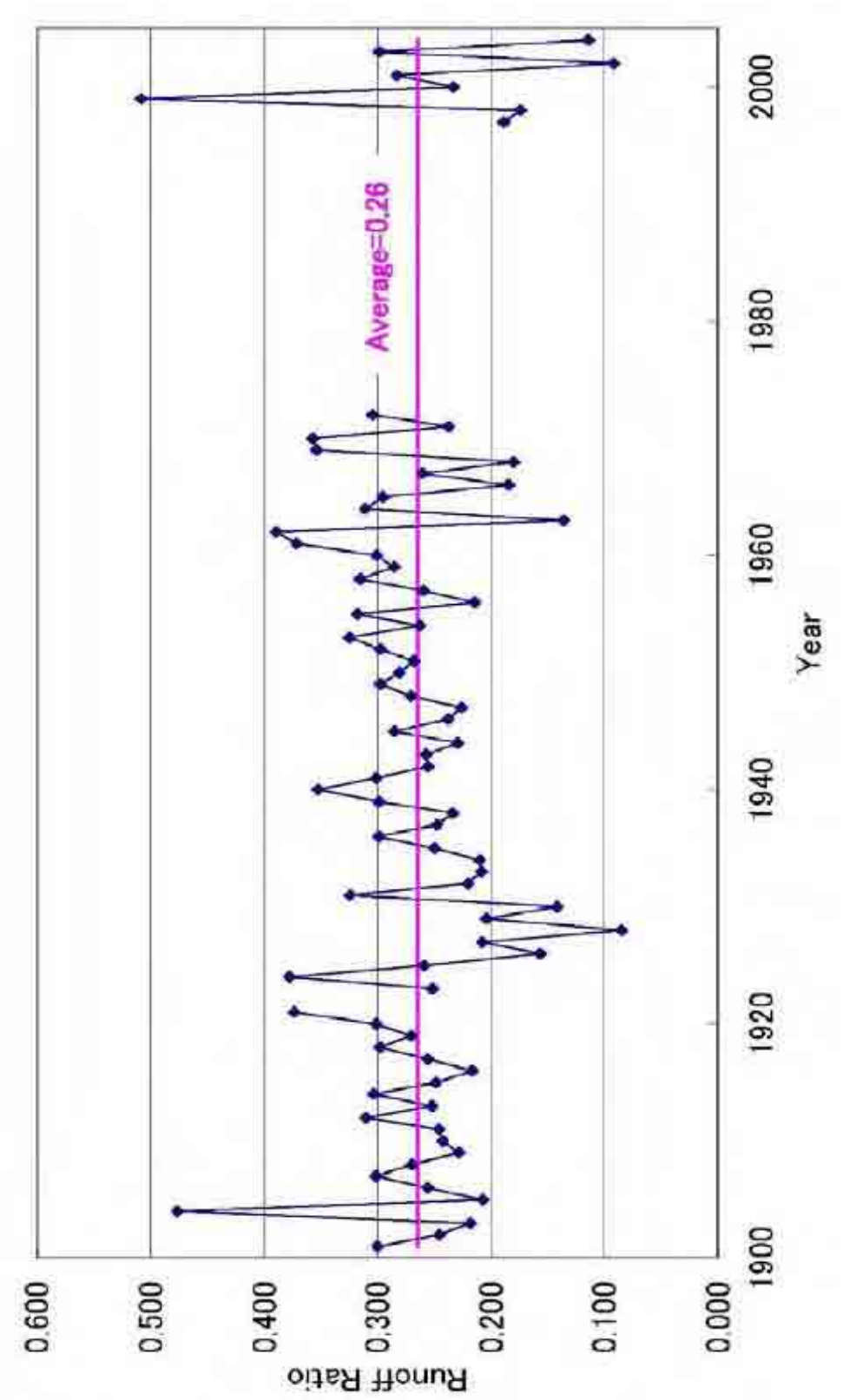
Figure A.7
Discharge Measurement Record and Rating Curve of Prek Thnot River at Peam Khley



Source: MOWRAM

The Study on Comprehensive Agricultural Development of Prek Thnot River Basin, The Kingdom of Cambodia	**Figure A.8** 5-day Discharge at Peam Khley (1997-2005)
Japan International Cooperation Agency	



Source: JICA Study Team

The Study on Comprehensive Agricultural Development of Prek Thnot River Basin, The Kingdom of Cambodia

Japan International Cooperation Agency

Figure A.9
Variation of Runoff Ratio at Peam Khley

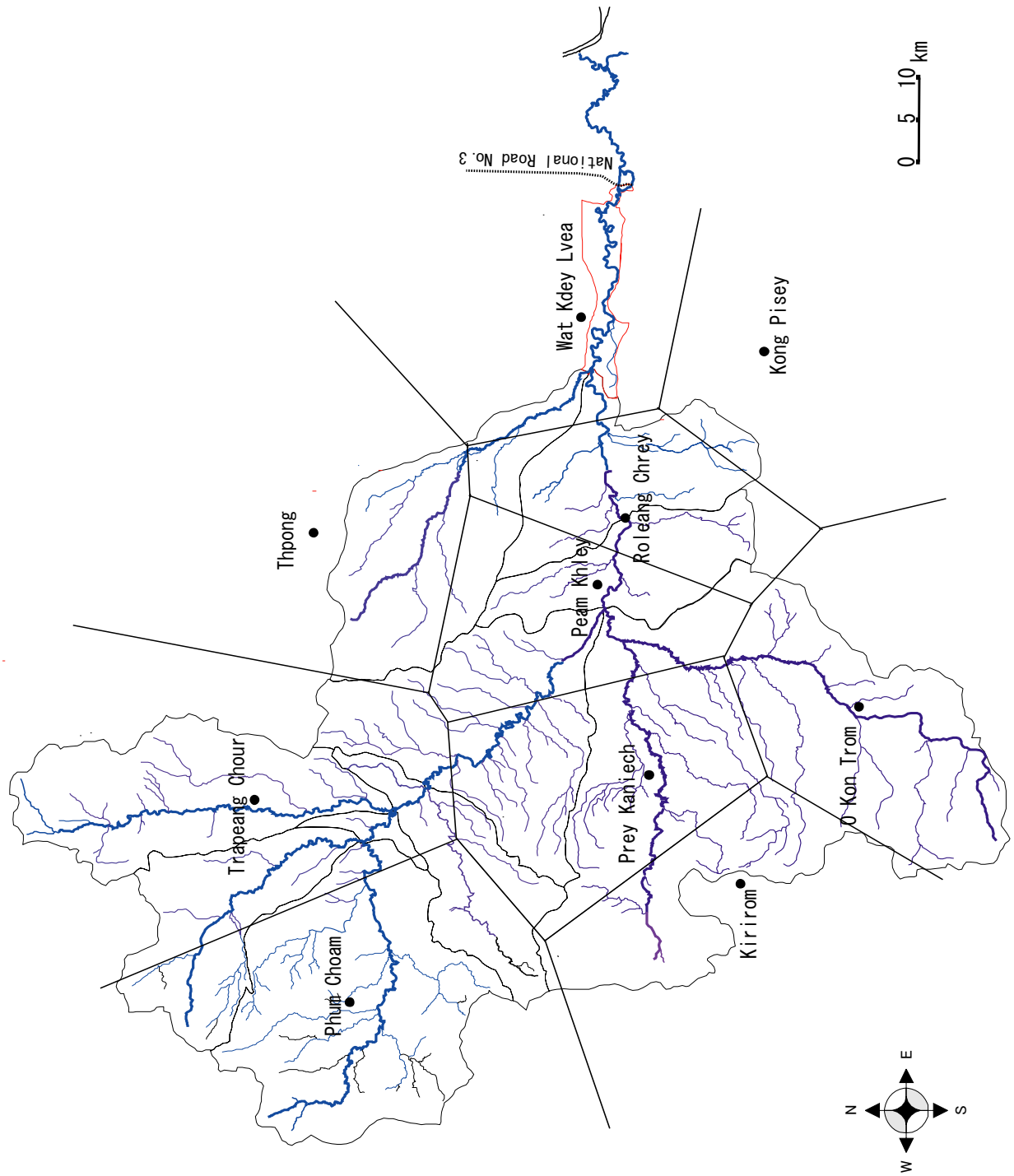


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Figure A.10
Thiessen Polygon Map for Prek Thnot River Sub-basins

Appendix-B

SOCIO-ECONOMY

THE STUDY
ON
COMPREHENSIVE AGRICULTURAL DEVELOPMENT
OF
PREK THNOT RIVER BASIN
IN
THE KINGDOM OF CAMBODIA

FINAL REPORT
Volume-VI: Appendixes for Master Plan
Appendix-B
Socio-economy

Table of Contents

List of Tables

List of Attachment

APPENDIX-B: SOCIO-ECONOMY

Chapter B-1 Socio-economy Survey

B-1.1 Purpose of Socio-Economic Survey

The Master Plan is aiming at formulating the development plans suitable to the features of 4 different Category Areas delineated in accordance with the water resources availability within the Target Area.

4 Different Category Areas Classified Based on Water Resource Availability

Category Area-1	Irrigated by Prek Thnot River or by its tributaries with sufficient water
Category Area-2	Irrigated by Prek Thnot River or by its tributaries with insufficient water
Category Area-3	Rainfed cultivated land with small reservoirs/ponds
Category Area-4	Rainfed cultivated land

It is assumed that among 4 Category Areas exist the differences not only in the aspect of water resource availability but also in social and economic aspects directly or indirectly related to water resource situation. Based on this assumption, the Socio-Economic Survey (a questionnaire interview survey) was conducted as one of the study activities to gather socio-economic baseline information and to grasp the features of 4 different Category Areas.[1]

B-1.2 Survey Team

The actual field implementation of the questionnaire survey was subcontracted to a local firm (jbj-Crossroads to Development), under the supervision of the Study Team. The survey was conducted during Sept. 22 to 28 for 7 days for the field work, and the total days required from execution of subcontracting arrangement to the data completion and report submission was 42 days, from Sept. 6 to Oct. 17, 2005. The Survey Team formed 10 teams of enumerators under it, each consist of 2 enumerators with one leader and one assistant. Enumerators were trained prior to the field dispatch, in order to unify the question methods and response recording, and for the quality control of the survey results as a whole.

B-1.3 Survey Design, Area and Sample Distribution

B-1.3.1 Survey Design

(1) Survey Questionnaire

The survey questionnaire drafted by the Study Team in English was translated into Khmer language by subcontractor, and after the field testing and improvement, it was applied for the field survey. The survey questionnaire is attached to this report as Attachment.

(2) Sampling Process

At the time of the Study Inception, the survey site selection was planned to follow the Communes Profiling. However, taking into account the fact that the water resource availability differ from location to location within the commune and even within the village, overly relying on Commune level information is considered insufficient to reach appropriate samples that represents the cultivators of particular Category Areas. Based on this notion, the following steps were taken to select the actual survey location and samples.

1) Studied the existing commune level data such as SEILA 2004 database, to

[1] Other study activities conducted in order to grasp socio-economic features are PCM Workshop and RRA.

roughly identify the communes that may fall into 4 different Category Area categories within the Target Area,

2) Created a draft map showing tentatively delineated Category Areas within the Target Area, based on water availability for agriculture,

3) Listed the Commune names for each Category Area by looking at both 1) and 2) above,

4) Listed the Village names within the Communes listed in above process,

5) Discussed with PDOWRAM officials for the relevance of previous Communes/Villages listing as against zoning, and asked them to recommend the appropriate Communes/Villages for the field survey,

6) The Survey Team entered to the recommended Villages and met Village Chiefs for the information of villagers cultivating under typical agricultural water conditions classified in zoning, and then

7) Interviewed the identified villagers.

As described above, in this sampling process not the random method but the purposive selection method was adopted. A major reason being that as previously touched upon, even within the same village the agricultural water resource availability can highly differ according to the topographical setting of the cultivated lands, and in order to achieve the survey purpose (grasp the features of different Category Areas), it was judged rather relevant to purposively select the typical households cultivating under particular water resource conditions of the Category Areas in question.

Thus, the survey results derived from this sampling method is invalid to analyze the socio-economic features of Villages, Communes or Category Areas where samples were selected, but is valid to analyze the socio-economic features of the "households cultivating under typical agricultural water resources conditions of the Category Areas in question."

An effort was taken to control the sampling bias by limiting the sample number per village to around 10 samples. This was to minimize the over-representation of particular village/s by selecting too little number of sampling villages for each Category Area. Instead, 6 to 7 villages for each Category Area were selected for sampling and as a result, location of sampled villages for each Category Area became fairly dispersed within the Target Area.

(3) Sample Size

The questionnaire survey was designed to cover 200 HH in total, by interviewing 50 HH for each one of 4 Category Areas. This sample size was decided in prior when the survey was planned to select one typical village for each Category Area with conducting random sampling. By such a method, statistical significance in analyzing the socio-economic characteristics of the sampled village as a whole could have been maintained.

However, since sampling method was altered as described above, it has to be noted that the statistical significance of this survey results became weak and the results should be regarded as the qualitative pictures of the typical households cultivating under the particular agricultural water resource conditions designated for each Category Area.

B-1.3.2 Survey Area and Sample Distribution

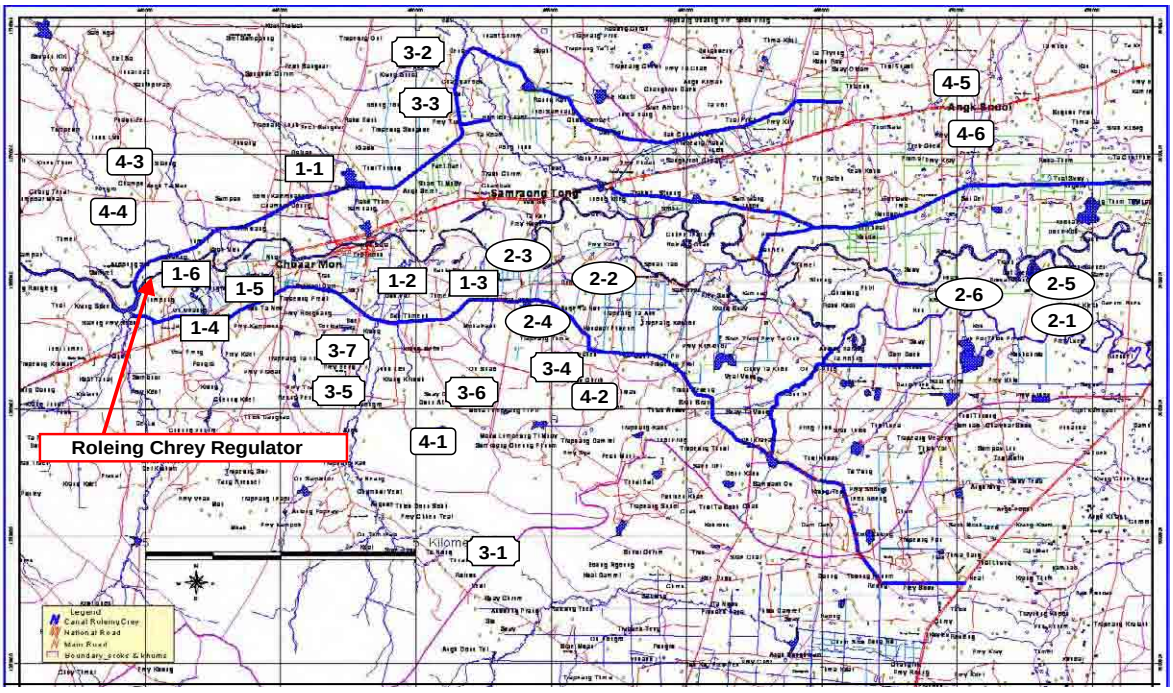
The information of administrative and zonal distribution of sample HH and the locations of sampled villages for each Category Area in the Target Area are shown in the Table and Figure in next page.

Socio-Economic Survey Sample Distributions

Province	District	Commune	Village (Code on Map)	C.A*- 1	C.A- 2	C.A- 3	C.A- 4	Total
KAMPONG SPEU	CHBAR MON	CHBAR MON	KTOMKRANG (1-1)	8				8
		KANDAOL DOM	SRAE THNAL (1-2)	9				9
			THMEI (1-3)	7				7
	KONG PISEI	PREAH NIPEAN	KOR (2-1)		8			8
	SAMRAONG TONG	KAHAENG	KAHAENG (1-4)	7				7
			OU VEAENG (1-5)	10				10
			ROLEANG CHREY (1-6)	9				9
		KRANG AM PIL	TA NONG (3-1)			6		6
		PNEAY	OU LEU (3-2)			8		8
			TRAPEANG MOAN (3-3)			8		8
		ROLEANG CHAK	LEAK ANLUNG (2-2)		8			8
			PRING (2-3)		10			10
			SRAE KAK (2-4)		8			8
		SKUH	KRANG TRALACH (4-1)				10	10
			OU SNAO (3-4) (4-2)			4	4	8
			REUNG PEUNG (3-5)			8		8
			TRAPEANG SRANG (3-6)			3		3
			TRAPEANG TA LUONG (3-7)			13		13
		TANG KROUCH	CHAMPEI (4-3)				8	8
			KRANG MKAK (4-4)				8	8
KANDAL	ANG SNOUL	PEUK	ANGK SAMNANG (4-5)				9	9
			CHAMKAR CHOU (4-6)				11	11
	KANDAL STUNG	ROKA	BOENG (2-5)		10			10
			KROUCH (2-6)		6			6
Total				50	50	50	50	200

* C.A : Category Area

Socio-Economic Survey Areas



In above Figure, total 25 locations are shown with 2 numbers connected by hyphen. These numbers mean that the first number is the Category Area number, and the second number is the code number of villages arbitrary given to sampled villages in the above Table.

The compiled survey results will be described in following chapters.

Chapter B-2 General Social Information

B-2.1 General Information

B-2.1.1 General Characteristics

(1) Household Size

The survey respondents are mostly the male and female heads of households (66% and 30% respectively) with their average age 47 years old. Of these households, the average household member population is 6.14person/HH for all samples and that of each Category Area are shown below.

Average Numbers of Household Member Population

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	50	50	50	50	200
Mean	5.72	5.96	6.46	6.40	6.14

The average household member populations differ among 4 Category Areas, with somehow increasing trend of 5.72 in Category Area-1 toward 6.4 or more in Category Areas-3 and 4.

(2) Male-Female Balance

Male-Female balance of the sampled household members are male 47.4% and female 52.6% for the average of all samples and that of each Category Area are shown below.

Male-Female Balance of the Sampled Households

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Male	136	47.6	140	47.0	156	48.3	150	46.9	582	47.4
Female	150	52.4	158	53.0	167	51.7	170	53.1	645	52.6
Total	286	100.0	298	100.0	323	100.0	320	100.0	1,227	100.0

(3) Working-age Population

The average number of working-age population (between 10 to 64 yrs old) per household is 5 person/HH for all samples and that of each Category Area are shown below.

Average Numbers of Working-Age Population in Households

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	50	50	50	50	200
Mean	4.80	4.74	5.28	5.20	5.01

(4) Age Composition

The age compositions of the household members of the sampled households are shown as follows.

Age Compositions of Sampled Household Members

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
1 - 10 years	33	11.5	51	17.1	56	17.3	49	15.3	189	15.4
11 - 20	94	32.9	96	32.2	119	36.8	102	31.9	411	33.5
21 - 30	57	19.9	44	14.8	50	15.5	68	21.3	219	17.8
31 - 40	21	7.3	36	12.1	30	9.3	24	7.5	111	9.0
41 - 50	34	11.9	34	11.4	32	9.9	36	11.3	136	11.1
51 - 60	32	11.2	24	8.1	24	7.4	19	5.9	99	8.1
61 - 70	11	3.8	9	3.0	6	1.9	12	3.8	38	3.1
71 - 80	3	1.0	4	1.3	6	1.9	7	2.2	20	1.6
80 year old	1	0.3					3	0.9	4	0.3
Total	286	100.0	298	100.0	323	100.0	320	100.0	1,227	100.0

An outstanding feature of household members' age composition in the Target Area is that the proportion of 11 – 20 years age groups is prominent (33.5% for all Category Areas) compared to other age groups. Since the national figure for this age group is approx. 25%, it is significant feature of the sampled households.

(5) Levels of Formal Education

The education levels of the sampled households are shown below.

Education Levels of Sampled Household Members

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
No formal education	19	6.6	23	7.7	24	7.4	31	9.7	97	7.9
Drop-out at primary school	64	22.4	55	18.5	57	17.6	64	20.0	240	19.6
Graduate from primary school	35	12.2	41	13.8	28	8.7	23	7.2	127	10.4
Drop-out at junior high school	36	12.6	44	14.8	50	15.5	51	15.9	181	14.8
Graduate from junior high	27	9.4	27	9.1	16	5.0	12	3.8	82	6.7
Drop-out at high school	24	8.4	16	5.4	13	4.0	18	5.6	71	5.8
Graduate from high school	9	3.1			8	2.5	8	2.5	25	2.0
More than high school	2	0.7							2	0.2
Presently going to school	51	17.8	62	20.8	93	28.8	84	26.3	290	23.6
Not going to school	2	0.7	2	0.7	4	1.2	4	1.3	12	1.0
Before school age	17	5.9	26	8.7	28	8.7	24	7.5	95	7.7
Non-formal education for			2	0.7	2	0.6	1	0.3	5	0.4
Total	286	100.0	298	100.0	323	100.0	320	100.0	1,227	100.0

No significant variance is observed among 4 Category Areas from above Table. In average of 4 Category Areas, approx. 38% of sampled household members received primary school level education or lower, while approx. 21% finished or dropped out junior high school and approx. 8% finished or dropped out high school.

(6) Literacy

Literacy rate of sampled household members is 81.6% for total samples, with minor variance among 4 Category Areas, as shown below.

Literacy Rate of Sampled Household Members

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Yes	245	85.7	240	80.5	263	81.4	253	79.1	1,001	81.6
No	41	14.3	58	19.5	60	18.6	67	20.9	226	18.4
Total	286	100.0	298	100.0	323	100.0	320	100.0	1,227	100.0

(7) Main Income Sources of Household Heads

The main income sources of the sampled household heads are predominantly from farming activity (97.5%) for all 4 Category Areas, as shown below.

Main Income Sources of Sampled Household Heads

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Farmer	48	96.00	48	96.00	49	98.00	50	100.00	195	97.50
Salaried worker	1	2.00	1	2.00	1	2.00			3	1.50
Private business	1	2.00	1	2.00					2	1.00
Total	50	100.00	50	100.00	50	100.00	50	100.00	200	100.00

(8) Main Occupations of Household Members

By looking at main occupations of individual household members, more detailed picture of sampled households' economic activities of will be seen.

Main Occupations of Sampled Household Members

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Farmer	156	54.5	150	50.3	137	42.4	141	44.1	584	47.6
On-farm labor	2	0.7					1	0.3	3	0.2
Non-farm labor	5	1.7	5	1.7	4	1.2	2	0.6	16	1.3
Salaried worker	24	8.4	22	7.4	33	10.2	41	12.8	120	9.8
Private business	1	0.3	4	1.3			4	1.3	9	0.7
Housekeeping (cooking, washing, child care, etc.)	1	0.3	2	0.7	2	0.6	5	1.6	10	0.8
No job	5	1.7	9	3.0	7	2.2	10	3.1	31	2.5
Student	72	25.2	73	24.5	106	32.8	88	27.5	339	27.6
Child (below school age)	16	5.6	25	8.4	28	8.7	24	7.5	93	7.6
Others	4	1.4	8	2.7	6	1.9	4	1.3	22	1.8
Total	286	100.0	298	100.0	323	100.0	320	100.0	1,227	100.0

According to above table, generally nearly half of all household members is engaging in farming as owner farmer, while only a fraction (3 persons) works as on-farm laborers. Salaried workers have some significance and consists nearly 10% of all sampled household members. Unemployment rate is quite low with being 2.5% of all sampled household members.

(9) Membership to Village-level Organizations

The village-level organizations that the household members (husband and wife) are belonging are as shown in the following.

Village-level Organizations the Husbands are Belonging

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Farmer water users	10	47.6	1	9.1	1	12.5	1	10.0	13	26.0
Credit group by government	1	4.8	1	9.1			2	20.0	4	8.0
Micro-credit group by NGO	2	9.5	2	18.2	4	50.0	2	20.0	10	20.0
Production group			1	9.1					1	2.0
Religion group	5	23.8	1	9.1	1	12.5	2	20.0	9	18.0
Drinking water users group	2	9.5							2	4.0
Youth group							2	20.0	2	4.0
Veteran group			1	9.1					1	2.0
Others	1	4.8	4	36.4	2	25.0	1	10.0	8	16.0
Total No. of Response	21	100	11	100	8	100	10	100	50	100

Village-level Organizations the Wives are Belonging

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Farmer water users	11	45.8					2	22.2	13	28.3
Credit group by government			2	33.3			1	11.1	3	6.5
Micro-credit group by NGO	4	16.7	1	16.7	4	57.1	4	44.4	13	28.3
Religion group	1	4.2			1	14.3	1	11.1	3	6.5
Drinking water users group	2	8.3							2	4.3
Youth group	1	4.2							1	2.2
Women group					1	14.3			1	2.2
Others	5	20.8	3	50.0	1	14.3	1	11.1	10	21.7
Total No. of Response	24	100	6	100	7	100	9	100	46	100

As it can be seen from above Tables, the number of respondents answered they are belonging any kind of village-level organizations are somewhat limited (only about a quarter of all respondents answered as they belong to any).

Two tendencies observed from above tables are that (1) there exist no significant difference between husbands and wives, and (2) Category Area-1 has relatively more village-level organization memberships in comparison to others.

B-2.1.2 Water for Drinking

(1) Sources and Sufficiency of Drinking Water in Dry Season

The sources of drinking water in dry season are as follows.

Sources of Drinking Water in Dry Season

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Tube pipe well	5	10	20	40	32	64	39	78	96	48
Dug well	5	10	25	50	18	36	2	4	50	25
Reservoir/pond	3	6	2	4			7	14	12	6
Spring/river	35	70	2	4					37	19
Bought							2	4	2	1
Rain	2	4	1	2					3	2
Total	50	100	50	100	50	100	50	100	200	100

Due to the existence of the perennial surface water, the significant difference appeared between Category Area-1 and others. The popular types of wells also differ among Category Area-2 to 4, as the number of dug wells decrease while that of tube pipe wells increase, as the agricultural water resource become scarcer.

The sufficiency of the drinking water in dry season is as follows.

Sufficiency of Drinking Water in Dry Season

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Sufficient	40	80	36	72	10	20	19	38	105	53
Just enough	6	12	4	8	8	16	6	12	24	12
Short	4	8	10	20	32	64	25	50	71	36
Total	50	100	50	100	50	100	50	100	200	100

The drinking water shortage is severe particularly in Category Area-3 and 4.

(2) Sources and Sufficiency of Drinking Water in Wet Season

The sources of drinking water in wet season are as follows.

Sources of Drinking Water in Wet Season

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Tube pipe well	1	2	5	10	13	26	23	46	42	21
Dug well	1	2	15	30	7	14	1	2	24	12
Reservoir/pond	2	4	2	4	1	2	3	6	8	4
Spring/river	17	34							17	9
Bought							1	2	1	1
Rain	29	58	28	56	29	58	22	44	108	54
Total	50	100	50	100	50	100	50	100	200	100

In contrast to dry season, rainwater is utilized as the main resource for drinking water for all Category Areas.

Sufficiency of Drinking Water in Wet Season

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Sufficient	38	76	39	78	32	64	27	54	136	68
Just enough	8	16	4	8	10	20	9	18	31	16
Short	4	8	7	14	8	16	14	28	33	17
Total	50	100	50	100	50	100	50	100	200	100

Although the water shortage is significantly alleviated due to rainfall, there still remain the households facing the difficulty to meet its drinking water consumption level.

The data on sources and sufficiency of the water for domestic use are almost identical to that of drinking water and thereby its description is skipped.

B-2.1.3 Fuel Sources for Cooking

(1) Fuel Sources for Cooking

Almost all households rely on firewood for cooking fuel, while a fraction (2 samples) answered charcoal is most important for cooking.

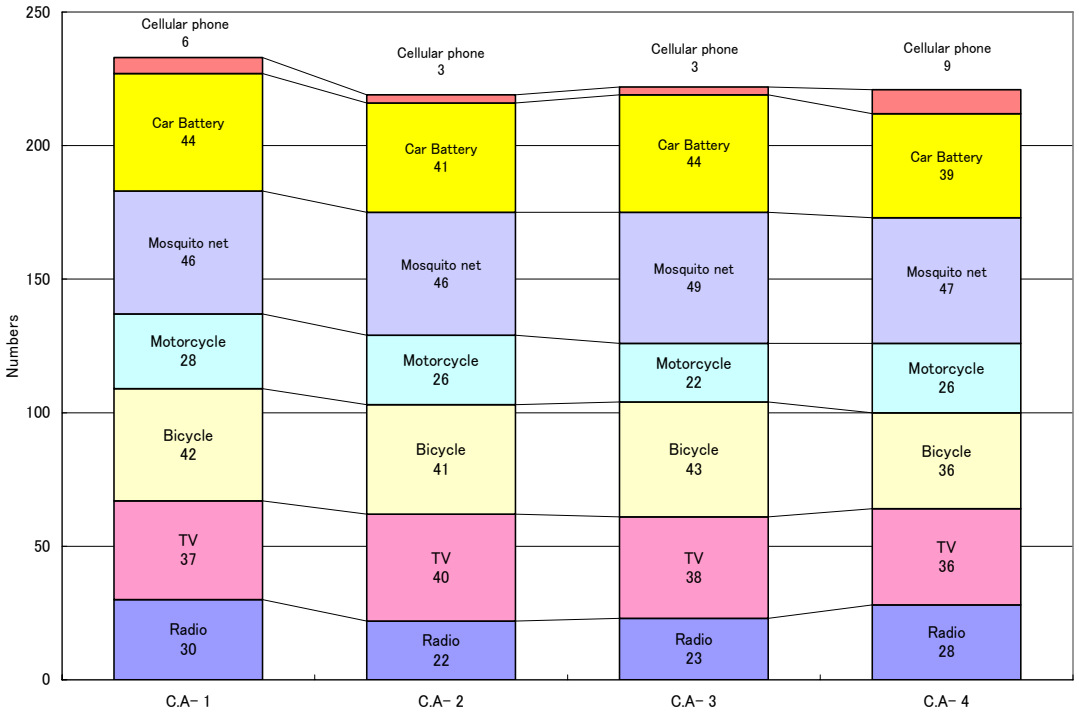
On the availability (easiness to obtain) of the firewood, approx. 80% of all samples responded as it is easy to obtain.

B-2.2 Material Abundance

B-2.2.1 Material Goods

Interestingly, the ownership of the material goods such as radio, TV, bicycle, motorcycle, etc. did not show any significant difference among 4 Category Areas. In the Figure below, the numbers shown inside of the columns are the total numbers of material goods in question owned by the households in each Category Areas, and does not reflect the distributions of these material goods among households.

Abundance of Material Goods



However, according to the survey data, the skewness of the distributions of above-listed goods are also similar among 4 Category Areas, e.g. while all TV sets are owned as 1 set/HH base, the mosquito nets are owned in multiple numbers by limited HH with its numbers ranging from 2.83 to 3.28 sets/HH and this means there are many households without mosquito net.

The ownership of the luxury goods such as car, tractor, and electric fan are observed though very limited in number, i.e. total 3 cars owned by households in Category Area-1, 2 and 4, total 7 tractors owned by 2 households of Category Area-1 to 3 and 1 household of Category Area-4, and total 4 electric fans owned by one household from all 4 Category Areas.

B-2.2.2 Residence

No significant difference is observed among 4 Category Areas. The houses the respondents are living are the owned houses except one sample which still pays the debt for housing. All houses are traditional type with 1 to 3 rooms (average 1.6) with its material mostly timber (93% of all sample) or otherwise made of palm leaves (6% of all sample) or cement/bricks (only 1 sample).

B-2.3 Utilities and Medical Services

B-2.3.1 Utilities

No modern utility services, i.e. electricity, piped water, piped gas, telephone line, have reached to the sampled households.

B-2.3.2 Medical Facilities

To the question "Where do you go when you get sick?" the respondent answered as follows.

Medical Service Facility

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Hospital	15	30	15	30	6	12	7	14	43	22
Clinic	9	18	8	16	30	60	22	44	69	35
Health center	11	22	22	44	13	26	15	30	61	31
Others	15	30	5	10	1	2	6	12	27	14
Total	50	100	50	100	50	100	50	100	200	100

Although the reasons are not clear, the proportion of those who go to clinic is higher in Category Area-3 and 4, compared that of Category Area-1 and 2. In Category Area-1, those who go to "other" category (15 samples) are comparably higher than other Category Areas. While one can speculate that it is due to the physical distance to those facilities, it requires further information for verification.

For the child bearing, TBAs and Midwives (qualified) are quite popular as against Hospital, as shown in next page.

Places to go for Child Bearing

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Hospital	12	24	9	18	5	10	8	16	34	17
Clinic	1	2	1	2	1	2	3	6	6	3
Health center	4	8	10	20	3	6	14	28	31	16
TBA	14	28	16	32	24	48	14	28	68	34
Traditional Dr					1	2	4	8	5	3
Midwife	16	32	14	28	16	32	7	14	53	27
Others	3	6							3	2
Total	50	100	50	100	50	100	50	100	200	100

While there are variances among 4 Category Areas, no effective explanations are available for its reasons. As in the case of medical service facilities discussed above, the physical distance to those facilities may be an important factor.

Additional but important information in relation to the medical service facility is that no respondents are covered by any kind of formal social security service, nor insurance scheme.

Chapter B-3 Gender Aspect

B-3.1 Female's and Male's Main Activities

Female's and male's main activities are as follows.

Female's Main Activities

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Housekeeping	19	38.0	7	14.0	7	14.0	11	22.4	44	22.1
Cooking	9	18.0	2	4.0	3	6.0			14	7.0
Farming	49	98.0	45	90.0	49	98.0	47	95.9	190	95.5
Handy crafting	2	4.0	1	2.0					3	1.5
Care of	9	18.0	4	8.0			1	2.0	14	7.0
Care of livestock	2	4.0							2	1.0
Making Palm sugar			1	2.0					1	0.5
Others	26	52.0	33	66.0	38	76.0	29	59.2	126	63.3

Totals exceed 100% due to multiple responses

Male's Main Activities

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Housekeeping	1	2	1	2					2	1
Cooking					1	2			1	1
Farming	47	94	48	96	48	96	48	96	191	96
Handy crafting	2	4			1	2			3	2
Care of livestock	4	8							4	2
Making Palm sugar	5	10			4	8	6	12	15	8
Others	23	46	35	70	38	76	33	66	129	65

Totals exceed 100% due to multiple responses

Some observations made from above Table are; 1) housekeeping and cooking are considered as the female's main activities, while 2) other activities including farming are undertaken by both sex, although 3) making of palm sugar seems as male's activity.

There exists variance in between 4 Category Areas but its reasons are not given in survey data.

B-3.2 Female's and Male's Main Cash Incomes

Main cash income sources for female and male are as follows.

Female's Main Cash Income Source

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Selling paddy	34	68	24	48	32	64	28	56	118	59
Working for other	13	26	15	30	12	24	11	22	51	26
Selling palm sugar	1	2	1	2	1	2	2	4	5	3
Selling handy craft	1	2	1	2			3	6	5	3
Working for a	15	30	12	24	17	34	8	16	52	26
Working for brick	1	2							1	1
Others	26	52	33	66	28	56	31	62	118	59

Totals exceed 100% due to multiple responses

Male's Main Cash Income Source

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Selling paddy	36	72	30	60	35	70	31	62	132	66
Working for other	11	22	14	28	10	20	16	32	51	26
Selling palm sugar	3	6	1	2	7	14	5	10	16	8
Selling handy craft			1	2					1	1
Working for a weaving factory	1	2	2	4	4	8			7	4
Others	36	72	46	92	42	84	41	82	165	83

Totals exceed 100% due to multiple responses

In between female and male, a significant difference was observed in the answer "working for a weaving factory." A considerable number of females (26% of all response) are working and earning from weaving factory, while only a fraction of males do. The male's employment opportunity for the weaving factory is assumed to be limited since usually for this type of industry, males from locality are employed as security guard or other kind of ancillary works.

Apart from above, no significant difference is observed in between female and male.

B-3.3 Female's Access to Resources

To the questions of whether females have accesses and have controls over resources such as water, residential land, farmland and livestock, 100% responded as females have accesses and controls over these resources. However, since this inquiry is not investigating the ownership statuses of these resources, it should be taken with some reservations.

Finally, to the question "whether you think there are discrimination against women or not," 97% of all respondents answered there are no discrimination. This aspect should be further followed up in coming times, since majority of respondents to this survey are the males and for this type of information, further in-depth inquiry will be effective.

Chapter B-4 Household Income and Expenditure

B-4.1 Income

For this category, the sources of income and their levels during year 2004 was inquired.

B-4.1.1 Variety of Income Sources

Household income sources are quite diversified. In average of all sample households, they earn from 3.5 different income sources (median value 3.0). This figure varies among four Category Areas ranging from 3.3 in Category Area-2 to 3.6 in Category Area-3.

The distribution of single and multi income source households among different Category Areas is as follows.

Number of Income Sources per Household

(No. of HH)

No. of Income Sources	1	2	3	4	5	6	7	Total
C.A- 1	0	7	23	10	7	2	1	50
C.A- 2	1	11	16	17	5	0	0	50
C.A- 3	1	10	13	11	11	4	0	50
C.A- 4	2	12	14	10	9	2	1	50
Total	4	40	66	48	32	8	2	200

As shown in above Table, single-income source HH is only 4 among total sample. Of them, only one household in Category Area-3 earns from paddy sales and others are earning from private business, livestock/poultry, and non-farm labor.[2]

The number of households earning “only” from agricultural income and “only” from non-agricultural incomes are as follows.

Number of Households Earning only from Agricultural and Non-Agricultural Incomes

(No. of HH)

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	Total
Agricultural Income Only	8	2	5	4	19
Non-Agricultural Income Only	3	4	1	8	16

Note1 : On-farm labor is classified in non-agricultural income

Note2: Selling forest vegetable/crop is classified in non-agricultural income

In the above Table, both agricultural-income-only (9.5% of total sample) and non-agricultural-income-only (8% of total sample) households are small in number and rest of sampled households (82.5%) are earning from both, though its composition highly vary.

Agricultural income includes sales from paddy, vegetable, fruits, palm sugar, livestock/poultry and fishes, while non-agricultural income includes permanent based salary, on-farm labor, off-farm labor, private business, remittance, selling of firewood/charcoal, handicraft/cottage industry products, forest vegetable/crop and others.

A tendency can be observed that agricultural water availability seems to have positive correlation to the number of agricultural-income-only households.

It should be noted that all sample households are practicing some degree of cultivation on their land and there are households not selling (self-consuming) their products, including the “non-agricultural-income-only” households listed above.

[2] Note that all sampled HH are practicing cultivation. Thereby no income from agriculture means that the products are self-consumed.

B-4.1.2 Proportional Income Volumes from Different Income Sources

The proportional income volumes from various income sources are calculated for each sources and Category Areas, as shown below.

Total Proportional Income Volumes from Different Sources (%)

	Income Sources	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.As
1	Selling paddy/rice	12.7	10.6	10.7	2.9	8.6
2	Selling vegetables	8.4	0.9	8.1	1.8	4.7
3	Selling fruits	3.7	1.5	1.9	0.3	1.7
4	Selling palm sugar	2.1	1.8	1.8	7.7	3.8
5	Selling livestock/ poultry products	21.3	21.3	25.5	22.3	22.7
6	Selling fishes	2.7	0.3	1.9	2.9	2.1
	SUB TOTAL of Agricultural Income	*50.8*	*36.3*	*49.9*	*38.0*	*43.6*
7	Salary from permanent job	16.4	21.5	20.0	29.3	22.5
8	Wage from temporary job on farm	1.8	3.4	4.7	2.6	3.1
9	Wage from temporary job out of farm	4.0	16.4	6.1	6.8	7.9
10	Private business	8.1	15.3	10.1	15.1	12.3
11	Remittance from family members	12.4	6.1	5.7	3.3	6.5
12	Selling firewood/charcoal	4.2	0.0	0.0	1.9	1.6
13	Selling handicraft/ cottage industry products	0.0	0.1	0.2	0.7	0.3
14	Selling forest vegetable/ crop	0.0	0.0	1.0	1.3	0.7
15	Others	2.1	0.9	2.3	1.1	1.6
	SUB TOTAL of Non-Agricultural Income	*49.2*	*63.7*	*50.1*	*62.0*	*56.5*
	TOTAL	100	100	100	100	100

From above Table, the following characteristics are observed.

(1) Agricultural incomes consist approximately 40 to 50% of the Category Area-wide and all-Category Area total cash incomes earned by sampled households.

(2) The income sources of sampled households are diversified not only in variety but also in proportional volume.

(3) Agricultural income is highest in Category Area-1 where most endowed with agricultural water resources.

(4) Among agricultural income sources, the “selling livestock/poultry” is the most viable cash income source.

(5) “Selling paddy/rice” is bearing proportionally small income, especially water-scarce Category Area-4 (though its importance should be noted not as source of cash income but as source of self-consumed staple food).

(6) “Salary from permanent job” is bearing especially high proportion of Category Area-wide total income in Category Area-4.

(7) Category Area-2 is bearing the lowest agricultural income despite its agricultural water resources endowment. However, it is seemingly not due to paddy/rice sales but very low vegetable sales, as well as relatively high off-farm labor and private business earnings from non-agricultural income category.

B-4.1.3 Income Levels

The average and median household incomes of each Category Area and all samples are shown below.

Average and Median Household Income per Category Area and Total Samples

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.As
N	50	50	50	50	200
Average/HH ('000 Riel)	3,154	2,847	3,697	4,683	3,595
Median/HH ('000 Riel)	2,455	2,540	3,635	3,495	2,902
Minimum	500	360	460	840	360
Maximum	16,100	12,350	9,750	25,370	25,370

As far as income is concerned, Category Area-4 is most affluent and earning 1.6 times more average wage/HH of Category Area-2 (or 1.4 times more median wage/HH).

In the above Table, the gaps between "average" and "median" income per household appeared in all Category Areas indicates that there exist numbers of very rich households, or there are few very riches in comparison to the number of poor, in all Category Areas. Such a situation is quite evident in Category Area-1 and 4 where the gaps between two figures are relatively wide, while it is less evident in Category Area-2 and 3 where the same gap is relatively small.

The minimum and maximum figures as well indicate the income gaps between poorest and richest among samples. The richest earns 32 times more than the poorest in Category Area-1, 34 times in Category Area-2, 21 times in Category Area-3, 30 times in Category Area-4, and 70 times (!) for all Category Areas.

The numbers of households earning from each income source and levels of earning per income source per HH are compiled for each Category Area and for all samples, and attached as Table B-1.

B-4.1.4 Income Structures Based on Income Strata

In order to grasp the picture of income structure against income classes, an attempt was made to divide the samples into different income strata, based on income level.

(1) All Samples (200 households from all Category Areas)

For all samples, the stratification was made to divide them into 5 different strata, by counting the samples with 40 households interval from richest to poorest.

As the result, the income structures of 5 strata for all samples turned out as below.

Income Structure against 5 Income Strata for All Category Areas (Value: '000 Riel)

INCOME STRATA	AVERAGE HH INCOME	INCOME STRUCTURE ('000 Riel)														
		AGRICULTURAL INCOME						NON-AGRICULTURAL INCOME								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Selling paddy/rice	Selling vegetables	Selling fruits	Selling palm sugar	Selling livestock/ poultry products	Selling fishes	Salary from permanent job	Wage from temporary job on farm	Wage from temporary job out of farm	Private business	Remittance from family members	Selling firewood/charcoal	Selling handicraft/ cottage industry products	Selling forest vegetable/ crop	Others
1st	7,995	489	188	139	434	1,735	111	1,893	260	632	1,477	520	25	0	23	71
2nd	4,124	320	265	37	33	996	195	1,218	84	272	321	238	111	2	32	0
3rd	2,943	278	218	34	108	714	60	537	112	177	184	227	76	43	63	113
4th	1,939	244	97	54	78	534	10	322	36	192	157	105	20	0	0	92
5th	974	207	78	44	28	101	0	78	73	148	78	71	47	12	3	8

Income Structure against 5 Income Strata for All Category Areas (Composition: %)

INCOME STRATA	AVERAGE HH INCOME	INCOME STRUCTURE (%)														
		AGRICULTURAL INCOME						NON-AGRICULTURAL INCOME								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Selling paddy/rice	Selling vegetables	Selling fruits	Selling palm sugar	Selling livestock/ poultry products	Selling fishes	Salary from permanent job	Wage from temporary job on farm	Wage from temporary job out of farm	Private business	1Remittance from family members	Selling firewood/charcoal	Selling handicraft/ cottage industry products	Selling forest vegetable/ crop	Others
1st	7,995	6.1	2.3	1.7	5.4	21.7	1.4	23.7	3.3	7.9	18.5	6.5	0.3	0.0	0.3	0.9
2nd	4,124	7.8	6.4	0.9	0.8	24.2	4.7	29.5	2.0	6.6	7.8	5.8	2.7	0.0	0.8	0.0
3rd	2,943	9.4	7.4	1.2	3.7	24.3	2.0	18.3	3.8	6.0	6.3	7.7	2.6	1.4	2.1	3.8
4th	1,939	12.6	5.0	2.8	4.0	27.5	0.5	16.6	1.8	9.9	8.1	5.4	1.0	0.0	0.0	4.7
5th	974	21.3	8.0	4.5	2.8	10.3	0.0	8.0	7.5	15.2	8.0	7.3	4.9	1.2	0.3	0.8

Before entering discussion, the basic questions in relation to the correlations of various household attributes will be touched upon. They are between;

(a) "Household income level" and "variety (number) of income sources per household," and

(b) "Household income level" and "number of working aged family members."

The results of the correlation analyses conducted for above two sets of variables indicated that there are no correlation (r=0.15) for above (a), and weak correlation (r=0.2) for above

(c). Therefore, as far as the sampled households are concerned, the income levels and variety (number) of income sources or number of working aged family members have almost no or only weak positive relations.[3]

Of the above Tables, the average value of each income sources are calculated through dividing the total value of income derived from particular income source for a stratum by the number of sample (40HH for each stratum). Therefore, the value indicated in above Table are the value "if all 40 households in particular stratum practiced and earned from such and such income sources," and are not the average income of the households in particular stratum actually practicing and earning from particular income source.

The followings are observed from above Tables.

1) The income difference between richest 20% (1st stratum) and the poorest 20% (5th stratum) are 8.2 times.
2) Income from "Selling paddy/rice" is proportionally the biggest for the poorest 20% (5th stratum) with occupying 21.3% of this stratum's income. The proportion (%) of this income for other stratum reduces as their income level increases. However, the value that each stratum earns from this income source increases as the income level become higher. Similar tendency can also be observed for the income sources "selling vegetables" and "selling fruits."
3) "Selling palm sugar" for richest 20% (1st stratum) is noticeable in both value and proportion (%).
4) Among agricultural income sources, "selling livestock/poultry products" is outstanding for all strata though relatively less in poorest 20% (5th stratum). The income difference between 4th and 5th stratum seem to be resulted from this income category, apart from "salary from permanent job."
5) Among all non-agricultural income sources, "salary from permanent job" is most outstanding for stratum 1st to 4th, especially of the 1st and 2nd stratum. Whether a household has this income source or not highly influences their income levels.
6) Wages from temporary job "on farm" as well as "out of farm" are relatively more important for 5th stratum than others, since they consist of considerable proportions to their income.
7) "Private business" contributes to the 1st stratum more than others, both in value and proportion. This means that there are owners of sizeable private business owners existing in 1st stratum.
8) "Remittance from family members" nearly equally contribute to all strata in proportion, while its values differ to the certain extent.

(2) Category Area-1 to 4 (50 households for each Category Area)

For the Category Areas, households of each Category Area were divided into 3 strata by counting the 50 samples of each Category Area 16 (32%), 18 (36%) and again 16 (32%) from highest income household toward bottom, or the other way around.

The income compositions of 3 strata for each Category Area are compiled as below.

[3] However, very high correlations were obtained when correlation of these variables not for all households but for "strata averages" were analyzed, i.e. a) r = 0.77 and b) r = 0.94.

Income Structure against Income Strata for Category Areas-1 to 4 (Value and Proportion)

Category Areas	INCOME STRATA	AVERAGE HH INCOME ('000 Riel)	VALUE OR PROPORTION	INCOME STRUCTURE														
				AGRICULTURAL INCOME						NON-AGRICULTURAL INCOME								
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				Selling paddy/rice	Selling vegetables	Selling fruits	Selling palm sugar	Selling livestock/ poultry products	Selling fishes	Salary from permanent job	Wage from temporary job on farm	Wage from temporary job out of farm	Private business	Remittance from family members	Selling firewood/charcoal	Selling handicraft/ cottage industry products	Selling forest vegetable/ crop	Others
C.A.- 1	1st	6,126	'000 Riel	535	339	241	173	1,369	263	1,126	31	324	344	970	413	0	0	0
			%	8.7	5.5	3.9	2.8	22.3	4.3	18.4	0.5	5.3	5.6	15.8	6.7	0.0	0.0	0.0
	2nd	2,401	'000 Riel	347	303	46	0	600	0	436	68	24	260	132	0	0	0	187
			%	14.4	12.6	1.9	0.0	25.0	0.0	18.1	2.8	1.0	10.8	5.5	0.0	0.0	0.0	7.8
	3rd	1,027	'000 Riel	326	150	74	31	54	0	0	71	42	165	108	6	0	0	0
			%	31.7	14.6	7.2	3.0	5.3	0.0	0.0	6.9	4.1	16.1	10.5	0.6	0.0	0.0	0.0
C.A.-2	1st	5,072	'000 Riel	319	2	22	25	912	0	1,490	0	1,011	943	318	0	0	0	31
			%	6.3	0.0	0.4	0.5	18.0	0.0	29.4	0.0	19.9	18.6	6.3	0.0	0.0	0.0	0.6
	2nd	2,469	'000 Riel	426	44	84	96	725	0	221	183	233	320	96	0	0	0	41
			%	17.3	1.8	3.4	3.9	29.4	0.0	9.0	7.4	9.4	13.0	3.9	0.0	0.0	0.0	1.7
	3rd	1,046	'000 Riel	142	30	16	25	165	25	171	101	189	63	114	0	8	0	0
			%	13.6	2.9	1.5	2.4	15.7	2.4	16.3	9.6	18.0	6.0	10.9	0.0	0.7	0.0	0.0
C.A.-3	1st	6,097	'000 Riel	755	316	126	75	1,408	225	1,298	513	206	925	112	0	1	99	38
			%	12.4	5.2	2.1	1.2	23.1	3.7	21.3	8.4	3.4	15.2	1.8	0.0	0.0	1.6	0.6
	2nd	3,435	'000 Riel	225	471	58	83	1,073	0	672	18	203	133	382	3	3	10	100
			%	6.5	13.7	1.7	2.4	31.3	0.0	19.6	0.5	5.9	3.9	11.1	0.1	0.1	0.3	2.9
	3rd	1,592	'000 Riel	228	87	29	38	333	0	254	13	268	94	114	0	23	0	113
			%	14.3	5.5	1.8	2.4	20.9	0.0	15.9	0.8	16.8	5.9	7.2	0.0	1.4	0.0	7.1
C.A.-4	1st	8,974	'000 Riel	104	125	25	831	1,872	278	2,484	256	412	2,087	306	63	0	25	108
			%	1.2	1.4	0.3	9.3	20.9	3.1	27.7	2.9	4.6	23.3	3.4	0.7	0.0	0.3	1.2
	2nd	3,524	'000 Riel	213	102	11	85	962	133	1,299	69	228	91	146	47	95	0	44
			%	6.1	2.9	0.3	2.4	27.3	3.8	36.9	1.9	6.5	2.6	4.2	1.3	2.7	0.0	1.3
	3rd	1,696	'000 Riel	76	31	12	204	305	0	343	46	327	17	9	162	0	164	0
			%	4.5	1.8	0.7	12.1	18.0	0.0	20.2	2.7	19.3	1.0	0.6	9.5	0.0	9.7	0.0

Some observations made from above Table are:

1) "Selling paddy/rice" is contributing especially to the Category Area-1, 3rd stratum's (poor) income (31.7%). On the contrary, the contribution of same income source to the same 3rd stratum in Category Area-4 is as low as 4.5%, while for the same stratum in Category Areas-2 and 3 are in between Category Area-1 and 4. Similar tendency is also observed for Selling "vegetables" and "fruits."

2) "Selling livestock/poultry products" generally contribute to the incomes of all strata in all Category Areas, though less in 3rd stratum in Category Area-1.

3) "Salary from permanent job" contributes much to the incomes of 1st and 2nd strata in all Category Areas, particularly of Category Area-4.

4) "Temporary job on farm" contributes to the 2nd and 3rd strata in Category Area-1 and 2, while it is to the 1st stratum in Category Area-3.

5) "Private business" contributes much to the incomes of 1st and 2nd strata in Category Areas-2 to 4 (especially to Category Area-4), while in Category Area-1 it contributes more to the 3rd stratum.

6) "Remittance from family member" contributes most to the 1st stratum in Category Area-1 in value as well as proportion. This indicates that the reliance of this stratum to this income source is especially high, compared to others.

Above observations are not exhaustive and various more matters could be perceived. However, as a rough and tentative outlining of income structure of each Category Area, the following can be said.

Category Area-1: Agriculture centered income structure

Due to agricultural water resource availability, the agriculture-centered income structure remains, in comparison to other Category Areas. Although the richer households earn much higher proportion of income from livestock/poultry sales, if other two high income contributors, i.e. salary from permanent job and remittance from family member are deleted, the income difference between 1st to 3rd strata will become quite flat.

Category Area-2: Low agriculture performance with temporary supplement

Relatively low agricultural income (especially livestock/poultry) is observed in this Category Area. Whether it is due to the shortage of land or capital or other, further inquiry will be needed. Low performance of agriculture income is supplemented by non-farm temporary job and private business.

Category Area-3: Fairly equal agriculture

Agricultural income in this Category Area is as good as the level of Category Area-1 and featured with relatively flat income distribution among different stratum, supplemented by permanent job salary which is also relatively flat in its distribution among strata. As a result, Category Area-3 samples turned out as most equal and affluent among all Category Areas.

Category Area-4: Non-agriculture income structure

The relative feature of Category Area-4 is that non-agriculture income especially that of permanent job salary is occupying high proportion, while agricultural income performance except palm sugar and livestock/poultry is quite low. It is evident that this Category Area is not relying much on cultivation.

B-4.2 Expenditure

B-4.2.1 Expenditure Levels

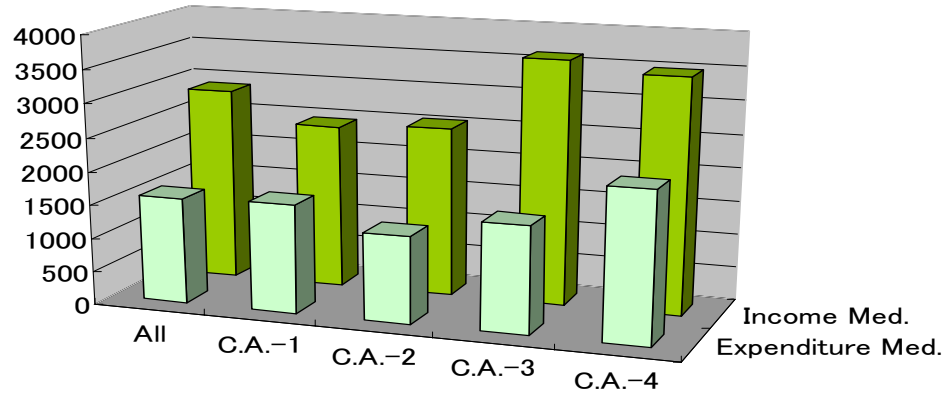
Average and median expenditure for samples in each and all Category Areas are as follows.

Average and Median Expenditure for Each and All Category Areas

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	50	50	50	50	200
Average ('000 Riel)	2,149	1,596	1,853	2,632	2,058
Median ('000 Riel)	1,632	1,306	1,594	2,235	1,585
Minimum	450	408	120	341	120
Maximum	11,396	4,966	4,200	14,887	14,887

The Figure below is the comparison of median income and median expenditure levels for each and all Category Areas.

Comparison of Median Income and Median Expenditure Levels for Each and All Category Areas



As shown in above Figure, the income and expenditure levels of each Category Area are not necessarily coinciding. For example, while expenditure levels of Category Areas-1 and 3 are close, their income levels differ considerably.

B-4.2.2 Proportional Expenditure Volumes for Different Purposes

The proportional expenditure volumes for different purposes are shown in the Table below.

Proportional Expenditure Volumes for Different Purposes

	C.A-1	C.A-2	C.A-3	C.A-4
1 Rice	2.7	3.7	18.2	21.1
2 Other Food	56.6	52.5	40.5	39.9
3 Health	9.2	11.5	11.0	10.3
4 Education	11.2	11.2	11.2	8.7
5 Clothes	5.4	5.6	5.0	3.7
6 Firewood/Kerosene/Electricity	4.4	5.3	6.1	3.4
7 Transportation	9.5	8.5	6.9	6.5
8 Tax	0.1	0.3	0.1	0.1
9 Others	0.9	1.3	1.0	6.3
10 Total	100.0	100.0	100.0	100.0

Some notable features observed from above Table are;

(1) Expenditure for "rice" is significantly less in Category Areas-1 and 2. This can be assumed as they are self-consuming the rice they have produced.

(2) Expenditures for "other foods," "clothes," and "transportation" differ among Category Areas. However, when looking at these proportional (%) figures converted into value (Riel) figures, e.g. the expenditures on these items between Category Areas-1 and 2, and Category Areas-3 and 4, will be very close.

(3) Interestingly, the expenditure for "health," "education" and "tax" are very close in proportional (%) figure, especially "education." While these in value (Riel) figure differ in accordance with the different income levels among Category Areas, seemingly the expenditure level for these items have some kind of "caps," as there are affordable ceilings.

B-4.2.3 Expenditure Structures Based on Income Strata

(1) All Samples (200 households from all Category Areas)

Expenditure structures for the different income strata divided in previous section are compiled as follows.

Expenditure Structure against Income Strata for All Category Areas (Value: '000 Riel)

INCOME STRATA	AVERAGE HH INCOME	EXPENDITURE STRUCTURE ('000 Riel)									
		1	2	3	4	5	6	7	8	9	10
		Rice	Other Food	Health	Education	Clothes	Firewood/ Kerosene/ Electricity	Transportation	Tax	Others	Total
1st	7,995	441	1,506	182	263	131	132	408	4	130	3,197
2nd	4,124	224	1,091	344	362	145	102	132	3	27	2,429
3rd	2,943	277	879	234	190	101	102	117	2	52	1,955
4th	1,939	167	678	148	138	62	66	85	3	47	1,395
5th	974	99	563	136	97	46	68	42	2	10	1,064

Expenditure Structure against Income Strata for All Category Areas (Composition: %)

INCOME STRATA	AVERAGE HH INCOME	EXPENDITURE STRUCTURE (%)									
		1	2	3	4	5	6	7	8	9	10
		Rice	Other Food	Health	Education	Clothes	Firewood/ Kerosene/ Electricity	Transportation	Tax	Others	Total
1st	7,995	13.8	47.1	5.7	8.2	4.1	4.1	12.8	0.1	4.1	100.0
2nd	4,124	9.2	44.9	14.2	14.9	6.0	4.2	5.4	0.1	1.1	100.0
3rd	2,943	14.2	45.0	12.0	9.7	5.2	5.2	6.0	0.1	2.7	100.0
4th	1,939	12.0	48.6	10.6	9.9	4.5	4.7	6.1	0.2	3.4	100.0
5th	974	9.3	52.9	12.8	9.1	4.3	6.4	3.9	0.2	1.0	100.0

Above Tables indicate, as a matter of course, different picture of expenditure structure from that of Category Area-based, discussed in previous section. The followings are observed from above Tables.

1) The higher the income strata, the more they buy "rice" and "other food." However, proportional (%) expenditures for all strata are not varying much.

2) Except the case of 1st strata, expenditure for "health" and "education" in proportional (%) term not so vary among strata, while in value (Riel) they vary. Seemingly there exist the kinds of proportional caps or ceiling per strata for these spending items.

3) Expenditure for "clothes" and "firewood/kerosene/electricity" also have similar tendency to "health" and "education" discussed above, but in this case including the 1st strata.

4) 1st strata seemingly saving on health and education while spending on food, transportation and others.

5) Tax is paid only in fractional volumes and is negligible in expenditure structure.

(2) Category Area-1 to 4 (50 households for each Category Area)

Expenditure structure is compiled in accordance with the 3-tier income strata previously divided for the Category Areas, i.e. households of each Category Area were divided into 3 strata by counting the 50 samples of each Category Area 16 (32%), 18 (36%) and again 16 (32%) from highest income household toward bottom, or the other way around.

The expenditure structures of 3 strata for each Category Area are shown in the following.

Some observations made from Table in the following are:

1) Expenditure for "rice" is significantly low in Category Areas-1 and 2 for all income strata, and in Category Areas-3 and 4, the amount of money they spend for rice is higher for high-income strata.

2) Expenditure for "other food" is the largest expenditure item for all income strata in all Category Areas. In terms of proportion, it occupies 37.5 to 61.2% of total expenditures of various income strata. In terms of value (Riel), it is quite uniform among 2nd and 3rd strata for all Category Areas, while disproportional amount of money is spent by 1st strata of Category Area-1.

3) "Health" and "Education" expenditures in value (Riel) terms are not corresponding to the income strata. More than half cases, 2nd income strata spent more than 1st income strata.

Expenditure Structure against Income Strata for Category Areas-1 to 4 (Value and Proportion)

C.A-S	INCOME STRATA	AVERAGE HH INCOME	VALUE OR PROPORTION	EXPENDITURE STRUCTURE									
				1	2	3	4	5	6	7	8	9	10
				Rice	Other Food	Health	Education	Clothes	Firewood/ Kerosene/ Electricity	Transportation	Tax	Others	Total
C.A- 1	1st	6,126	'000 Riel	70	2,268	148	399	229	138	440	7	7	3,705
			%	1.9	61.2	4.0	10.8	6.2	3.7	11.9	0.2	0.2	100.0
	2nd	2,401	'000 Riel	48	821	290	198	87	79	153	1	41	1,717
			%	2.8	47.8	16.9	11.5	5.1	4.6	8.9	0.0	2.4	100.0
	3rd	1,027	'000 Riel	57	608	143	131	33	68	29	2	9	1,080
			%	5.3	56.3	13.2	12.2	3.0	6.3	2.6	0.2	0.8	100.0
C.A- 2	1st	5,072	'000 Riel	35	1,175	340	291	131	118	220	3	22	2,334
			%	1.5	50.4	14.6	12.4	5.6	5.1	9.4	0.1	0.9	100.0
	2nd	2,469	'000 Riel	108	774	107	145	74	57	139	8	25	1,436
			%	7.5	53.9	7.4	10.1	5.2	4.0	9.7	0.5	1.8	100.0
	3rd	1,046	'000 Riel	29	573	112	107	67	84	48	4	14	1,037
			%	2.7	55.2	10.8	10.3	6.5	8.1	4.6	0.4	1.4	100.0
C.A- 3	1st	6,097	'000 Riel	547	828	160	210	80	179	280	2	11	2,297
			%	23.8	36.1	7.0	9.1	3.5	7.8	12.2	0.1	0.5	100.0
	2nd	3,435	'000 Riel	289	831	301	283	141	80	65	1	32	2,025
			%	14.3	41.0	14.9	14.0	7.0	4.0	3.2	0.1	1.6	100.0
	3rd	1,592	'000 Riel	180	581	139	121	50	82	49	0	12	1,215
			%	14.8	47.8	11.4	10.0	4.1	6.8	4.0	0.0	1.0	100.0
C.A- 4	1st	8,974	'000 Riel	594	1,284	253	201	101	84	352	3	311	3,181
			%	18.7	40.4	7.9	6.3	3.2	2.6	11.1	0.1	9.8	100.0
	2nd	3,524	'000 Riel	548	963	357	328	116	116	63	3	73	2,567
			%	21.3	37.5	13.9	12.8	4.5	4.5	2.5	0.1	2.9	100.0
	3rd	1,696	'000 Riel	392	665	131	94	53	47	69	2	87	1,539
			%	25.5	43.2	8.5	6.1	3.4	3.1	4.5	0.1	5.7	100.0

Chapter B-5 Investment, Saving and Loan

B-5.1 Investment

Investments during last 2 years (2003-2004) were inquired.

B-5.1.1 Investment for Livestock

In terms of household numbers invested for livestock, the most popular livestock in general is cattle (146HH), followed by chicken (141HH), pig (89HH) and ducks (20HH). Water buffalo, horse and goat are not popular among respondents.

B-5.1.2 Investment for House, Land and Private Business

(1) House (building/maintenance)

Housing investment during 2003-2004 is done as follows.

Investment in House during Last 2 Years ('000 Riel)

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	12	8	7	3	30
Average	624	3,419	1,183	9,080	2,345
Median	450	450	190	12,000	350
Minimum	40	100	60	40	40
Maximum	2,200	12,000	7,000	15,200	15,200

Category Area-1 has highest number of investment though in terms of capital spent, it is smallest.

(2) Land

Land investment during 2003-2004 is done as follows.

Investment in Land during Last 2 Years ('000 Riel)

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	5	1	3	1	10
Average	3,310	360	653	900	1,977
Median	450	360	700	900	575
Minimum	400	360	180	900	180
Maximum	14,500	360	1,080	900	14,500

Limited number of land investment took place. Category Area-1 is most frequent with land investment, though its purpose was not inquired in survey. Whether these investments have relations with agricultural land or residential land or other is unknown.

(3) Private Business

Private business investment during 2003-2004 is done as follows.

Investment in Private Business during Last 2 Years ('000 Riel)

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	7	7	5	6	25
Average	185	550	1,630	292	602
Median	150	200	120	225	200
Minimum	15	150	60	100	15
Maximum	400	2,000	4,000	800	4,000

Despite the outstanding volume of the income Category Area-4 earns from private business, its investment is quite mediocre. B-5.2Savings and Loans

B-5.2 Saving and Loans

B-5.2.1 Saving

To the inquiry for saving, the following responses were returned.

Saving in any Forms

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Money in bank			1	3.7	1	4.0	2	8.3	4	4.0
Land	7	28.0	5	18.5	1	4.0	3	12.5	16	15.8
Livestock	16	64.0	19	70.4	22	88.0	19	79.2	76	75.2
Cash	1	4.0	2	7.4	1	4.0			4	4.0
Others	1	4.0							1	1.0
Total	25	100.0	27	100.0	25	100.0	24	100.0	101	100.0

Among 200 samples, 101 households responded as they do saving. Of them, most popular and predominant form is saving as livestock (all Category Area average 75%).

B-5.2.2 Loan

To the inquiry of loans and debts, total 119 households (60%) among 200 samples responded as they have loan or debt. The detail is shown as follows.

Loans and Debts

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Money lender	1	3.6			1	5.9			2	2.5
Friend/Relatives	8	28.6	4	28.6	5	29.4	6	27.3	23	28.4
Trader	2	7.1	2	14.3	2	11.8	3	13.6	9	11.1
NGO	13	46.4	6	42.9	8	47.1	11	50.0	38	46.9
Commercial bank	2	7.1	1	7.1	1	5.9	1	4.5	5	6.2
Others	2	7.1	1	7.1			1	4.5	4	4.9
Total	28	100.0	14	100.0	17	100.0	22	100.0	81	100.0

The most significant source of loan is NGO (47% for all Category Area average), followed by friends/relatives (28%). Traders and money lenders often looked as binding farmers in debts are seemingly rare in the Target Area.

The amounts of loan/debts the respondents from all Category Areas owe are ranging from 14,000 Riels up to 3,000,000 Riels, with average 525,000 Riels and median 300,000 Riels.

The levels of interest rates vary from lowest 3% up to highest 120%. The interest rates charged by NGO strangely varying wide from 20 to 120%, though mostly around 36 to 42%, while trader/money lender between 28 to 120%, commercial bank between 16 to 48%, and friend/relative mostly 0%.

Collateral is not required for roughly 2/3 (64%) of these loan/debt cases. When it is required, land is most popular form.

The purpose of loan/debt is as follows.

Purpose of Loans/Debts

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Seeds/fertilizers/agro-chemicals	9	32.1	3	21.4	5	29.4	5	22.7	22	27.2
Farm equipment/tools	5	17.9			3	17.6	1	4.5	9	11.1
Animals	3	10.7	1	7.1	1	5.9	2	9.1	7	8.6
Food	2	7.1	1	7.1	2	11.8	7	31.8	12	14.8
Assets			1	7.1					1	1.2
Land	1	3.6	1	7.1	1	5.9			3	3.7
Debt repayment	1	3.6	1	7.1			1	4.5	3	3.7
Ceremonial occasions	1	3.6					1	4.5	2	2.5
Business	2	7.1			2	11.8	1	4.5	5	6.2
Reclamation/Rehabilitation of farm land	1	3.6			1	5.9	1	4.5	3	3.7
Building/repair of house			3	21.4	1	5.9			4	4.9
Others	3	10.7	3	21.4	1	5.9	3	13.6	10	12.3
Total	28	100.0	14	100.0	17	100.0	22	100.0	81	100.0

Most popular purpose for loans/debts is for agricultural inputs, followed by food consumptions.

Chapter B-6 Agriculture, Land Use and Water Resources

B-6.1 Land Holding Status

As shown in Table below, 100% of the sampled households are the land owner cultivating on their field. Among them, 3 households also cultivate as sharecroppers and as a tenant.

Land Holding Statuses

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Owner cultivator	48	96.0	50	100.0	50	100.0	50	100.0	198	99.0
Owner cum sharecropper	1	2.0	1	2.0					2	1.0
Owner cum tenant	1	2.0							1	0.5

Totals exceed 100% due to multiple responses

B-6.2 Agricultural Land Use

Agricultural land use information is compiled as the Table below.

Agricultural Land Use

Item	Land Use (ha)							
	Paddy Field							
	Irrigated Field	Supplementary Irrigated Field	Irrigated Field Total	Rainfed Field	Total Paddy Field	Upland Field for Field Crop	Upland Field for Tree Crop	Total Farm Land
C.A- 1								
Total	19.3	17.4	36.7	10.1	46.8	5.5	2.8	55.0
No. of Respondent	40	25	49	26	49	19	12	49
Per Respondent	0.48	0.70	0.75	0.39	0.96	0.29	0.23	1.12
Per Sample (50 samples)	0.39	0.35	0.73	0.20	0.94	0.11	0.06	1.10
C.A- 2								
Total	15.62	17.29	32.91	5.43	38.34	3.73	2.70	44.77
No. of Respondent	27	33	47	20	47	13	8	47
Per Respondent	0.58	0.52	0.70	0.27	0.82	0.29	0.34	0.95
Per Sample (50 samples)	0.31	0.35	0.66	0.11	0.77	0.07	0.05	0.90
C.A- 3								
Total	0.44	24.03	24.47	35.17	59.64	11.59	1.34	72.57
No. of Respondent	3	44	47	37	47	24	9	47
Per Respondent	0.15	0.55	0.52	0.95	1.27	0.48	0.15	1.54
Per Sample (50 samples)	0.01	0.48	0.49	0.70	1.19	0.23	0.03	1.45
C.A- 4								
Total	0	0	0	48.13	48.13	7.84	2.12	58.09
No. of Respondent	0	0	0	41	41	18	9	41
Per Respondent				1.17	1.17	0.44	0.24	1.42
Per Sample (50 samples)	0	0	0	0.96	0.96	0.16	0.04	1.16
All C.A-s								
Total	35	59	94	99	193	29	9	230
No. of Respondent	70	102	143	124	184	74	38	184
Per Respondent	0.51	0.58	0.66	0.80	1.05	0.39	0.23	1.25
Per Sample (200 samples)	0.18	0.29	0.47	0.49	0.96	0.14	0.04	1.15

1/: Results of the Socio-economic Survey conducted by the JICA Study Team, 2005
Note: Sample No. per category 50; total 200 samples

As it can be seem from Table in previous page, average land size for paddy cultivation is approx. 1 ha for all Category Areas. While zonal differences exist, they are minor in terms of area but its classification largely differ whether their lands are irrigated or rainfed, e.g. there are no irrigated lands in Category Area-4.

B-6.3 Cropped Area, Intensity and Production of Paddy

Cropped area, intensity and production for paddy cultivation are compiled in attached Table B-2.

For the detailed analyses of agricultural sector based on Socio-Economic Survey results, see another volume (Appendix D Agriculture).

B-6.3.1 Cropped Area of Paddy

Cropped area of paddy differs among Category Areas due to water resources availability.

Paddy Cropped Areas

	Total Paddy Cropped Area (ha)	Paddy Cropped Area per Respondents
C.A.-1	64.8	1.32
C.A.-2	39.7	0.84
C.A.-3	57.2	1.22
C.A.-4	36.8	0.9
All C.As	198	1.08

For the detail, see attached Table B-2.

B-6.3.2 Cropping Intensity of Paddy

Cropping intensity of paddy is shown below.

Cropping Intensity of Paddy (%)

	C.A.-1	C.A.-2	C.A.-3	C.A.-4	All C.As
Cropping Intensity (%)	138	103	96	77	103

For Category Areas-1 and 2 due to existence of irrigation system and Category Area-3 with existence of small ponds, cropping intensities are maintained to certain levels in these Category Areas.

Category Area-4 with the lowest cropping intensity combined with limited cropped area of paddy, the production volume will become much smaller compared to other Category Areas.

For the detail, see attached Table B-2.

B-6.3.3 Production of Paddy

Total production volume of p__addy produced by the sample households is 353 tons. For which 133 tons (38%) cont￥ributed by Category Area-1, 96 tons (27%) by Category Area-2, 86 tons (24%) and 37 tons (11%) by Category Area-4.

Paddy Production and Yields

	Paddy Production (kg)	Irrigated Paddy Yield (kg/ha)	Rainfed Paddy Yield (kg/ha)
C.A.-1	133,050	2,061	2,011
C.A.-2	96,285	2,589	1,413
C.A.-3	86,415	1,980	1,123
C.A.-4	37,412	-	1,016
All C.As	353,162 (total)	2,199	1,192

For the detail, see attached Table B-2.

B-6.3.4 Self-Sufficiency of Rice

Of the total rice production achieved, 34% are marketed. However, it does not necessarily mean that the rice is self-sufficient among the sampled households. Some indicators with regard to the level of rice self-sufficiency is shown below.

Rice Self-Sufficiency

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Own harvest/ product exceed the household demand	25	50.0	20	40.0	18	36.0	11	22.0	74	37.0
Own harvest/ product is just enough to the household demand	17	34.0	23	46.0	11	22.0	4	8.0	55	27.5
Purchased (or exchanged) to meet the household demand	7	14.0	6	12.0	20	40.0	32	64.0	65	32.5
Insufficient	1	2.0	1	2.0	1	2.0	3	6.0	6	3.0
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

As shown in above Table, total 71 respondents among 200 samples (35.5%) answered as they are purchasing rice or in shortage of rice. Especially of the samples in Category Areas-3 (42%) and 4 (72%) it is significant.

Other foods, e.g. vegetable, other cereals, meat, fish, etc. are more so, e.g. 72 % of all sampled households are purchasing vegetable, and for other food items the proportion of samples purchasing will increase up to 100%.

For the details of Agriculture sector analysis based on Socio-Economic survey results, see another volume of Appendix D Agriculture.

B-6.4 Irrigation, Water Management and Farmers Water Users Committee and Group (FWUC and FWUG)

B-6.4.1 Source and Time of Water to the Paddy Field

(1) Sources of Water for Paddy Fields

The sources of the water for the paddy field whether the respondents utilize the; 1) rainwater only, 2) mainly rainwater but sometimes from canal, or 3) mainly from canal but sometimes rainwater, are inquired.

Water Sources for Paddy Field

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Only rainfall	1	2.0					50	100.0	51	25.5
Mainly rainfall but sometime canal	14	28.0	21	42.0	35	70.0			70	35.0
Mainly from canal but rainfall	35	70.0	29	58.0	15	30.0			79	39.5
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

As shown in above Table, the water availability from canal is highest in Category Area-1 and decreases toward Category Area-3, and Category Area-4 is solely depending on rainfall.

(2) Amount of Time Taking Water from Canal

The amount of time (number of days) the respondents are taking water from canal is inquired, and the result is shown below.

Number of Days the Sampled Households Taking Water from Canal

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
1 day	2	4.0	3	6.0	6	12.2			11	7.4
2 days	1	2.0	5	10.0	10	20.4			16	10.7
3days	2	4.0	2	4.0	10	20.4			14	9.4
4days	6	12.0			3	6.1			9	6.0
5 days	4	8.0	12	24.0	6	12.2			22	14.8
6 days	5	10.0	3	6.0	3	6.1			11	7.4
7 days	2	4.0	1	2.0	2	4.1			5	3.4
8 days	1	2.0	4	8.0	1	2.0			6	4.0
9 days	3	6.0			1	2.0			4	2.7
10 days	7	14.0	9	18.0	3	6.1			19	12.8
11 ~ 15 days	1	2.0	5	10.0	3	6.1			9	6.0
16 ~ 20 days	10	20.0	5	10.0	1	2.0			16	10.7
21 ~ 25 days	2	4.0							2	1.3
1 ~ 1.5 months	2	4.0							2	1.3
1.5 ~ 2 months			1	2.0					1	0.7
2 ~ 3 months	1	2.0							1	0.7
> 3 months	1	2.0							1	0.7
Total	50	100.0	50	100.0	49	100.0			149	100.0

The days the respondents answered as they are taking water from canal are the days that they take water from canal "intermittently," not continuously a whole day nor accumulated length of time calculated in terms of days.

It is evident that respondents in Category Area-1 situated in upstream areas are allowed to take much more water (therefore, time) than to the respondents in Category Area-2 situated in downstream.

Note that Category Area-3 is not connected to the existing irrigation system originated from Prek Thnot River but to the irrigation system with small pond situated in micro watershed with seasonal streams.

B-6.4.2 Modes of Watering Paddy Fields

The ways how respondents deliver the water to their paddy fields were inquired and the results are as follows.

The Ways of Watering Paddy Fields

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
From neighboring field	7	14.3	11	22.0	13	26.0			31	20.8
By natural gravity from canal	15	30.6	16	32.0	2	4.0			33	22.1
By pump from canal	27	55.1	23	46.0	35	70.0			85	57.0
Total	49	100.0	50	100.0	50	100.0			149	100.0

The above Table indicates that significant numbers of respondents are relying on "pumping" for watering their fields. Popular pumps among respondents are portable ones with diameter around 80mm, and during cropping season such pumps are operated for approx. 30 hours in average.

The ownership of pumps is also inquired. As the result, in Category Area-1 approx. 50% of pump users owned their own pumps while others rented, in Category Area-2 it was approx. 40% owned and others rented, and in Category Area-3 approx. 20% owned and others rented.

B-6.4.3 Farmers Water Users Community (FWUC) and Group (FWUG)

In this section the information gathered on FWUC and FWUG in the Socio-Economic survey will be discussed. However, it should be noted here in advance that there might occurred some confusion over the concept of FWUC and FWUG, both on the part of enumerators as well as respondents. Even so, it is considered worthwhile to record the result.

(1) FWUC

The memberships of existing FWUC among sampled households are as follows.

Membership of Existing FWUC among Sampled Households

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Yes	6	12.0			4	8.0	2	4.0	12	6.0
No	39	78.0	49	98.0	36	72.0	43	86.0	167	83.5
Not know	5	10.0	1	2.0	10	20.0	5	10.0	21	10.5
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

Only 12 samples or 6% of all respondents belong to existing FWUC as members. Of them, 2 respondents answered as they belong to FWUC in Category Area-4 should be discounted since the existence of FWUC in Category Area-4 is in doubt.

By looking at the answers to following inquiries, it was found that those who not belonging as members are also involved in FWUC activities.

To the inquiry on whether the respondents attended the FWUC's general member meeting last year, the answers turned out as follows.

Attendance to Previous Year's FWUC General Member Meeting

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Yes	14	28.0	1	2.0	5	10.0			20	10.0
No	30	60.0	44	88.0	45	90.0	48	96.0	167	83.5
No held	6	12.0	5	10.0			2	4.0	13	6.5
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

Non-members are also attending to the general member meeting, as indicated in above Table.

The FWUC activities the sampled households attended in previous year are as follows.

FWUC Activities the Respondents Attended in Previous Year

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Distribute water	11	22.0	2	4.0	6	12.0			19	9.5
Make/desilting canal	17	34.0	14	28.0	14	28.0	13	26.0	58	29.0
Make dam	2	4.0							2	1.0
Meeting with FWUC for	1	2.0							1	0.5
NA	25	50.0	35	70.0	33	66.0	37	74.0	130	65.0
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

The numbers of respondents who attended the FWUC activities far exceed the number of members, especially to the "make/desilting canal" activity. Again, 13 number of Category Area-4 respondents attended make/desilting canal activity should be put aside since FWUC existence in Category Area-4 is unrealistic and there is a possibility with which they are talking about some other village level organizations.

To the inquiry with regard to irrigation fee payment, the answers turned out as follows.

Irrigation Fee Payment in Previous Year

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Yes	19	38.0	1	2.0	2	4.0			22	11.0
No	26	52.0	47	94.0	40	80.0	50	100.0	163	81.5
No fee charges	5	10.0	2	4.0	8	16.0			15	7.5
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

As in the case of activity attendance, in Category Area-1 those who paid irrigation fees exceeded the number of FWUC membership.

The amount of irrigation fees above respondents paid are as follows.

Amount of Irrigation Fees Paid

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	19	1	2		22
Average	19,921	8,000	15,150		18,945
Minimum	3,000	8,000	300		300
Maximum	100,000	8,000	30,000		100,000

The amount of irrigation fees paid by respondents vary widely even within Category Area-1 which extends from 3,000 to 100,000. Since information on how irrigation fees are decided for each water user households are lacking in this survey, further investigation on this aspect will be required.

(2) FWUG

The memberships of existing FWUG among sampled households are as follows.

Membership of Existing FWUG among Sampled Households

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Yes	14	28.0	5	10.0	3	6.0	2	4.0	24	12.0
Not know	36	72.0	45	90.0	47	94.0	48	96.0	176	88.0
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

FWUG membership turned out as there are more respondents belonging to FWUG than FWUC. All these respondents answered as they are belonging to FWUG attended previous year's FWUG general meeting.

The FWUG activities the respondents attended previous year are inquired and result turned out as follows.

FWUG Activities the Respondents Attended in Previous Year

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Maintain canal/dam	3	6.0	3	6.0	1	2.0			7	3.5
Make dam	12	24.0	4	8.0	2	4.0	1	2.0	19	9.5

The activities (maintain canal/dam, and make dam) attended by FWUG members are less both in kind and number, in comparison to the case of FWUC.

To the inquiry with regard to irrigation fee payment, the answers turned out as follows.

Irrigation Fee Payment in Previous Year

	C.A- 1		C.A- 2		C.A- 3		C.A- 4		All C.A.s	
	n	%	n	%	n	%	n	%	n	%
Yes	14	28.0	1	2.0	1	2.0			16	8.0
No	30	60.0	48	96.0	41	82.0	46	92.0	165	82.5
No fee charges	6	12.0	1	2.0	8	16.0	4	8.0	19	9.5
Total	50	100.0	50	100.0	50	100.0	50	100.0	200	100.0

In Category Area-1, all who answered as they belong to FWUG paid the water fee, while in other Category Areas not.

The amount of irrigation fees above respondents paid are as follows.

Amount of Irrigation Fees Paid

	C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.A.s
N	14	1	1		16
Average	17,393	8,000	300		15,738
Minimum	2,500	8,000	300		300
Maximum	100,000	8,000	300		100,000

As in the case of FWUC, the amounts of irrigation fees paid by respondents vary widely.

Tables

Table B-1 Income Sources, Number of HH, Income Level

			C.A- 1	C.A- 2	C.A- 3	C.A- 4	All C.As
1	Selling paddy/rice	N	40	30	24	13	107
		%	80%	60%	48%	26%	54%
		Ave. Income/HH ('000 Riel)	500	501	824	517	575
		Med. Income/HH ('000 Riel)	400	490	505	420	480
2	Selling vegetables	N	19	8	29	9	65
		%	38%	16%	58%	18%	33%
		Ave. Income/HH ('000 Riel)	699	163	515	480	520
		Med. Income/HH ('000 Riel)	500	80	300	180	300
3	Selling fruits	N	16	15	15	7	53
		%	32%	30%	30%	14%	27%
		Ave. Income/HH ('000 Riel)	366	141	236	111	232
		Med. Income/HH ('000 Riel)	80	100	200	100	100
4	Selling palm sugar	N	2	4	6	10	22
		%	4%	8%	12%	20%	11%
		Ave. Income/HH ('000 Riel)	1,635	633	550	1,810	1,236
		Med. Income/HH ('000 Riel)	1,635	565	550	920	665
5	Selling livestock/ poultry products	N	31	31	37	35	134
		%	62%	62%	74%	70%	67%
		Ave. Income/HH ('000 Riel)	1,083	977	1,275	1,490	1,218
		Med. Income/HH ('000 Riel)	600	500	1,200	800	800
6	Selling fishes	N	2	1	1	3	7
		%	4%	2%	2%	6%	4%
		Ave. Income/HH ('000 Riel)	2,100	400	3,600	2,280	2,149
		Med. Income/HH ('000 Riel)	2,100	400	3,600	2,400	2,400
7	Salary from permanent job	N	12	16	21	29	78
		%	24%	32%	42%	58%	39%
		Ave. Income/HH ('000 Riel)	2,154	1,909	1,758	2,366	2,076
		Med. Income/HH ('000 Riel)	2,226	1,700	1,400	2,160	1,800
8	Wage from temporary job on farm	N	16	14	10	22	62
		%	32%	28%	20%	44%	31%
		Ave. Income/HH ('000 Riel)	179	350	874	276	364
		Med. Income/HH ('000 Riel)	95	130	165	65	100
9	Wage from temporary job out of farm	N	11	17	10	14	52
		%	22%	34%	20%	28%	26%
		Ave. Income/HH ('000 Riel)	572	1,375	1,123	1,137	1,093
		Med. Income/HH ('000 Riel)	200	500	870	690	615
10	Private business	N	9	12	9	10	40
		%	18%	24%	18%	20%	20%
		Ave. Income/HH ('000 Riel)	1,424	1,820	2,077	3,529	2,216
		Med. Income/HH ('000 Riel)	1,000	1,040	1,000	1,440	1,060
11	Remittance from family members	N	13	12	10	6	41
		%	26%	24%	20%	12%	21%
		Ave. Income/HH ('000 Riel)	1,510	720	1,049	1,280	1,133
		Med. Income/HH ('000 Riel)	576	460	1,440	925	600
12	Selling firewood/charcoal	N	3	0	1	6	10
		%	6%	0%	2%	12%	5%
		Ave. Income/HH ('000 Riel)	2,233	0	50	738	1,118
		Med. Income/HH ('000 Riel)	3,000	0	50	820	820
13	Selling handicraft/ cottage industry products	N	0	1	3	2	6
		%	0%	2%	6%	4%	3%
		Ave. Income/HH ('000 Riel)	0	120	147	852	377
		Med. Income/HH ('000 Riel)	0	120	60	852	240
14	Selling forest vegetable/ crop	N	0	0	3	3	6
		%	0%	0%	6%	6%	3%
		Ave. Income/HH ('000 Riel)	0	0	587	1,007	797
		Med. Income/HH ('000 Riel)	0	0	500	400	450
15	Others	N	3	3	4	3	13
		%	6%	6%	8%	6%	7%
		Ave. Income/HH ('000 Riel)	1,120	413	1,050	840	871
		Med. Income/HH ('000 Riel)	1,200	500	1,050	800	720
16	TOTAL INCOME / HH	N	50	50	50	50	200
		%	100%	100%	100%	100%	100%
		Ave. Income/HH ('000 Riel)	3,154	2,847	3,697	4,683	3,595
		Med. Income/HH ('000 Riel)	2,455	2,540	3,635	3,495	2,902

Table B-2 Land Use and Cropped Area, Cropping Intensity, Production, Unit Yield & Marketing Volume of Paddy by Category of Land

Item	Land Use (ha)								Cropped Area of Paddy (ha)					Cropping Intensity of Paddy (%)					Paddy Production (kg)				Paddy Yield (kg/ha)				Marketed Volume of Paddy (kg & %)				
	Paddy Field								Irrigated Paddy					Irrigated Field					Irrigated Paddy				Irrigated Paddy				Irrigated Paddy				
	Irrigated Field	Supplementary Irrigated Field	Irrigated Field Total	Rainfed Field	Total Paddy Field	Upland Field for Field Crop	Upland Field for Tree Crop	Total Farm Land	Wet Season	Dry season I	Total	Rainfed Paddy	Total	Wet Season	Dry Season	Annual	Rainfed Field	Overall	Wet Season	Dry Season	Rainfed Paddy	Total Production	Wet Season	Dry Season	Average	Rainfed Paddy	Wet Season	Dry Season	Rainfed Paddy	Total	Proportion to Total Production
C.A-	C.A- 1: Fully Irrigated Rice Field																														
Total	19.3	17.4	36.7	10.1	46.8	5.5	2.8	55.0	35.0	20.7	55.7	9.1	64.8	95	56	152	90	138	68,690	46,100	18,260	133,050	1,964	2,225	2,061	2,011	23,090	23,950	2,750	49,790	37
No. of Respondent	40	25	49	26	49	19	12	49	49	40	49	26	49	49	49	49	26	49	49	39	25	49	49	40	49	26	33	31	8	49	49
Per Respondent	0.48	0.70	0.75	0.39	0.96	0.29	0.23	1.12	0.71	0.52	1.14	0.35	1.32						1,402	1,182	730	2,715					700	773	344	1,016	37
Per Sample (50 samples)	0.39	0.35	0.73	0.20	0.94	0.11	0.06	1.10	0.70	0.41	1.11	0.18	1.30	95	44	152	90	138	1,374	922	365	2,661					462	479	55	996	37
C.A-	C.A- 2: Supplementary Irrigated Rice Field (large irrigation system)																														
Total	15.62	17.29	32.91	5.43	38.34	3.73	2.70	44.77	33.19	1.03	34.22	5.43	39.65	101	3	104	100	103	83,330	5,280	7,675	96,285	2,511	5,126	2,589	1,413	18,876	2,500	1,900	23,276	24
No. of Respondent	27	33	47	20	47	13	8	47	47	4	47	20	47	47	47	47	20	47	47	5	17	47	47	4	47	20	24	1	4	47	47
Per Respondent	0.58	0.52	0.70	0.27	0.82	0.29	0.34	0.95	0.71	0.26	0.73	0.27	0.84						1,773	1,056	451	2,049					787	2,500	475	495	24
Per Sample (50 samples)	0.31	0.35	0.66	0.11	0.77	0.07	0.05	0.90	0.66	0.02	0.68	0.11	0.79	101	3	104	100	103	1,667	106	154	1,926					378	50	38	466	24
C.A-	C.A- 3: Supplementary Irrigated Rice Field (small irrigation system)																														
Total	0.44	24.03	24.47	35.17	59.64	11.59	1.34	72.57	24.47	1.40	25.87	31.32	57.19	100	6	106	89	96	47,090	4,140	35,185	86,415	1,924	2,957	1,980	1,123	14,570	1,970	15,350	31,890	37
No. of Respondent	3	44	47	37	47	24	9	47	45	2	47	37	47	45	45	45	37	47	43	3	26	47	45	2	45	37	16	2	10	47	43
Per Respondent	0.15	0.55	0.52	0.95	1.27	0.48	0.15	1.54	0.54	0.70	0.55	0.85	1.22						1,095	1,380	1,353	1,839					911	985	1,535	679	37
Per Sample (50 samples)	0.01	0.48	0.49	0.70	1.19	0.23	0.03	1.45	0.49	0.03	0.52	0.63	1.14	100	2	106	89	96	942	83	704	1,728					291	39	307	638	37
C.A-	C.A- 4: Rainfed Rice Field																														
Total	-	-	-	48.13	48.13	7.84	2.12	58.09	-	-	-	36.83	36.83	-	-	-	77	77	-	-	37,412	37,412	-	-	-	1,016	-	-	13,200	13,200	35
No. of Respondent	-	-	-	41	41	18	9	41	-	-	-	41	41	-	-	-	41	41	-	-	41	41	-	-	-	41	-	-	13	41	41
Per Respondent	-	-	-	1.17	1.17	0.44	0.24	1.42	-	-	-	0.90	0.90	-	-	-			-	-	912	912	-	-	-		-	-	1,015	322	35
Per Sample (50 samples)	-	-	-	0.96	0.96	0.16	0.04	1.16	-	-	-	0.74	0.74	-	-	-	77	77	-	-	748	748	-	-	-		-	-	264	264	35
C.A-	Overall																														
Total	35	59	94	99	193	29	9	230	94	23	116	83	198	100	25	123	84	103	199,110	55,520	98,532	353,162	2,126	2,398	2,199	1,192	58,686	28,920	33,200	120,806	34
No. of Respondent	70	102	143	124	184	74	38	184	141	46	143	124	184	141	141	141	124	184	139	47	109	184	141	46	141	124	73	34	35	184	-
Per Respondent	0.51	0.58	0.66	0.80	1.05	0.39	0.23	1.25	0.66	0.50	0.81	0.67	1.08						1,432	1,181	904	1,919					804	851	949	657	34
Per Sample (200 samples)	0.18	0.29	0.47	0.49	0.96	0.14	0.04	1.15	0.47	0.12	0.58	0.41	0.99	100	12	123	84	103	996	278	493	1,766					293	145	166	604	34

1/: Results of the Socio-economic Survey conducted by the JICA Study Team, 2005
Note: Sample No. per category 50; total 200 samples

Attachment

Survey Questionnaire

Questionnaire (for all interviewees)

Note: SELECTION CRITERIA FOR QUESTIONNAIRE SURVEY

Target farmers for the questionnaire survey are selected from 4 categories described as below.

Category	Basic Cropping Pattern	Sample No.
Category 1	Paddy double cropping Area	50 farmers
Category 2	Rainy season paddy + (small-scale) upland crops/vegetables	50 farmers
Category 3	Rainy season paddy + (small-scale) upland crops	50 farmers
Category 4	Rainy season paddy	50 farmers
		Total 200 farmers

Sample No. ____

Date (M/D/Y): / /

Enumerator: ____ Team Leader: ____

Province: Kandal / Kampong Spueu Q-1 District: ____ Q-2

Commune: ____ Q-3 Village: ____ Q-4

Type of village: 1 Paddy (*slock slae*) 2 Upland crop Q-5

Sample No.: All questionnaires shall be attached sequential numbers, i.e. 001, 002, ---, 200.

Date (M/D/Y): Data format shall be written as "08/22/05" (Month: August /Date: 22nd /Year: 2005). This item is not necessarily given in the data summary.

Enumerator: Name of enumerator shall be written in block letters. This item is not necessarily given in the data summary.

Team Leader: Enter name of team leader after proofreading. This item is not necessarily given in the data summary.

Province : "Kandal" or "Kampong Spueu " shall be chosen here.

PART 1 Socio-Economic Survey

SECTION I GENERAL INFORMATION

I-1 Name and Age of interviewee
Name ____ Q-6
Age ____ Q-7

I-1' Who is it? ____ Q-8
1 Male head of the household
2 Female head of the household
3 Oldest son of the household
4 Oldest daughter of the household
5 Other ( )

Note

I-1 Write interviewee's name (full name in block letters). This item is not necessarily given in the data summary.

I-1' Circle a code number and write her/ his age.

I-2 Total number of household members ____ Q-9

I-2' Number of working available aged persons in the household (Older than 10, younger than 64) ____ Q-10

I-3 Main activity of this household ____ Q-11

Note: Choose main activity of this household from codes below.

Main activity	Code	Remarks
Farmer	1	Own/rented land, and agricultural income is more than other one.
On-farm labor	2	Wage for labor work on farm is more than other income.
Non-farm labor	3	Wage for labor work except on farm is more than other income.
Salary worker	4	Salary is more than other work.
Private business	5	Income from private business is more than other work.
Others	6	Specify.

I-4 Household member in the same house

	Sex		Age		Education		Farming		Main occupation		Literacy	
1	M / F	Q-12		Q-13		Q-14	Y / N	Q-15		Q-16	Y / N	Q-17
2	M / F	Q-18		Q-19		Q-20	Y / N	Q-21		Q-22	Y / N	Q-23
3	M / F	Q-24		Q-25		Q-26	Y / N	Q-27		Q-28	Y / N	Q-29
4	M / F	Q-30		Q-31		Q-32	Y / N	Q-33		Q-34	Y / N	Q-35
5	M / F	Q-36		Q-37		Q-38	Y / N	Q-39		Q-40	Y / N	Q-41
6	M / F	Q-42		Q-43		Q-44	Y / N	Q-45		Q-46	Y / N	Q-47
7	M / F	Q-48		Q-49		Q-50	Y / N	Q-51		Q-52	Y / N	Q-53
8	M / F	Q-54		Q-55		Q-56	Y / N	Q-57		Q-58	Y / N	Q-59
9	M / F	Q-60		Q-61		Q-62	Y / N	Q-63		Q-64	Y / N	Q-65
10	M / F	Q-66		Q-67		Q-68	Y / N	Q-69		Q-70	Y / N	Q-71

Note:

Sex: Choose sex of this member. "M" means male and "F" means female.

Age: Enter age of the members at present.

Education: Education background shall be chosen from codes below.

for adult (>18 yr)	Code	for children (<18 yr)	Code
No formal education	1	Presently going to school	9
Drop-out at primary school	2	Not going to school	10
Graduate from primary school	3	Before school age	11
Drop-out at junior high school	4	Non-formal education for adults	12
Graduate from junior high school	5		
Drop-out at high school	6		
Graduate from high school	7		
More than high school	8		

Farming: Question whether if he/she engages in farming (including livestock raising and fishery).

Main occupation: Main occupation shall be chosen from codes below.

Main occupation	Code	Main occupation	Code
Farmer	1	Housekeeping (cooking, washing, child care, etc.)	6
On-farm labor	2	No job	7
Non-farm labor	3	Student	8
Salary worker	4	Child (below school age)	9
Private business	5	Others	10

* Definition of Main Occupation: "A person who has more than 1 job, the work that most of his/ her working time is spent is regarded as a main occupation. In case, he/ she engages in only 1 job, it is regarded as a main occupation" (NIS, 1995)

Literacy: If he/she is able to write, read, and calculate for making living, choose "Y".

I-5 Member of village organization (husband) in

1 [ ] Q-72 2 [ ] Q-73 3 [ ] Q-74 4 [ ] Q-75 5 [ ] Q-76

Note: Choose village organization codes below which head of the family belong to. If there are other organization, fill in the name.

Village organization	Code	Village organization	Code
Farmer's water users' community	1	Marketing group	7
Credit group by government	2	Youth group	8
Micro-credit group by NGO	3	Veteran group	9
Production group	4	Women's group	10
Religion group	5	Others ( )	11
Drinking water users' group	6		

I-6 Member of village organization (wife)

1 [ ] Q-77 2 [ ] Q-78 3 [ ] Q-79 4 [ ] Q-80 5 [ ] Q-81

Note: Choose village organizations codes below which housewife belong to. If there are other organizations.

Village organization	Code	Village organization	Code
Farmer's water users' community	1	Marketing group	7
Credit group by government	2	Youth group	8
Micro-credit group by NGO	3	Veteran group	9
Production group	4	Women's group	10
Religion group	5	Others ( )	11
Drinking water users' group	6		

SECTION II LIVING CONDITION

II-1 Drinking water

	Main source		Distance		Sufficiency	
Dry season		Q-82	m	Q-83		Q-84
Wet season		Q-85	m	Q-86		Q-87

Note: Choose fuel source primary and secondary (supplemental), and its availability.

Fuel source	Code	Fuel source	Code
Firewood	1	Gas cylinder (LPG)	4
Kerosene	2	Electricity	5
Charcoal	3	Others	6

Availability	Code	Availability	Code
Easy to obtain	1	Very difficult to obtain	3
Difficult to obtain	2		

II-2 Water for domestic use

	Main source		Distance		Sufficiency	
Dry season		Q-88	m	Q-89		Q-90
Wet season		Q-91	m	Q-92		Q-93

Note: Choose fuel source primary and secondary (supplemental), and its availability.

Fuel source	Code	Fuel source	Code
Firewood	1	Gas cylinder (LPG)	4
Kerosene	2	Electricity	5
Charcoal	3	Others	6

Availability	Code	Availability	Code
Easy to obtain	1	Very difficult to obtain	3
Difficult to obtain	2		

II-3 Fuel source for cooking

	Importance		Availability	
1 Most important		Q-94		Q-95
2 Secondary importance		Q-96		Q-97

Note: Choose fuel source primary and secondary (supplemental), and its availability.

Fuel source	Code	Fuel source	Code
Firewood	1	Gas cylinder (LPG)	4
Kerosene	2	Electricity	5
Charcoal	3	Others	6

Availability	Code	Availability	Code
Easy to obtain	1	Very difficult to obtain	3
Difficult to obtain	2		

II-4 Fuel source for lightening

		Importance		Availability	
1	Most important		Q-98		Q-99
2	Secondary importance		Q-100		Q-101

Note: Choose fuel source primary and secondary (supplemental), and its availability.

Fuel source	Code	Fuel source	Code
Firewood	1	Gas cylinder (LPG)	4
Kerosene	2	Electricity	5
Charcoal	3	Others	6

Availability	Code	Availability	Code
Easy to obtain	1	Very difficult to obtain	3
Difficult to obtain	2		

II-5 Facilities with your household (1 Yes / 2 No)

		No.				No.	
1	Radio		Q-102	10	Tractor		Q-111
2	TV		Q-103	11	Power generator		Q-112
3	Bicycle		Q-104	12	Electric Fan		Q-113
4	Motorcycle		Q-105	13	Refrigerator		Q-114
5	Car		Q-106	14	Mosquito net		Q-115
6	Audio (CD/ cassette player)		Q-107	15	Cellular Telephone		Q-116
7	VCR		Q-108	16	Telephone		Q-117
8	Row boat		Q-109	17	Weaving machine		Q-118
9	Boat with motor		Q-110	18	Others		Q-119

II-6 Residence

Q-120	Ownership		1 Owned (already paid) 2 Owned (under payment) 3 Lent 4 Borrowed
Q-121	Material		1 Cement and bricks 2 Palm leaves 3 Wood 4 Others ( )
Q-122	Type of Hose		1 Traditional 2 One-storied 3 Two-storied 4 Others ( )
Q-123	Number of rooms		
Q-124	Toilet		1 Yes 2 No
Q-125	Electrical Supply		1 Yes 2 No
Q-126	Piped Water Supply		1 Yes 2 No
Q-127	Gas Line Supply		1 Yes 2 No
Q-128	Land telephone line		1 Yes 2 No

II-7 Social Service

1. Health and medical service When you/ your family get/gets sick, Q-129 Where do you go? Q-130 How do you go there? Q-131 How long does it take to be there?		 1 Hospital 2 Clinic 3 Health center 4 Others ( ) By 1 Walk 2 Bike taxi 3 Owned motor bike 4 Bike 5 Others ( ) Day (s)/ Hour(s) / Minute(s)
2. Reproductive Health When you/ your wife delivers a baby, Q-132 where do you go? Q-133 how do you go there? Q-134 how long does it take to be there?		 1 Hospital 2 Clinic 3 Health center 4 TBA 5 Traditional Dr. 6 Midwife 7 Others( ) By 1 Walk 2 Bike taxi 3 Owned motor bike 4 Bike 5 Others ( ) Day (s)/ Hour(s) / Minute(s)
2. Social security service Q-135 Do you have any social security service/ insurance?		 1 Yes 2 No

II-8 Gender in Development

1. Marriage Q-136 How old usually do women get married in your village?, 2. Daily activities Q-137 What are FEMALE's main activities in your village? Q-138 What are MALE's main activities in your village?		 1 15-17 2 18-20 3 21-23 4 24-26 5 27-29 6 Older than 30 1 Housekeeping 2 Cooking 3 Farming 4 Handy crafting 5 Care of children/ elders 6 Care of livestock 7 Making Palm sugar 8 Others ( ) 1 Housekeeping 2 Cooking 3 Farming 4 Handy crafting 5 Care of children/ elders 6 Care of livestock 7 Making Palm sugar 8 Others ( )
3. Income source Q-139 What are FEMALE's main cash income sources in your village? Q-140 What are MALE's main cash income sources in your village? 4. Discrimination Q-141 Is there any social discrimination against women?		 1 Selling paddy 2 Working for other's field 3 Selling palm sugar 4 Selling handy craft 5 Working for a weaving factory 6 Working for bricks factory 7 Selling straw mat 8 Selling cotton/ silk 9 Others ( ) 1 Selling paddy 2 Working for other's field 3 Selling palm sugar 4 Selling handy craft 5 Working for a weaving factory 6 Working for bricks factory 7 Selling straw mat 8 Selling cotton/ silk 9 Others ( ) 1 Yes 2 No

Q-142 Women's Access/ Control on resources Write if it is accessible/ controlable.

	Water Source	Land	Farm land	Livestock
Access				
Control				

* Access: You have a right to work on.
Control: You have a right to buy or rent.

SECTION III INCOME AND EXPENDITURE

III-1 Cash income sources in last year(Last year: January 2004 – December 2004)

1	Selling paddy/rice	riel/Yr	Q-143	9	Wage from temporary job out of farm	riel/Yr	Q-151
2	Selling vegetables (red pepper/ tobacco/ water melon/ others)	riel/Yr	Q-144	10	Private business (transportation, trading, shop, etc.)	riel/Yr	Q-152
3	Selling fruits (mango/ papaya, banana/ hairly fruit/ orange/ others)	riel/Yr	Q-145	11	Remittance from family members	riel/Yr	Q-153
4	Selling palm sugar	riel/Yr	Q-146	12	Selling firewood/charcoal	riel/Yr	Q-154
5	Selling livestock/ poultry products	riel/Yr	Q-147	13	Selling handicraft/ cottage industry products	riel/Yr	Q-155
6	Selling fishes	riel/Yr	Q-148	14	Selling forest vegetable/ crop	riel/Yr	Q-156
7	Salary from permanent job	riel/Yr	Q-149	15	Others (Specify: Q-158)	riel/Yr	Q-157
8	Wage from temporary job on farm	riel/Yr	Q-150	16	Total	riel/Yr	Q-159

Note: Write cash income of this household in 2004 (total of one year). If the interviewee answer in US$, convert to riel (US$ = 4,000 riel).

III-2 Expenditure for consumption (Last year: January 2004 – December 2004)

1	Rice	riel/Yr	Q-160
2	Other foods	riel/Yr	Q-161
3	Health/ medicine	riel/Yr	Q-162
4	Education	riel/Yr	Q-163
5	Clothes	riel/Yr	Q-164
6	Firewood/Kerosene/Electricity	riel/Yr	Q-165
7	Transportation	riel/Yr	Q-166
8	Tax	riel/Yr	Q-167
9	Others	riel/Yr	Q-168
10	Total	riel/Yr	Q-169

Note Write expenditure for consumption of this household in 2004. Total of expenditure should be less than total of income.
If the interviewee answer in US$, convert to riel l (US$ = 4,000 riel).

III-3 Investment of productive and fixed assets in the last two year (January 2004 – December 2004)

		2004	
1	Livestock		
1-1	Chicken	Head(s)	Q-170
1-2	Ducks	Head(s)	Q-171
1-3	Cattle	Head(s)	Q-172
1-4	Water buffalo	Head(s)	Q-173
1-5	Pig	Head(s)	Q-174
1-6	Horse	Head(s)	Q-175
1-7	Goat	Head(s)	Q-176
1-8	Others ( )	Head(s)	Q-177
2	Housing (building/ maintenance)	Riel	Q-178
3	Private business	Riel	Q-179
4	Land	Riel	Q-180

SECTION IV SAVINGS AND LOAN

IV-1 Savings of any type at present

Note If family member(s) have savings, choose "Y" and choose type of the savings and purposes from the codes below. If the family member(s) do not have saving, choose "2" and fill in Q-190.

	Source	Amount	Interest rate	Purpose	Reason for no Saving Q-190
1 Yes 2 No Q-181	Q-182	Q-183	Q-184	Q-185	
	Q-186	Q-187	Q-188	Q-189	

Source of savings	Code
Money in bank	1
Land	2
Livestock	3
Cash	4
Others	5

Purpose for savings	Code
For safety	1
Saving for future expenditure	2
Saving for emergency needs	3

Reason of no savings	Code
No idle money	1
Credit is available at anytime	2
Others	3

IV-2 Loans and debts at present

Note If the family member(s) have loan(s) and debt(s), choose "Y" and choose the source of loan(s) and debt(s), write interest rate (per year, %), choose purpose for loan(s) and debt(s) and Collateral from code below and write amount of repayment per year. If the family member(s) do not have loan(s), choose "N" and choose reasons from codes below.

1 Yes 2 No Q-191

Source	Amount	Interest rate	Purpose	Collateral	Amount repaid
Q-192	Q-193	Q-194	Q-195	Q-196	Q-197
Q-198	Q-199	Q-200	Q-201	Q-202	Q-203

Source of loans/debts	Code
Money lender	1
Friend/Relatives	2
Trader	3
NGO	4
Commercial bank	5
Rice miller	6
Others	7

Purpose for loans/debts	Code	Purpose for loans/debts	Code
Seeds/fertilizers/agro-chemicals	1	Debt repayment	8
Farm equipment/tools	2	Ceremonial occasions	9
Animals	3	Business	10
Food	4	Reclamation/Rehabilitation of farm land	11
Assets	5	Building/repair of house	12
Land	6	Others	13
Children's education	7		

Collateral for loans/debts	Code	Collateral for loans/debts	Code
Nothing	1	Jewelry	4
Land	2	Others	5
Crop products	3		

PART 2 Agriculture , Land Use and Water Resources Survey

SECTION V LIVESTOCK AND FRUITS TREES

V-1 LIVESTOCK

Note: Write number of each livestock and choose codes for feed sufficiency from answer code.

		Number				Food sufficiency			
		Adult		Calf		Wet season		Dry season	
1	Cows/ Oxen		Q-204		Q-205		Q-206		Q-207
2	Water buffalo		Q-208		Q-209		Q-210		Q-211
3	Goat/ Sheep		Q-212		Q-213		Q-214		Q-215
4	Swine		Q-216		Q-217		Q-218		Q-219
5	Chicken		Q-220		Q-221				
6	Duck		Q-222		Q-223				

Answer code & answer for food sufficiency

1. Sufficient	3. Short
2. Just enough	4. Very short

V-2 FRUITS TREES

Note:Indicate estimated numbers of sugar palm and major three fruit trees possessed by the interviewee.

		No. of trees				No. of trees	
1	Sugar palm		Q-224	3	( )		Q-226
2	( )		Q-225	4	( )		Q-227

SECTION VI LAND HOLDING AND CROPPED AREA

VI-1 Land holding (only for farm land)

Note: Write area of farmland by item. “Land owned” + “Land rented from others” – “Land leased to others” = “Land operated”. If the household is categorized as complete landless labor farmer, all the items must be “0 ha”.Please differentiate irrigated paddy field by gravitation (irrigation canal) from supplementary irrigated field by pumping. If both gravity and pumping irrigation are employed, indicate detail in box of “Note”.

		Land owned		Land rented from others		Land leased to others		Land operated	
1	Irrigated paddy field	ha	Q-228	ha	Q-229	ha	Q-230	ha	Q-231
2	Irrigated paddy field (supplementary pump irrigated)	ha	Q-232	ha	Q-233	ha	Q-234	ha	Q-235
3	Rainfed paddy field	ha	Q-236	ha	Q-237	ha	Q-238	ha	Q-239
4	Upland for field crop	ha	Q-240	ha	Q-241	ha	Q-242	ha	Q-243
5	Upland for tree crop	ha	Q-244	ha	Q-245	ha	Q-246	ha	Q-247
6	Total	ha	Q-248	ha	Q-249	ha	Q-250	ha	Q-251

VI-2 Land holding status (fill in answer code)

Note: The categorization of the land holding status shall be chosen from the codes shown in Questionnaire. The evaluation of the land holding status shall be chosen from the codes below.

Q-252

1	Owner cultivator	2	Owner cum sharecropper	3	Sharecropper
4	Owner cum tenant	5	Tenant	6	Not operating any farm land

VI-3 Condition for land tenure

Note: Write land rental charge. If the household pays land rental charge in kind, choose the codes for responsibility to pay production cost. If the household use land without any kind of payment, choose "Free of charge". Choose the codes below for decision maker for crop selection in rental land.

Code for production cost/Decision maker for crop selection in rental land	Code
Land owner	1
Tenant	2
Both	3
Other	4

1. Land rental charge

			Rental charge		Production cost born by		Answer code
1	In cash	Irrigated paddy field	riel/ha/season	Q-253		Q-254	1. Land owner
		Rainfed paddy field	riel/ha/season	Q-255		Q-256	2. Tenant
		Upland field	riel/ha/season	Q-257		Q-258	3. Both
2	In kind	Irrigated paddy field	% of harvest	Q-259		Q-260	4. Other
		Rainfed paddy field	% of harvest	Q-261		Q-262	
		Upland field	% of harvest	Q-263		Q-264	
3	Free of charge			Q-265			
4	Others	Specify:		Q-266			

2. Decision maker for crop selection in rented land

1 Irrigated paddy field [ ] Q-267
2 Rainfed paddy field [ ] Q-268
3 Upland field [ ] Q-269

Note: Answer and answer code: for "production cost born by" & "decision maker"

1 Land owner	2 Tenant/share cropper	3 Both	4 Other

SECTION VII LAND USE

VII-1 Cropped Area

Note: Write land use by category for last cropping season. If this farmer uses reservoir and/or canal for cultivation, fill out its area.

	Wet season	Dry season I	Dry season II	Land on reservoir and/or canal
Paddy Field				
1 Irrigated paddy	ha Q-270	ha Q-271	ha Q-272	ha Q-273
2 Rainfed paddy	ha Q-274	ha Q-275	ha Q-276	ha Q-277
3 ( )	ha Q-278	ha Q-279	ha Q-280	ha Q-281
4 Others	ha Q-282	ha Q-283	ha Q-284	ha Q-285
Upland Field				
1 ( )	ha Q-286	ha Q-287	ha Q-288	ha Q-289
3 Others	ha Q-290	ha Q-291	ha Q-292	ha Q-293

VII-2 Cropping pattern (from sowing to harvest): nursery ---- ; planting ○ ; harvest X

Note: Illustrate cropping pattern according to the sample shown below. In a spread sheet indicate as follows:
Irrigated paddy field : Rice P - Beginning May H - End July; Rice P - Mid Aug. H - End Nov.
Rainfed paddy field : Rice P - End July H - Beginning Dec

Land Use Category	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Irrigated paddy field (Q-294)												
Rainfed paddy field (Q-295)												
Upland field (Q-296)												

VII-3 Reason for fallow

Note: If the household leave his farmland fallow for some period, please choose reasons by the answer code given.

1 Wet Season [ ] Q-297 2 Dry season [ ] Q-298

1	Labor shortage (busy for other works, owner became sick, etc.)	4	Flood/inundation
2	Working capital shortage	5	Others (specify)
3	Water shortage		

SECTION VIII FARMING PRACTICES

Note: Write responses of interviewee by specifying or by answer code. Please ask reasons for selection of rice varieties.

VIII-1 Rice

Variety	Wet season	Q-299 (specify)	Dry season	Q-300 (specify)

Reasons for selection of the variety (specify)		Q-301

Seed source		Q-302 (fill in answer code)

Answering code

1. Own products	2. Exchange with others	3. Procured at local market	4. Certified seed purchased	5. Other (specify)

Seed replacement		Q-303 (fill in answer code)

Answering code	1. once per 3 croppings	2. once 4 ~ 6 croppings	3. once > 6 croppings

Land preparation		Q-304 (fill in answer code)

Answering code	1. Draft animal	2. Machinery	3. Manual

Fertilization	Urea (kg/ha)		Q-305	DAP (kg/ha)		Q-306
	KCl (kg/ha)		Q-307	Others (specify;kg/ha)		Q-308

VIII-2 Other crops

Seed source/upland crops		Q-309 (Pls select from answer code below)

1. Own products	2. Exchange with others	3. Procured at local market	4. Certified seed purchased	5. Other (specify)

Seed source/vegetables		Q-310 (Pls select from answer code below)

1. Own products	2. Exchange with others	3. Procured at local market	4. Certified seed purchased	5. Other (specify)

SECTION IX PRODUCTION

IX-1 Crops

Note: "Production" – self-consumption = "Sold Production". The "Price" shall be average of the year. "Income" = "Product Sold" x "Unit Price".

	Commodity	Production		Sold product		Price		Income	
1	Irrigated paddy (wet season)	kg	Q-311	Kind: kg	Q-312	riel/kg	Q-313	riel	Q-314
2	Irrigated paddy (dry season)	kg	Q-315	Kind: kg	Q-316	riel/kg	Q-317	riel	Q-318
3	Rainfed paddy	kg	Q-319	Kind: kg	Q-320	riel/kg	Q-321	riel	Q-322
4	Fruits	kg	Q-323	kg	Q-324	riel/kg	Q-325	riel	Q-326

5	Sugar Palm	Kind: kg	Q-327	Kind: kg	Q-328	riel/kg	Q-329	riel	Q-330
6	Others (specify)	kg	Q-331	kg	Q-332	riel/kg	Q-333	riel	Q-334
7	Others (specify)	kg	Q-335	kg	Q-336	riel/kg	Q-337	riel	Q-338
8	Others (specify)	kg	Q-339	kg	Q-340	riel/kg	Q-341	riel	Q-342

IX-2 Livestock & Fish

Note: Write number of livestock/poultry sold in last year, unit prices and gross return.

	Livestock/Fish	Sold product in last year		Price (riel/unit)		Income	
1	Cow	(no.)	Q-343	riel	Q-344	riel	Q-345
2	Cattle	(no.)	Q-346	riel	Q-347	riel	Q-348
3	Water Buffalo	(no.)	Q-349	riel	Q-350	riel	Q-351
4	Swine/Pig	(no.)	Q-352	riel	Q-353	riel	Q-354
5	Poultry	(no.)	Q-355	riel	Q-356	riel	Q-357
6	Egg	kg	Q-358	riel/kg	Q-359	riel	Q-360
7	Fish	kg	Q-361	riel/kg	Q-362	riel	Q-363

IX-3 Food condition/ availability

Note: The food condition/ availability shall be chosen from the codes given in Questionnaire.

		Condition				Condition	
1	Rice		Q-364	5	Vegetables		Q-365
2	Other cereals		Q-366	6	Meat		Q-367
3	Roots and tuber crops		Q-368	7	Fish		Q-369
4	Beans		Q-370	Others(	)		Q-371
Volume of rice purchased in last one year (kg)							Q-372

Note: Answer & answer code

1. Own harvest/ product exceed the household demand	3. Purchased (or exchanged) to meet the household demand
2. Own harvest/ product is just enough to the household demand	4. Insufficient

SECTION X PRODUCTION COST

X-1 Production cost of crops

Note: Write production cost. The production cost consists of seed, fertilizer, agricultural chemicals, cost for land preparation, transplanting, harvesting, rental cost for agricultural machine, and others. Write in riel, If the interviewee answer in US$, convert to riel l (US$ = 4,000 riel).

		Wet season	Dry season I	Dry season II	Total
1	Irrigated paddy	Q-373	Q-374	Q-375	Q-376
2	Rainfed paddy	Q-377	Q-378	Q-379	Q-380
3	Vegetables in paddy field	Q-381	Q-382	Q-383	Q-384
4	Vegetables in upland	Q-385	Q-386	Q-387	Q-388
5	Annual crops	Q-389	Q-390	Q-391	Q-392
6	Total	Q-393	Q-394	Q-395	Q-396

SECTION XI POST-HARVEST, PROCESSING AND MARKETING

XI-1 Post-harvest operation of rice

Note: Write kind of machinery and its ownership (Own/ Borrow/ Cooperative) if interviewee uses it, and its charge for borrowing. The codes indicated in Questionnaire shall be chosen for each processing. Write unit for borrowing charges, e.g. riel/ time, riel/hour or riel/day. In case of rice milling cost, indicate who receive rice bran.

Operation	Method	Ownership	Charge in case of borrowing
Threshing	Q-397	Q-398	Q-399
Drying	Q-400	Q-401	Q-402
Cleaning	Q-403	Q-404	Q-405
Rice milling cost	In case rice bran received by miller		riel/ton Q-406
	In case rice bran received by interviewee		riel/ton Q-407

Method						Ownership	
Threshing	Code	Drying	Code	Cleaning	Code	Ownership	Code
Engine thresher	1	Dryer (machine)	1	Engine winnower	1	Own	1
Pedal thresher	2	Sun drying	2	Manual winnower	2	Borrowed	2
Manual threshing	3		3	Manual without winnower	3	Cooperative	3

XI-2 Storage and post-harvest losses of rice

Note: Write means of storage of rice. The kind of container shall be chosen from the codes given in Questionnaire. Use of fumigant answer by code for yes or no.

Product	Kind of container	Size of container	Maximum storage period
Paddy	Q-408	M3 Q-409	months Q-410
Rice	Q-411	M3 Q-412	months Q-413
Use of fumigant	1. Yes 2. No	Q-414	

Bag	Code 1	Bamboo basket	Code 2	Wooden box	Code 3	Others	Code 4	Q-415

Post-harvest losses of rice

Note: Choose the two (2) dominant losses on the processing from the codes given in Questionnaire and write roughly estimated total post-harvest losses in % of total products.

Most dominant loss [ ] Q-416 2nd dominant losses [ ] Q-417 Total losses [ ] % Q-418

During harvesting	Code 1	At threshing	Code 2	At drying	Code 3
At Cleaning	Code 4	At storage	Code 5	At other time (specify)	Code 6

XI-3 Marketing of rice

Note: Indicate marketing timing of rice and roughly estimated proportion (%) to the total volumes of rice sold in according to the question. Form of sold products (dry unhusked rice/paddy; milled rice etc) and marketing destination (to whom sell products) by the codes given in Questionnaire.

Timing	1. Just after harvest ( )% of total sold	2. When cash is needed ( )% of total sold	3. When price is high ( )% of total sold	Q-419

Sold product	1. Field dried paddy	2. Sun dried paddy	3. Milled rice		Q-420
Destination	1. Rice miller in village	2. Rice miller in commune center	3. Rice miller in district center		Q-421
	4. Collector/middleman	5. Local market	6. Others (specify)		Q-422

XI-4 Processing of rice (for selling being done by interviewee)

Note: If interviewee process white rice for sell, choose kind of the rice processing from the codes given.

1. Noodle	2. Confectionary	3. Powder	4. Liquor	5. Others		Q-423

XI-5 Marketing of other products

Note: Indicate marketing destination of other products by choosing the codes given in Questionnaire.

Crop	Fill in answer code		Answer code & answer
Vegetable		Q-424	1. Market in village
Field Crops		Q-425	2. Market in commune center
Vegetables		Q-426	3. Market in district center
Livestock		Q-427	4. Collector/middleman
Fish		Q-428	5. Other (specify)

SECTION XII AGRICULTURAL SUPPORT SERVICES

Note: Reponses shall be chosen from the codes given in Questionnaire.

XII-1 Extension services

Question	Answer code & answer				
Visit of extension worker	1. once per < 2 weeks	2. once per 2 weeks~1 month	3. Seldom visited		Q-429
Technical capability of extension workers	1. Sufficient	2. Not sufficient	3. No services provided		Q-430
Are you satisfied with current extension services	1. Satisfied	2. Not satisfied	3. No services provided		Q-431
What kind of extension services are needed ? (specify)					Q-432

XII-2 Rice seed supply

Question	Answer code & answer				
Procurement of wanted seeds	1. Easy	2. Difficult	3. Not possible		Q-433
Procurement of certified/quality seeds	1. Easy	2. Difficult	3. Not possible		Q-434
Seed supply timing	1. In time	2. Delayed	3. Not obtained		Q-435
Quality seed prices	1. Too expensive	2. Acceptable	3. Not purchased		Q-436

XII-3 Farm inputs supply

Question	Answer code & answer				
Procurement of wanted fertilizer	1. Easy	2. Difficult	3. Not possible		Q-437
Fertilizer supply timing	1. In time	2. Delayed	3. Not obtained		Q-438
Fertilizer prices	1. Too expensive	2. Acceptable	3. Not purchased		Q-439

XII-4 Farm credit

Question	Answer code & answer				
Access to farm credit	1. Easy	2. Difficult	3. Not possible		Q-440
Timing of provision	1. In time	2. Delayed	3. Not provided		Q-441
Amount of credit	1. Sufficient	2. Not sufficient	3. Not provided		Q-442
Procedures for credit application	1. Easy	2. Difficult	3. Not possible		Q-443

SECTION XIII FARMING CONSTRAINTS AND IMPROVEMENT

XIII-1 Farming constraints (agronomic & farm management)

Note: Ask about agronomic and farming constraints to the interviewee and indicate up to 4 constraints (maximum) in order of seriousness by consulting the answer codes given in Questionnaire.

What are serious agronomic & farm management constraints for farming ? (select plural answer)

1. Most serious [1st] 2. 2nd serious [2nd] 3rd serious [3rd] 4th serious [4th] Q-444

Note

Answer and answer code

1	Low yield of crops (paddy)	9	Difficulty for obtaining quality seeds
2	Crop losses due to pest & disease	10	Difficulty for purchasing fertilizers
3	Weed problem	11	Expensive farm inputs
4	Crop losses due to wild animal	12	Poor soil conditions
5	Difficulty for hiring draft animal/machinery	13	Marketing problems of products
6	Labor shortage	14	Lack of farm credit
7	Insufficient extension services	15	Others (specify)
8	Shortage of farming capital	16	Others (specify)

XIII-2 Farming constraints (physical)

Note: Ask about physical constraints for farming to the interviewee and indicate up to 3 constraints (maximum) in order of seriousness by consulting the answer codes given in Questionnaire.

What are serious physical constraints for farming ? (select plural answer)

1. Most serious constraints [1st] 2. 2nd serious constraints [2nd] 3rd serious constraints [3rd] Q-445

Note

Answer and answer code

1	Irrigation water shortage in wet season	6	Lack of transportation means
2	Irrigation water shortage in dry season	7	Leveling problem of paddy field
3	Inundation/flooding	8	Others (specify)
4	Drainage problem	9	Others (specify)
5	Lack of farm road	10	Others (specify)

XIII-3 Marketing constraints

Note: Ask about marketing constraints to the interviewee and indicate up to 3 constraints (maximum) in order of seriousness by consulting the answer codes given in Questionnaire.

1. Most serious constraints [1st] 2. 2nd serious constraints [2nd] 3rd serious constraints [3rd] Q-446

Answer and answer code

1	Unstable market prices of paddy/rice	7	Unstable market prices of livestock
2	Low market prices of paddy/rice	8	Low market prices of livestock
3	Limitation of market of paddy/rice	9	Limitation of market of livestock
4	Unstable market prices of other crops	10	Lack of or poor farm to market road
5	Low market prices of other crops	11	Others (specify)
6	Limitation of market of other crops	12	Others (specify)

XIII-4 Reasons for limited productivity of crops in the rice field of interviewee (not specific to last year)

Note: Ask reasons for limited (low) productivity of crops in the rice fields of the interviewee and indicate up to 3 constraints (maximum) in order of

seriousness by consulting the answer codes given in Questionnaire. Reasons should not be specific to last year but general problems faced by the interviewee.

1. Most serious constraints [1st] 2. 2nd serious constraints [2nd] 3rd serious constraints [3rd] Q-447

Answer and answer code

1	Drought in wet season	7	Damages caused by wild animal (rat)
2	Water shortage in dry season	8	Poor drainage
3	Shortage of farming capital	9	Flooding/inundation
4	Poor seed quality	10	Inadequate farming technologies
5	Poor soil	11	Damages caused by pest & disease
6	Limited application of fertilizer	12	Others (specify)

XIII-5 Activities/practices to improve rice productivity implemented by the interviewee in the past 3 years (plural answer)

Note: Ask activities or practices carried out to improve rice productivity by the interviewee in the past 3 years by consulting the answer codes given in Questionnaire. Indicate all activities/practices implemented.

1.	2.	3.	4.	Q-448

Answer and answer code

1	Increased fertilization doses	6	Started to use water pump for irrigation
2	Applied of compost/manure	7	Improved farming practices
3	Used quality seed (local variety)	8	Improved post-harvest practices
4	Used quality seed (high yielding variety)	9	Changed marketing methods
5	Constructed of farm pond	10	Others (specify)

XIII-6 Necessary activities to improve rice productivity in the field of the interviewee (farming & farm management; plural answer)

Note: Ask farming or farm management activities or practices necessary for the improvement of rice productivity in the field of interviewee by consulting the answer codes given in Questionnaire. Indicate up to 4 activities/practices required (maximum) in order of degree of necessity.

1. Most required [1st] 2. 2nd required [2nd] 3rd required [3rd] 4th required [4th] Q-449

Answer and answer code

1	Improvement of farming practices	7	Intensive weeding
2	Use of quality seed (local variety)	8	Formation/strengthening of farmers organization
3	Use of quality seed (high yielding variety)	9	Others (specify:)
4	Use of adequate doses of fertilizer	10	Others (specify:)
5	Improved leveling of paddy field	11	Others (specify:)
6	Planting at proper time	12	Others (specify:)

XIII-7 Necessary physical works to improve rice productivity in the field of the interviewee (plural answer)

Note: Ask physical works necessary for the improvement of rice productivity in the field of interviewee by consulting the answer codes given in Questionnaire. Indicate up to 3 works required (maximum) in order of degree of necessity.

1. Most required [1st] 2. 2nd required [2nd] 3rd required [3rd] Q-450

Answer and answer code

1	Irrigation water supply for wet season	7	
2	Irrigation water supply for dry season	8	
3	Mitigation of inundation/flooding	9	Others (specify)

4	Drainage improvement	10	Others (specify)

SECTION XIV LIVESTOCK CONSTRAINTS

Note: Ask livestock constraints to the interviewee by consulting the answer codes given in Questionnaire. Indicate up to 3 constraints in order of degree of seriousness.

1. Most serious constraints [1st] 2. 2nd serious constraints [2nd] 3rd serious constraints [3rd] Q-451

Answer and answer code

1	Low productivity	6	Insufficient veterinary services
2	Shortage of feed	7	Insufficient extension services
3	Low or unstable market prices	8	Difficulty in obtaining good breed
4	Market availability	9	Others (specify)
5	Losses due to diseases	10	Others (specify)

SECTION XV EXPECTATIONS

Note: Ask expectations of the interviewee on agronomic & farm management, farming system, physical aspects. And agricultural support services by consulting the answer codes given in Questionnaire. Indicate up to 3 responses in order of degree of expectation or requirement.

XV-1 Farming (agronomic & farm management)

1. Most required [1st] 2. 2nd required [2nd] 3rd required [3rd] Q-452

Answer and answer code

1	Productivity improvement of wet season rice	6	Increasing livestock holding size & production
2	Productivity improvement of dry season rice	7	Increasing poultry holding size & production
3	Productivity improvement of field crops	8	Strengthening or formation of farmers organizations
4	Productivity improvement of vegetables	9	Improvement of post-harvest operation
5	Productivity improvement of livestock/poultry	10	Others (specify)

XV-2 Farming (farming system)

1. Primarily intended [1st] 2. 2nd intended [2nd] 3rd intended [3rd] Q-453

1	Double cropping of rice	3	Multiple farming (crop + livestock etc.)
2	Stable single cropping of rice	4	Crop diversification

XV-3 Farming (physical)

1. Most required [1st] 2. 2nd required [2nd] 3rd required [3rd] Q-454

Answer and answer code

1	Adequate (volume/timing) irrigation water supply in wet season	6	Drainage improvement
2	Adequate (volume/timing) irrigation water supply in dry season	7	Leveling of paddy field
3	Mitigation of inundation & flooding	8	Others (specify)
4	Construction/rehabilitation of farm road	9	Others (specify)
5	Construction/rehabilitation of farm to market road	10	Others (specify)

XV-4 Agricultural support services

1. Most required [1st] 2. 2nd required [2nd] 3rd required [3rd] Q-455

Answer and answer code

1	Field Extension services (demonstration / field guidance)	6	Provision of market information
2	Provision of quality seed	7	Provision of farm credit
3	Farmer training (technical & host-harvest operation)	8	Provision of fertilizer
4	Farmer training (organization, marketing, farm management)	9	Others (specify)
5	Support to organize farmers	10	Others (specify)

SECTION XVI PARTICIPATORY AWARENESS LEVEL FOR THIS PROJECT

Note: Choose or write about participatory awareness level for this project. If the interviewee chooses "No", write its reason.

1	To participate to construction of on-farm irrigation facilities		
	Construction works (Earthworks, concreting-works: small bridge, lining of canal, etc.)	Y / N	Q-456
	If "No", what is the reason?		Q-457
	Carrying works of construction materials	Y / N	Q-458
	If "No", what is the reason?		Q-459
	Assistance works (measurement, etc.)	Y / N	Q-460
	If "No", what is the reason?		Q-461
	Sharing the construction cost (payment by installments in long term)	Y / N	Q-462
	If "No", what is the reason?		Q-463
	Donation of local materials for construction (gravel, ballast, sand, etc.)	Y / N	Q-464
	If "No", what is the reason?		Q-465
	Donation of equipment for construction works (spade, shovel, etc.)	Y / N	Q-466
	If "No", what is the reason?		Q-467
	Donation of draft animals (cow, horse, etc.)	Y / N	Q-468
	If "No", what is the reason?		Q-469
2	To be a member of FWUC	Y / N	Q-470
	If "No", what is the reason?		Q-471
3	To participate in FWUC meeting	Y / N	Q-472
	If "No", what is the reason?		Q-473
4	To pay water charge by cash		Q-474
	If "Yes", how much can you pay per year?	riel/year	Q-475
	If "No", could you pay it by crops (rice, vegetable, fruit, etc)	Y / N	Q-476
	If "No", what is the reason?		Q-477
5	To pay member fee of FWUC	Y / N	Q-478
	If Yes, how much can you pay per year?	riel/year	Q-479
	If "No", could you pay it by crops (rice, vegetable, fruit, etc)	Y / N	Q-480
	If "No", what is the reason?		Q-481
6	To participate to maintenance of irrigation facilities		
	Desilting	Y / N	Q-482
	If "No", what is the reason?		Q-483
	Weeding	Y / N	Q-484
	If "No", what is the reason?		Q-485
	Repairing	Y / N	Q-486
	If "No", what is the reason?		Q-487
7	To participate to operation of irrigation facilities		
	Gate operation	Y / N	Q-488
	If "No", what is the reason?		Q-489
	Water distribution	Y / N	Q-490
	If "No", what is the reason?		Q-491

SECTION XVII NEGATIVE EFFECT

Note: Choose negative effect specified by the interviewee. The question XIII-1 is only for farmer who cultivate land on reservoir. As the project can't promise to compensate at this moment, do not explain to farmer to compensate for their loss.

Note: 1-3: If interviewee chooses "Not accept", write its reason. If interviewee chooses "Need compensation", choose their request for compensation. 4: If interviewee chooses "Not accept", write its reason.

1	To a deeper inundation depth (If this farmer plant on reservoir area)	1 Not accept	2 Need compensation	3 No choice	4 No problem	Q-492
	If he/she chooses "1 Not accepts", write reason of it.	Reason:				Q-493
	If he/she chooses "2 Need compensation", what does he/she want to compensation?	1 Money	2 Other land	3 Both	4 Others	Q-494
2	To loss of present cultivation on reservoir area and/or canal	1 Not accept	2 Need compensation	3 No choice	4 No problem	Q-495
	If he/she chooses "1 Not accept", write reason of it.	Reason:				Q-496
	If he/she chooses "2 Need compensation", what does he/she want to compensation?	1 Money	2 Other land	3 Both	4 Others	Q-497
3	To loss of your land for irrigation facilities	1 Not accept	2 Need compensation	3 No choice	4 No problem	Q-498
	If he/she chooses "1 Not accept", write reason of it.	Reason:				Q-499
	If he/she chooses "2 Need compensation", what does he/she want to compensation?	1 Money	2 Other land	3 Both	4 Others	Q-500
	Do you think illegal to cultivate on reservoir and/or canal?	1 Yes	2 No			Q-501
4	To a lower drinking water quality by application of fertilizer and chemicals	1 Not accept	2 Need other drinking water source	3 No choice	4 No problem	Q-502
	If he/she chooses "1 Not accept", write reason of it.	Reason:				Q-503

SECTION XVIII IRRIGATION, WATER MANAGEMENT & FARMERS WATER USERS COMMUNITY AND GROUP (FWUC & FWUG)

Note: Fill in Questionnaire Sheet according to the instructions given in the Sheet

XVIII-1 Source and time of water to the paddy field

1. What is the source of water for your paddy field? (Please choose from answer code below) Q- 504

1. Only rainfall	2. Mainly rainfall but sometime canal water	3. Mainly from canal but rainfall too

2. Do you take water from canal for rice cultivation? (Please choose from answer code below) Q- 505

1. Never take water from canal	2. Take water from canal

3. Number of days taking water from canal (if you take water from canal; answer code below) Q- 506

1. 1 day	2. 2 days	3. 3days	4. 4days	5. 5 days	6. 6 days
7. 7 days	8. 8 days	9. 9 days	10. 10 days	11. 11 ~ 15 days	12. 16 ~ 20 days
13. 21 ~ 25 days	14. 26 days ~ 1month	15. 1 ~ 1.5 months	16. 1.5 ~ 2 months	17. 2 ~ 3 months	18. > 3 months

4. If you take water from canal more than 2 days, please indicate irrigation method Q- 507

1. Intermittent irrigation	2. Continuous flow/irrigation

If you select “intermittent irrigation”, please answer to the following

5. Number of days (how many days do you supply water) for one irrigation ____ days Q- 508

6. Interval of one irrigation to the next irrigation (irrigation interval) ____ days Q- 509

7. If you select “continuous irrigation”, how is? Q- 510

1. During all the cropping season	2. Continuously only in a part of the cropping season

8. When do you take water from canal for? (select from below, plural answer is allowed) Q- 511

1. Throughout the growing season	2. For land preparation	3. For transplanting
4. Initial tillering stage	5. During flowering stage	6. At maturing stage

9. If you irrigate water intermittently, what is the reason? (select from below) Q- 512

1. The canal has water only some time	2. Not necessary continuous irrigation because rainfall is enough
3. Operation cost of pump is too high to operate pump frequently	4. Saving irrigation water for obtaining more production.
5. A rule of FWUC or requested by community or government agency	

10. Do you think you can take water from canal enough for paddy? (select from below) Q- 513

1. Enough for one season paddy growing, because supported by canal & rainfall	2. Not enough

11. Do you know the recent rice cultivation system "SRI (System for Rice Intensification)" Q- 514

1. Yes, very well and interested	2. Yes, but not interested	3. No

12. “SRI” is a newly introduced program in Cambodia to get more paddy production by saving water and chemical fertilizer. Are you interested “SRI”? Answer by (1. Yes 2. No) Q- 515

13. If you answer "No", why are not you interested with? (plural answer is allowed) Q- 516

1. Never seen a farmer applying “SRI”	2. Not receive technical guidance about “SRI” yet
3. Not have a canal to control water by yourself. (SRI requires frequent water control in the paddy field)	
4. Other reasons, please specify	

XVIII-2 Canal by side of your paddy field

1. How do you take water to the paddy field? Q- 517

1. From neighboring fields	2. By natural gravity from canal	3. By pump from canal

2. If you take water from your neighboring fields, is your neighbor cooperative with you? Q- 518

1. Yes, he are always cooperative with you	2. No

If you take water by a pump, please answer to the following questions.

1. How many millimeter is the diameter of pump? mm Q- 519

2. How many hours do you operate a pump in one cropping season? hours Q- 520

3. Do you rent a pump or have a pump? 1. Rent 2. Own pump Q- 521

4. If rent, how much is the rental cost in one cropping season? Riel Q- 522

5. Is there a canal by the side of your field? (Select from below) Q- 523

1. Yes	2. No

6a. If no, how many meters are from your paddy field to the nearest canal? (answer code below) Q- 524

1. 5 m	2. 10 m	3. 20 m	4. 50 m	5. 100 m	6. 200 m
7. 300 m	8. 400 m	9. >400 m, Please answer how many meters: m			

6b. If your field is very far (ex. more than 400 m) from the water source canal, how many times do you pump up water from the water source canal to your paddy field? Q- 525

1. 2 times	2. >2 times, Please write how many times: _____ times

7. If you have no canal by the side of your paddy field, do you wish to have a canal by the side of your field? Q- 526

1. Yes	2. No

8. If yes, why you do not construct a canal by yourself? Q- 527

1. Because you have to construct a canal in your neighbor's paddy field, but he does not agree with you
2. Because the mother canal is so far from your paddy field, that you have to hire labors but can not pay to the labors
3. Other reasons (please specify)

9. If no, why you do not want a canal by the side of your paddy field? Q- 528

1. Because, you can take water from canal or neighboring fields without having any difficulty and problem
2. Because you assume construction work is hard and expensive for you
3. Other reasons (please specify)

XVIII-3 Number of weeks from seeding to transplanting of rice

1. How many weeks do you keep seedlings in the nursery in your paddy field in the normal year? Q- 529

1. 2 weeks	2. 3 weeks	3. 4 weeks	4. 1 month	5. 1.5 months	6. 2 months	7. > 2 months

2. If you keep rice seedlings more than 4 weeks, please select the reason (multiple answer is allowed) Q- 530

1. Wait for rainfall	2. Wait for agriculture labor
3. Other reason (please specify)	

3. If you wait for rainfall for transplanting why you can not use canal water? (multiple answer is allowed) Q- 531

1. No water in the canal or not sufficient	2. No fund to purchase or operate a pump
3. Other reason (please specify)	

XVIII-4 About FWUC

	Question	Answer code & answer				
1	Are you a member of FWUC	1. Yes	2. No	3. Not know		Q-532
2	Do you know the name of FWUC you belong	1. Yes	2. Not know	3. No name		Q-533
3	Do you know the name of FWUC chairman you belong	1. Yes	2. Not know			Q-534
4	Do you know the intended functions of FWUC	1. Yes	2. Not know			Q-535
5	Do you know the FWUC activities carried out in the last 1 year	1. Yes	2. Not know			Q-536
6	Did you attend the FWUC general members meeting of last year	1. Yes	2. No	3. Not held		Q-537
7	In what FWUC activities did you attend last year; please specify	1.	2.	3.		Q-538
8	Did you pay irrigation fee in last year; if yes how much	1. Yes	2. No	3. No fee charged		Q-539
		riel/ha				Q-540
9	Expectations for FWUC					Q-541

XVIII-5 About FWUG

1	Are you a member of FWUG	1. Yes	2. Not know			Q-542
2	Do you know the same name of FWUG you belong	1. Yes	2. Not name			Q-543
3	Do you know the name of FWUG chairman you belong	1. Yes	2. Not know			Q-544
4	Do you know the intended functions of FWUG	1. Yes	2. Not know			Q-545
5	Do you know the FWUG activities carried out in the last 1 year	1. Yes	2. Not know			Q-546
6	Did you attend the FWUG general members meeting of last year	1. Yes	2. No	3. Not held		Q-547
7	In what FWUG activities did you attend last year; please specify	1.	2.	3.		Q-548
8	Did you pay irrigation fee in last year; if yes how much	1. Yes	2. No	3. No fee charged		Q-549
		riel/ha				Q-550
9	Expectations for FWUG					Q-551

SECTION XIX FLOOD DAMAGE

Note: Fill in Questionnaire Sheet according to the instructions given in the Sheet

1. Do you suffer from flood damage? Q- 552

1. YES	2. No

If you select 'Yes',

2. How often do you suffer from flood in a year Q- 553

1. Once a year	2. Twice a year	3. 3 times a year	4. 4 times or more a year

3. How many days does one flood continues on average? Q- 554

1. 1 day	2. 2 days	3. 3 days	4. 4 days or more

4. How do the floods damage you? (multiple answers are allowed) Q- 555

1. Paddy	2. Vegetable Field	6. Large Livestock e.g. Buffalo, Cow	5. Poultry	4. Fish
3. Household Goods e.g. House, Motorcycle	7. Family's Life	8. Others ( )		

Questionnaire (for Selected Farmers)

SECTION XX CROP BUDGET ANALYSIS ON RICE PRODUCTION

Note: To collect information for crop budget analyses on rice production from 15 representative farmers selected from the sample farmers in each target group of this Questionnaire Survey for Agriculture, by using the survey sheet on next page. In a fully irrigated group, at least 10 samples practicing double cropping of rice to be surveyed and in case of double cropping of rice practiced, crop budget survey for both wet and dry season of rice shall be made.

Sample No.	Commune:	Village:	Enumerator:
Land Use Category	1. Roleng Chrey (sufficient)	2. Roleng Chrey (insufficient)	3. Small Scale Irrigation
	4. Rainfed Paddy Field	Serial sample No. in a subject land use category:	/ 15 samples
Commodity	1. Irrigated Rice/Wet Season	2. Irrigated Rice/Dry Season	3. Rainfed Rice

I. Gross Return

Items	Per Farm				Per Ha			Remarks
	Unit	Unit Price (riel)	Quantity	Amount (1000riel)	Unit	Quantity	Amount (1000riel)	
Planted Area	ha	—		—	ha	1.0	—	
Harvested Area	ha	—		—	ha	1.0	—	
Production								
- Dry unhusked rice	kg				kg/ha			
- Milled rice	kg				kg/ha			
Gross Return	—	—	—		—	—		

II. Production Costs - 1/2

Items	Per Farm				Per Ha			Remarks
	Unit	Unit Price (riel)	Quantity	Amount (1000riel)	Unit	Quantity	Amount (1000riel)	
1. Farm Inputs	—	—	—		—	—		Variety:
Seed	kg				kg/ha			Seed source:
Fertilizer	—	—	—		—	—		
1st Dressing								
Urea	kg				kg/ha			
DAP	kg				kg/ha			
KCl	kg				kg/ha			
Compost	kg				kg/ha			
Others	kg				kg/ha			
2nd Dressing								
Urea	kg				kg/ha			
( )								
( )	kg				kg/ha			
3rd Dressing								
Urea	kg				kg/ha			
( )	kg				kg/ha			
( )	kg				kg/ha			
Agro-chemicals	—	—	—		—	—		
( )	kg				kg/ha			
( )	kg				kg/ha			
( )	lit				lit/ha			
( )	lit				lit/ha			
2. Land Preparation	—	—	—		—	—		
Draft Animal	animal day			—	animal day		—	a pair of animal day
Tractor	tractor day			—	tractor day		—	Working hours/day:
3. Pumping Irrigation Costs	times				times/ha			times/season
4. Other Materials	—	—	—		—	—		
( )					/ha			
( )					/ha			
( )					/ha			

Sample No.	Commune:	Village:	Enumerator:
Land Use Category	1. Roleng Chrey (sufficient)	2. Roleng Chrey (insufficient)	3. Small Scale Irrigation
	4. Rainfed Paddy Field	Serial sample No. in a subject land use category:	/ 15 samples

II. Production Costs - 2/2

Items	Per Farm Unit	Per Farm Unit Price (riel)	Per Farm Quantity	Per Farm Amount (1000riel)	Per Ha Unit	Per Ha Quantity	Per Ha Amount (riel)	Remarks
5. Other Costs								
Land Rent	riel				riel/ha			
Land Tax	riel				riel/ha			
Irrigation Fee	riel				riel/ha			
Interest	riel				riel/ha			
6. Hired Labor Costs								
Male	man-day							Working hours/day:
Female	man-day							Working hours/day:
Production Costs	—	—	—		—	—		

III. Net Return

Net Return	**Per Farm**		**Per Ha**		

Labor Requirements & Costs

Farming Activities	Unit	Hired Labor Quantity (man-day)	Hired Labor Unit Price (riel)	Hired Labor Amount (1000riel)	Family Labor (man-day)	Total Requirement (man-day)	Remarks
Nursery	Male						
	Female						
Land Preparation	Male						
	Female						
Transplanting	Male						
	Female						
Fertilization	Male						
	Female						
Chemical Spray	Male						
	Female						
Weeding	Male						
	Female						
Water Management	Male						
	Female						
Harvesting	Male						
	Female						
Threshing	Male						
	Female						
Transportation	Male						
	Female						
Drying	Male						
	Female						
Other Works	Male						
	Female						
Labor Requirements & Costs	Male						
	Female						
	Total						