

# Proposal for application of FHM in Lao PDR: Case of Nam Ngum River Basin

## I. Nam Ngum River and Its Basin

Nam Ngum River Basin is of vital importance to the Lao PDR, it is considered as the food house of the country. The basin area is home of more than 600,000 people, second only to Sebanghieng. Its resources provide a subsistence livelihood to about 80,000 lowland and upland cultivators.

The basin is located in the central part of the Lao PDR, covered 1678975.00ha area of four provinces e.g. Xieng Khuang, Vientiane province, Special zone and Vientiane Municipality. It is one of the major tributaries of the Mekong River.

Over the past decades, residents of Nam Ngum basin suffer from reoccurring flood in the down stream region.

Fig No.1: Location of Nam Ngum River Basin



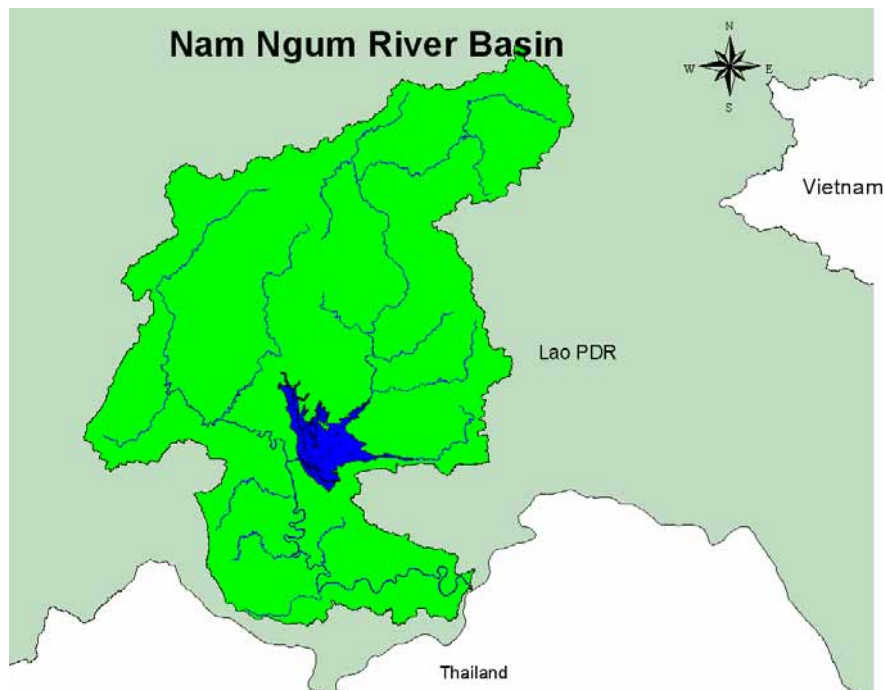
The Nam Ngum Basin is formed by two rivers as Nam Ngum is the main and its tributary called Nam Lik.

Like. From the origin of this river which situated at the North- Eastern of the basin to its outlet to the Mekong River which located approximate 98km downstream of Vientiane capital, the Nam Ngum flows down on it course of about 420 km with the head of approximate 1450 metre height from msl.

About 4 km upstream of the Nam Lik junction to Nam Ngum (Ban Thin Keo), there is big dam called Nam Ngum 1. The dam is major river regulation infrastructure in the basin and its maximum storage is apprx. 8.5 billions M3 with reservoir surface area of 370 km<sup>2</sup> and the dam was started operation since 1971. Beside, the Nam Ngum dam that build in the main river, one more barrage also was constructed on the Nam Song tributary and divert flows to Nam Ngum reservoir. The operation of these two major infrastructures is the main driving forces that effected to the hydrological regime of the Nam Ngum Basin.

Catchment upstream of the Nam Ngum Reservoir; there are a high mountainous ranges stretched from east to west, with the height ranges from 250-2800 m. Theses mountain ranges affect the distribution of the rain fall in the basin.

Fig N.2



Downstream of the Nam Lik confluence with Nam Ngum flows to the mouth with gentle slope of 1/10000 to 1/25000 and meandering on it course. The Vientiane plain extended from each bank and cover area of about 2000 km<sup>2</sup> at elevation of 160-180m. The plain is form mostly alluvium soil suitable for the cultivation of rice and other short duration crops. The river section downstream of Tha Ngon bridge( about 20 km north of Vientiane) has narrow cross sections on it course, therefore the flow in the rainy season is retarded and inundation frequently occurs on the flat land upstream of Tha Ngon.

### Available Meteorological and Hydrological data

#### *Rain fall*

The spatial distribution of mean annual rain fall in the Nam Ngum River Basin ranges from 1700 to 2800mm. There are 10 stations of rainfall in and around the basin.

NO.	Station Name	Location	Latitude	Longitude	Available period
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1	Kasy	Nam Lik	18°13'05"	102°15'16"	1969-06;(77-87);(91)(94)
2	Hinheup	Nam Lik	18°39'48"	102°21'18"	1968-06;(71-81);(83-86)
3	Vangvieng	Nam Spng	18°54'24"	102°46'45"	1969-06;(71-73);(77);(86);(88)
4	Nalouang	Nam Ngum	18°54'48"	102°46'42"	1987-06
5	Phonhong	Nalongkhoun	18°09'40"	102°26'15"	1985-06
6	Pakhanhung	Muong Kao	18°25'06"	102°32'00"	1965-06;(69;78-89;92-93)
7	Napheng	Napheng	18°21'00"	102°30'00"	1975-06;(76-77;79;84-86;89-93)
8	Veunkham	Nam Ngum	18°11'00"	102°17'00"	1999-06
9	Thangon	Nam Ngum	18°10'00"	102°40'00"	1965-06;(86)
10	Vientiane (DMH)	Mekong	17°57'30"	102°33'00"	1951-06

### *Temperature and Evaporation*

The seasonal range of mean temperature in the low and river valleys mountain if the Lower Mekong Basin is modest, reflecting the topical and sub-topical nature of the climate. There are, however, significant changes both seasonally and diurnally at increasing attitude and the more temperature climate in the North.

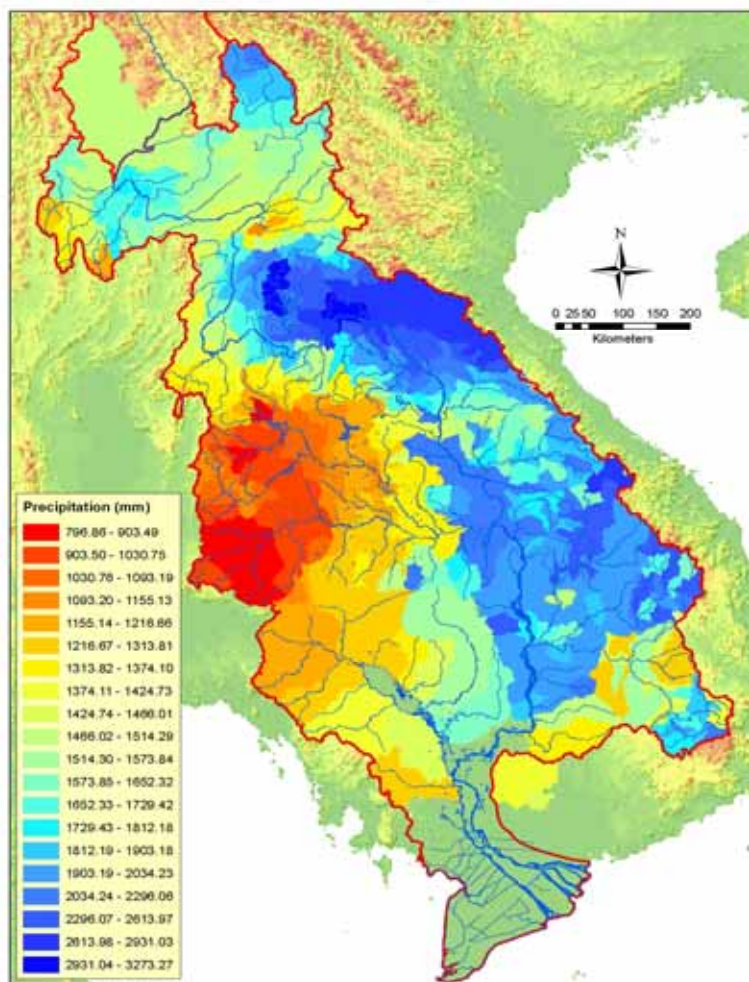
Table of sample mean from two main climatic stations is shown below:

Site	Altitude m.asl	Latititude	Longitude	Mar	Ap	Ma	Ju	Jul	Au	Sep	Oct	No	Dec
Luangprabang	305	22	23	26	28	28	28	28	28	27	27	24	21
Vientiane	170	24	25	28	29	29	29	28	28	28	28	25	23

### *Flow and water level*

Since preparation for construction and after operation of Nam Ngam dam the flow and water level data of station Nam ngum at Ban Pakkangoung have been contentiously recorded, some additional network also been installed such as Nam Lik and Hin Heup and inflow to Nam Ngum reservoir at Ban Na Luang.

NO.	Station Name	River	Latititude	Longitude	Available data, H	Available data, Q
1	Kasy	Nam Lik	18°13'05"	102°15'16"	1987-06	1987-06;(95)
2	Hinheup	Nam Lik	18°39'48"	102°21'18"	1966-06;(72-86)	1990-06
3	Vangvieng	Nam Song	18°54'24"	102°46'45"	1984-06	1987-06;(98)
4	Nalouang	Nam Ngum	18°54'48"	102°46'42"	1987-06	1990-06
5	Pakhanhung	Nam Ngum	18°25'06"	102°32'00"	1963-06;(78-88)	1991-06
6	Veunkham	Nam Ngum	18°11'00"	102°17'00"	1991-06	1991-06
7	Vientiane (Km4)	Mekong	17°55'42"	103°37'12"	1952-06	1992-06



*Cross section data*

More than 50 cross section data of the river channel along the flood plain area are already available.

*Hydrological data*

Hydrological model of Mekong River Commission will be used to produce runoff for the flood simulation.

**II. Objectives**

The objectives of the case studies are to strengthen knowledge for Lao staff on creation FHM by using tools and methodology trained by ICHARM. The case study of Nam Ngum River Basin will be a fostering idea to carry out further applications for basin in the country.

**Expected benefits:**

- Reducing losses caused by flood
- Decision support to local government for future structural measure
- Creation of flood evacuation awareness for local people
- FHM ready in use describing areas of evacuation, location and routes and the dangerous spots

### III. Outlines of work

- Data collection
- Set-up HECRAS Model for hydrological Model covering the whole Nam Ngum basin by using detailed DEM, and and up to date climatic data and infrastructure
- On field point checking of HECRAS results and infrastructure.
- Creation of initial FHM
- Meeting with local residents on the proposed initial FHM
- Adjust the FHM according to actual needs
- Distribution of FHM

### IV. Working Methodology

LNMC and DOI will establish core team that comprises of the manger and modeller whose were trained by the ICHARM to carry out case study and some project assistants. ICHARM specialists will provide technical assistance on Arc GIS, HECRAS Models set up, calibration and town watching analysis.

At the end of the process, core team will conduct a national workshop to reviews and concludes their achievements.

#### **The process of national case study is subjected to the following conditions:**

- Using the models and Modules available within MRC umbrella and provided by JICA
- No development/purchase of any new model/software
- Using the available data within country together with some provided by JICA
- Site visits and residents interview will made based on available budget and necessity
- Use country experiences and supporting expertise and Knowledge from ICHARM

## Implementation Schedule

No.	Activities	2008																																			
		Feb				Mar				Apr				May				Jun				Jul				Aug				Sep							
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
1	Initial site investigation and people interview of inundation risk area	█	█	█	█	█	█	█	█									█	█	█	█																
	HECRAS model setup													█	█	█	█																				
	data collection as Rainfall, Discharge, Water level, Land use,	█	█	█	█																																
	Arial photograph of the area.			█	█	█	█																														
2	Creating FHM															█	█	█	█																		
	Editing FHM based on local requirement																							█	█												
3	On site point checking																			█	█	█	█	█	█												
	Meeting with local people on FHM acceptance																							█	█												
	Dissemination of FHM																									█	█	█	█								
4	Training course on Flood Hazard Mapping											█	█																								
	Training on Anticipated Inundation Area Mapping (Nam Ngum River)									█	█																										

## V. Estimated budget

No.	Activities	Cost Estimate (US\$)
1	Investigation and people interview of inundation risk area	15,000
	Draw Contour of inundation risk area on 1:10.000 scale Map,	
	data collection as Rainfall, Discharge, Water level, Land use,	
	Arial photograph of the area and training course Period.	
2	Regional Experts for making TIN data and Training course	20,000
	on Flood Hazard Mapping of Vientiane Floodplain.	
	Training on GIS application	
	Training on Anticipated Inundation Area Mapping (Nam Ngum River)	
	<b>Total</b>	<b>35,000</b>

## VI. Suggestions and Opinion for FHM Training Course

In general, this FHM training course is well satisfied to our national and organizational demand in strengthening staff capacity in the area of water resources sector especially water related disaster but course duration is rather short to be technically specific. However, to further improve the course will would like to have following comments:

- Duration of the course is too short to go in depth to any parts. The course may be divided in into two streams (or courses); one digging in more technical depth and another specialized in more management, or keep the contents with extended period.
- Course materials are good enough for use in this course, but still in limited extent for future use as reference. Textbooks should be made available either in soft copy or hard copy.