A MATHEMATICAL MODEL FOR LOCATING FLOODING AREA IN THE LOWER MAEKLONG RIVER BASIN

WALEERAT RANGSIMAPIRAT

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ABSTRACT

The propose of this study was to develope a mathematical model to predict flooding. The model calculates flood elevation at Banpong, Photharam, Ratchaburi and Bangkhonthi. Terrain elevation (Digital Elevation Model: DEM) was constructed to apply along with flood elevation from model. Flooding area was generated using Geographic Information Systems (GIS).

The study found that the model shows good prediction of flooding areas compared to those that actually occurred. The model can predict the time that the maximum flood elevation will occur elevation at downstream sites (Banpong, Photharam, Ratchaburi nd Bangkhonthi). In addition, the model is easier to use than other hydrologic models because the model only requires the water elevation instead of the quantity of water (Q) at Maeklong Dam. The water elevation can be read directly from a gage measurement, so the official government at Maeklong Dam can able to warn people who live at downstream sites as to when and where flooding will occur.

However, due to the limitation of this investigation, the numbers of used control points in generating DEM are quite few which may cause generated flood map errors. The recommendation from the study is that an alternative method using a computing lag time procedure calculating water travel time between downstream sites be used.

KEY WORDS: MODEL / PREDICTION / FLOODING / GIS

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แบบจำลองคณิตศาสตร์เพื่อทำนายพื้นที่น้ำท่วมบริเวณลุ่มน้ำแม่กลองตอนล่าง
(A MATHEMATICAL MODEL FOR LOCATING FLOODING AREA IN THE MAEKLONG RIVER BASIN)

วลีรัตน์ รังสิมาภิรัต 4537035 EGTI/M

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บทคัดย่อ

ปัญหาน้ำท่วมเป็นปัญหาที่สำคัญของประเทศไทย การสร้างเขื่อนเป็นวิธีการหนึ่งที่นิยมใช้ในการป้องกันน้ำท่วม แต่หากมีการระบายน้ำออกจากเขื่อนในขณะที่ระดับน้ำท้ายเขื่อนสูงอยู่แล้วจะทำให้เกิดน้ำท่วมในพื้นที่ตอนล่างได้

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาแบบจำลองคณิตศาสตร์เพื่อทำนายพื้นที่ที่คาดว่าจะเกิดน้ำท่วม แบบจำลองคณิตศาสตร์ที่พัฒนาขึ้นนี้ จะคำนวณค่าระดับน้ำที่ทำให้เกิดน้ำท่วมและสร้างแบบจำลองภูมิประเทศ (Digital elevation model: DEM) จากภาพถ่ายทางอากาศขึ้น เพื่อนำมาสร้างเป็นแผนที่น้ำท่วมโดยโปรแกรม ArcView และนำแผนที่น้ำท่วมที่ได้นั้นมาทำการเปรียบเทียบกับภาพถ่ายดาวเทียม LANDSAT 5 เพื่อหาค่าความคลาดเคลื่อนของแบบจำลอง

ผลการศึกษาพบว่าแบบจำลองคณิตศาสตร์ที่พัฒนาขึ้นนี้ สามารถทำนายพื้นที่น้ำท่วมได้ รวมถึงเวลาที่จะเกิดระดับสูงสุดที่สถานีบ้านโป่ง, โพธาราม, ราชบุรี และบางคนที แบบจำลองนี้สามารถใช้งานได้ง่ายกว่าแบบจำลองทางชลศาสตร์ที่มีอยู่ในปัจจุบัน เพราะใช้เพียงแค่ระดับน้ำจากสถานีเขื่อนแม่กลองเท่านั้นซึ่งสามารถดูได้โดยตรงจากเครื่องมือวัดระดับน้ำที่เขื่อนแม่กลอง ทำให้เจ้าหน้าที่ที่เขื่อนแม่กลอง สามารถเตือนประชาชนที่อาศัยอยู่ในบริเวณท้ายเขื่อนได้ว่าจะเกิดน้ำท่วมเมื่อไรและที่บริเวณใดบ้าง

เนื่องจากข้อจำกัดในเรื่องเวลาและงบประมาณของการศึกษา เช่น ข้อมูลระดับน้ำ, จำนวนจุด GCP ทำให้แผนที่น้ำท่วมที่ได้จากแบบจำลองมีความคลาดเคลื่อนเกิดขึ้น รวมถึงแบบจำลองภูมิ-ประเทศที่ได้อยู่ในพื้นที่บาง ส่วนของลุ่มน้ำแม่กลองตอนล่างเท่านั้น

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CHAPTER I
INTRODUCTION

1.1 Problems and Their Important

Flooding is a situation which excess amount water flows or fills up an area. Its damage occur called flood damages. Flooding is an important problem of Thailand because it damages roads, forests, agricultural lands and residential areas in the affected areas. For example, the severe flooding in Petchaburi and Prachuabkirikhan in October 2003 caused severe damages worth about 1,000 million baht. Flooding problems usually occur during rainy season because river and cannels can not carry the excess amount of water. One method to solve the problem is to construct a dam.

The large dams are usually designed by engineers in order to protect flooding. Unfortunately, large dams could cause severe flooding instead if rapid draining of excess water must be done in order to avoid dam failure caused by the over capacity. Important problems in Thailand are the lack of water rather than the excess of water passing through spillways. Therefore, the government tends to keep as much as water in the dams. The ability of dam to collect excess water will be minimized, thus when more rains come, the water must be drained rapidly and the sudden flood occurs. It can be clearly seen that construction of dams for protecting flooding may not be a good solution (1).

Every year, people who live in the lower Maeklong Basin must experience flooding because the areas are mostly flood plains and thus flooding is inevitable. Flooding causes losses of properties and farmlands. Infact, flooding is a natural disaster, however, if it is known in advance of when and where the flooding would

occur, protection measures could be done efficiently. This is the concept of flood modeling in this investigation.

Presently, there have been a number of mathematical models to predict flooding, for example, HEC-1, HEC-2, HEC-RAS and MIKE11. Infact, these models work well but they must be imported and costly. An important concern is some model parameters not compatible with the environment for Thailand environment due to, for example, the copyright law. This investigation is trying to find parameters suitable for Thailand, especially for the lower Maeklong River Basin.

The mathematical model derived in this investigation is based on the relational equation where inputs are the water levels draining over the Maeklong Dam spillway and outputs are the elevation of water surface of the interesting downstream sites. The downstream sites are Banpong (K55), Photaram (K56), Ratchaburi (K 2B) and BangKhonthi (K 57). The mathematical model derived in this investigation can predict water levels at these sites by knowing only water levels at the Maeklong Dam spillway. A Digital Elevation Model (DEM) of the area was created using aerial photographs and the software called OrthoBASE Pro. The calculated water level was used as an input to the software called ArcView to select areas having the elevation lower than the calculated water level. Assuming that the effect of flowing process is minimum, then the predicted flooding area will be the “lake” having the surface elevation equal to that calculated by the model.

1.2 Propose of the Investigation

To develop a mathematical model to predict flooding areas in the lower Maeklong Basin.

1.3 Limitation and Area of the Investigation

1.3.1 The study site is the lower Maeklong Basin from the Meaklong Dam to Maeklong River mouth.

1.3.2 The used water elevation data were taken from the following stations:

- Maeklong Dam (K11A) : input data
- Banpong (K55) : Predicted flooding areas
- Photharam (K56) : Predicted flooding areas
- Ratchaburi (K2B) : Predicted flooding areas
- Bangkhonthi (K57) : Predicted flooding areas

1.3.3 According to the statistics, it was found that large amount of water was measured from September to November annually.

1.3.4 The recorded water level data during those periods in Year 1998 to 2003 were used for calibrating the model parameters. Because of Royal Irrigation Department of Thailand (RID) has not stored the water elevation of some sites before 1998.

In this investigation, flood elevation of Ratchaburi is used for making predicted flooding areas because of time and budget limitation. Thus, the mathematical models in this investigation are limited using some conditional situations as follows:

1) The water use and the quantity of water situation in the lower Maeklong River Basin have to be normal
2) Because of model input is the water level of Maeklong Dam spillway, if some downstream sites are raining, the relational equations from this study are not able to be used to calculate flood elevation of those sites

1.4 Steps of Investigation

1.4.1 Collecting data; water level, aerial photographs etc.

1.4.2 Developing and improving the mathematical model

1.4.3 Constructing the digital elevation model data

1.4.4 Making and checking the output maps of flood areas

The material presented in this investigation was designed as follows: 1) Chapter one explains about problems of flooding, previous methods to solve the problems and their disadvantages, flooding models currently in use, and the concept of the model presented by this investigation 2) Chapter two gives brief explanations about the previous studies related to flood modeling. Theories used in this investigation are also discussed in this chapter 3) Chapter three discusses about methods used in this research. This chapter includes methods using software OrthoBASE Pro to create DEM, ArcView 3.3 to create flooding maps by showing the onscreen menus 4) Chapter four shows the results of the investigation. Statistical comparison between observed and predicted boundaries of flooding areas is shown in this chapter. Finally, discussion and recommendation for future research are discussed in chapter five.

1.5 The Result of Investigation

The result of this investigation shows that despite the simple relational equation was used. The difference between calculated and observed water level is statistically acceptable. However, it differs significantly in areas where marine tides are dominant, Bangkhonthi, for example. This is an important limitation of the model. Regarding predicted flood areas, the boundaries of observed flood areas and those predicted by the model are statistically the same. However, due to the limitation of time and budget to carry out this research, only observed and predicted flood areas in Ratchbiri was compared. Although the result from one site can not make a conclusion, it, however, serves as a guide for future improvement or for a preliminary investigation.

CHAPTER II
LITERATURE REVIEW

2.1 Maeklong River Basin

2.1.1 Location and Boundary

Maeklong River is a main river in central region of Thailand. It is formed by two main tributaries Kwai Noi and Kwai Yai, which emerge at Kanchanaburi. It enters the sea at Samutsongkram. Meaklong River Basin covers 7 provinces: Kanchanaburi, Supanburi, Nakhonpathom, Samutsakorn, Samutsongkram, Ratchaburi and Phetchaburi. Its total area is 30,837 Km^2 (Figure 2.1)

The lower Maeklong River Basin which is the study site of this investigation covers 5,430 Km^2. The distances measured from the river mouth to each location are follows:

- To Samutsongkram 6 Kilometers
- To Ampawa 15 Kilometers
- To BangKhonthi 20 Kilometers
- To Dumnernsaduak 27 Kilometers
- To Ratchaburi 37 Kilometers
- To Photharam 57 Kilometers
- To Banpong 71 Kilometers
- To Maeklong Dam spillway 109 Kilometers

2.1.2 Geography

The geography of the study area can be classified into three types which are follows:

a) Mountain and Hill

Areas having the height over 50 meters above the adjacent valley bottom and more than 10 % slope. This type of geography covers about 70% of the basin. Due to the extended areas of mountains and big rivers with large amount of water, two major dams, Kholaem Dam and Srinakarin Dam were constructed.

b) Rolling Plain

Areas having the height between 50 to 100 meters above the adjacent valley bottom and the slope between 2 % to 10 %. This type of geography is found in the south west part of the area and covers about 10 % of the whole basin.

c) Plain

Areas having the height lower than 30 meters above the adjacent valley bottom and slope smaller than 2 %. This type of geography is found in both sides of the Maeklong River, from Kanchanaburi to Samutsongkram, covering about 20 % of the whole basin. Flooding occurs in this type of geography.

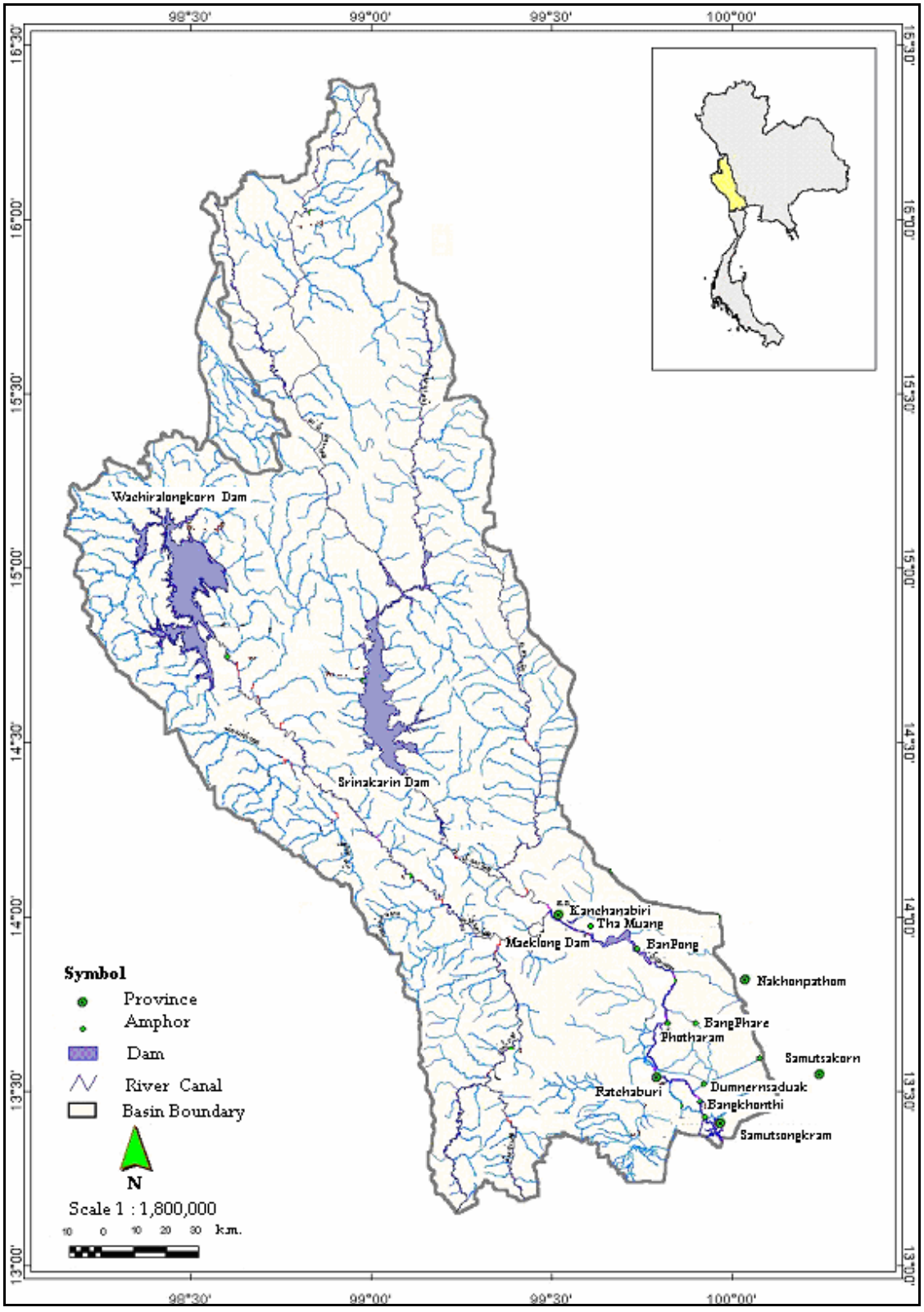


Figure 2.1: Location and Boundary of Maeklong Basin

Source: Royal Irrigation Department of Thailand (RID)

2.1.3 Land Use and Economic Situation

About 70 % of the Maeklong River Basin areas are forest, mostly in the upper part of the basin. Agricultural areas are in the lower part, especially on both sides of the Maeklong River (From Kanchanaburi to the river mouths). Most part of the basin, apart from forest, is used for sugarcane plantation which is the major production of sugar of the country. The rest of the areas are for rice and others. The economic structure is based on agriculture and fishery (2).

2.1.4 Flooding Problem

Flooding problem usually occurs during rainy season due to the flat geography and the effect of marine tides. Flooded areas are shown in Figure 2.2

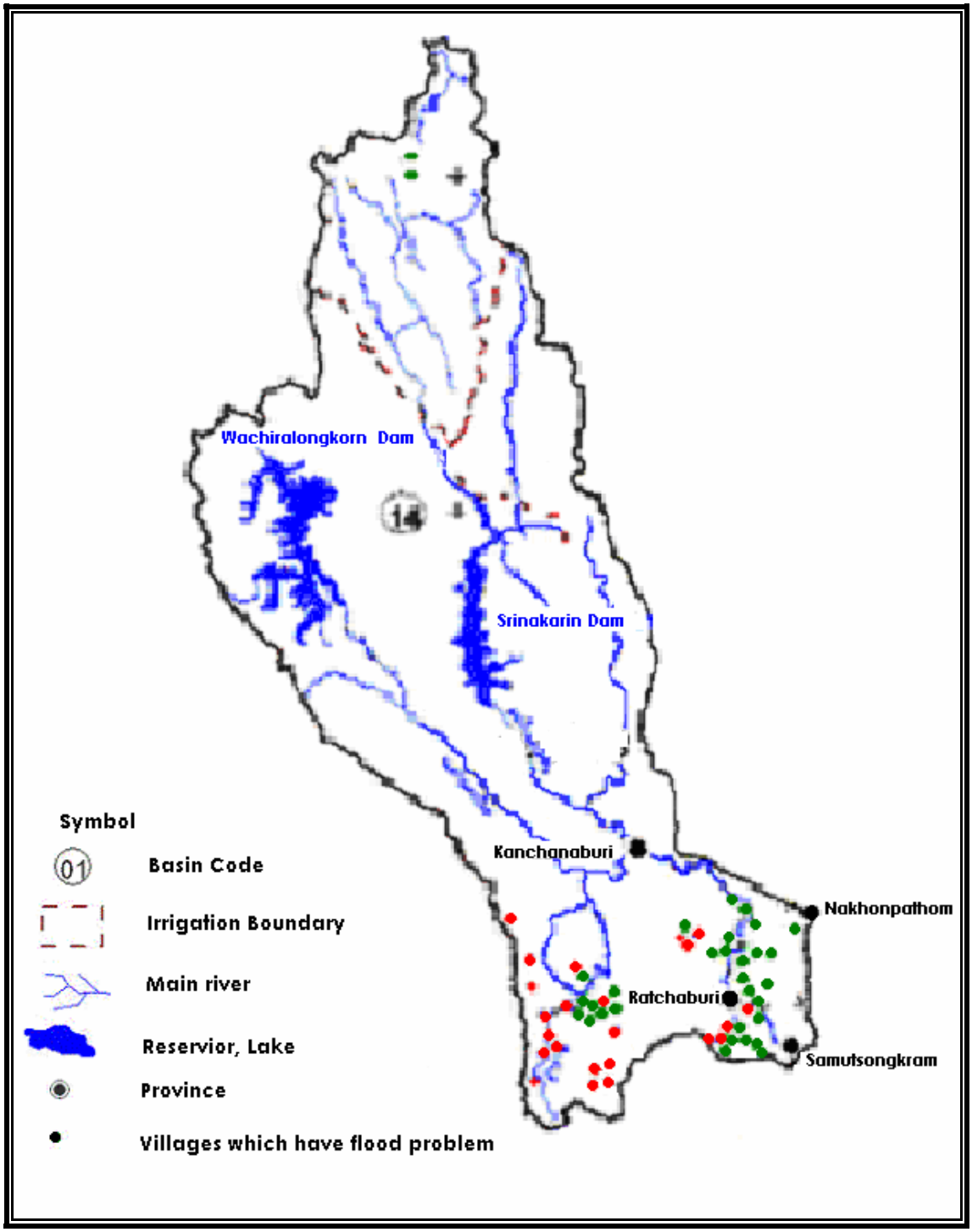


Figure 2.2: Flooded Areas in Lower Maeklong River Basin

Source: Royal Irrigation Department of Thailand (RID)

2.2 Hydrological Model

At present there are a number of hydrological models which can be used in hydrological prediction and are compatible to different types of computers, personal computers and mainframe. Most of these models were developed by government agencies or academic institutions of many countries. DeVries and Hromadka (1993) divided the hydrological models into the groups: 1) Single-event rainfall-runoff and routing models; 2) Continuous-stream-flow; 3) Flood-hydraulics model and 4) Water-quality models.

2.2.1 Single-Event Rainfall-Runoff and Routing Models

HEC-1 is an example of this type of model. It is used to model the flow processes of complex watersheds by using rainfall as input and a link between hydrology and hydraulic. It can be used for analyzing different types of flood, evaluating damages caused by flooding, and offering proper measures to control flooding. It can be extended to find a relationship between flow rate and flow frequency of ungauged watersheds. It was developed by Hydrologic Engineer Center of the U.S. Army Corps of Engineers (3) and is widely used in U.S.A.

2.2.2 Continuous-Stream-Flow

SHE (Systeme Hydrologique European) is an example of this type. It was developed by three organizations: the Danish Hydraulic Institute, the United Kingdom institute of Hydrology and the French Consulting company SOGREAH with an objective to increase the model abilities in hydrology. It is suitable for studying input of landuse on water quality. The model structure is rather flexible for wide range of inputs and parameters. Inputs to the model are water characteristics, rainfall, meteorological data, and vegetation type. Other sub-models, for example, water quality and sedimentation can be added (4).

2.2.3 Flood-Hydraulics Model

HEC-2 was developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers to compute steady-state water surface elevation profile in natural and constructed channels (5). Its primary use is for natural channels with complex geometry such as river and stream.

HEC-2 uses the standard step method for water surface profile calculation, assuming that flow in one dimensional, gradually varied steady flow. Usually a different discharge is used for each profile. The discharge can be changed at each cross section to reflect tributaries, lateral inflows or diversions. The water surface elevation at the starting cross section can be specified in one of four ways: as a given elevation, as critical depth by a rating curve or as a computation by program, by the slope-area method. The water surface elevation associated with critical flow is computed for conditions of minimum energy at cross section.

In a few last years, HEC has developed HEC-RAS, for River Analysis System that has the same features as HEC-2 but difference is Windows interface.

2.2.4 Water-Quality Models

MIKE11 was developed by the Danish Hydraulic Institute (DHI) for the simulation of flows, water levels and transport of sediment and dissolved or suspended materials (6). MIKE 11 is a general purposed microcomputer based model that simulates not only rainfall-runoff processes, but also river hydraulics, sediment transport and water quality. MIKE 11 can be used in design, management and operation of river systems and channel networks. MIKE 11 provides a similar set of modeling system capabilities in mainframe computer.

Mike 11 model consists of several individual modules, allowing the user to add specific modules for various types of hydrologic simulation as the need for these features arises in the application. It is configured with a core component termed

the basis module plus a series of other add-on modules. Mike 11 model consists of four modules as following:

1) Hydrological Information System (HIS Module):- this module is used for management, processing, presentation and analysis about time series of some data.

2) Rainfall-Runoff (Nam Module):- this module function is used for stream flow calculation by using rainfall as input.

3) Hydrodynamic Module (HD Module):- this module is used for hydro - movement calculation.

4) Flood Forecasting Module (FF Module): this module is used for flood forecasting.

2.3 Geo-Informatics

Some techniques are familiar to make flood areas map using geo-informatics. For examples;

2.3.1 Digital Terrain Models and Digital Elevation Models

Digital terrain and elevation models provide graphical representations of land surface elevations. A digital terrain model (DEM) generally deals with a regular array of elevations, normally created in a square grid or hexagonal pattern over the ground surface (7). The shortcoming of this regular grid-based approach is that the distribution of the data points is not related to the characteristics of the terrain itself (8).The DEM approach is superior for analysis of very large areas where fully automated data collection is much more cost-effective. Canada and most western European nations are undertaking similar programs for the development of DEM data from existing topographic data.

By contrast, a Digital elevation model (DTM) can usually accept elevations at random locations. As such, a DTM can preserve important topographic features such as ridge lines, stream banks and stream-flow lines. Generally, the DTM approach is superior for local areas in which data for specific features are available.

2.3.2 Geographic Information System: GIS

A geographical information system is an electronics system of maps connected to tables of data that describe the features on the maps. A vector-based GIS describes map features as points, line, or polygons. Points can represent gauging station, capital city etc. Lines can represent river, road etc. A polygon can represent government boundary, countries etc.

A GIS can store and analyze the data by using relationships between the various points, lines and polygon entities. Each spatial feature in a GIS has a unique geographic location specified by its coordinates and a unique identifying number by which it is connected to descriptive data in a relational database. The GIS generally uses Structured Query Language or similar nonprocedural database query language to find information in the database. A complete GIS system contains computer mapping and display capabilities for generating high-quality cartographic products. The user can specify size and scale to produce the desired map outputs (9).

2.4 Related Researches

The related researches with this investigation have not much. However, the examples of the similar research with this investigation as the follows:

Wongwitaya (2544) had developed and modified ArcView GIS, which is a geographic information system (GIS) to make flood map in the Yom Basin but in this study, the focus was on Phare and Sukhothai Province. In this investigation,using some functions in ArcView along with the developed program. The program has the capability to develop the flood area maps. By integrating maximum flood water level

data from MIKE 11 along with geological information data. The result of research is the application, which can make GIS flood map boundary similar to that of a manual flood map in shape and area, users can observe the preliminary spread out of flooding area. However, the accuracy of the result depends on the scale of the contour line input. The large scaled data shoed better results compared to the smaller one (10).

Arayawongwarn (2544) had studied the flood phenomena in the Yom basin, Phare province by using MIKE 11 and the Geographic Information System (GIS). MIKE11 is used for forecasting flooding at three periods of 10 years, 25 years and 100 years. The GIS is advantageous for displaying spatial data and it is applied for estimating flood areas and generating flood maps. The maps are analyzed considering physical factors and land use change, which are also considered in this research, in order to suggest guidelines for management of future flood areas in the Yom basin, Phare province. The results of the flooding forecast indicate that most of the maximum water levels at the reference points are over the banks, scattered throughout the river. Flood areas are mainly occupied by forest, agriculture and urban areas. The future flooding areas will not be much different from the present (11).

Weerapan (2538) had studied on flood forecasting and warning at Hat Yai Station by using MIKE 11 model. NAM parameters and hydrodynamic coefficients have been calibrated by the model until the simulated water levels and discharges approach to the observed data. After that all calibrated parameters have been used for testing a flood forecast module. The final result of the testing gives an acceptable error. It means that, the modeling is suitable for a daily operational flood forecasting. However, U-thaphao River is a small and flashy catchment. Using daily data in the model will get some errors especially in the period of heavy rains. So, hourly data, such as, three or six hourly interval data should be observed and used in the model for giving a high accuracy of forecast (12).

Chanasriratanakul (2543) had carried out the application of HEC-RAS in conjunction with GIS for Flooding in Lower Chao Phaya River. The objective of this study is to analyze data which is effected to flooding in lower Chao Phaya River by

collecting the data from three of responsible government agencies, the Royal Irrigation Department, the Harbour Department, and the Port Authority of Thailand. The “HEC-RAS” Hydraulic Model is a selective analytical tool to be applied for studying about the river in Thailand so as to calculate and find appropriate variables for the Chao Phaya River. By this model, the variables effected to the flood state are found and they can be use for prediction of flooding at any return period on the basis of Hydrological principle. The outcome of “HEC-RAS” can be linked with Geographic Information System by using Map Basic and Visual Basic languages. It can indicate flood plain and flood level in expected areas, provinces, districts and irrigation projects at various return periods. The result of this analysis enables the director of irrigation projects to prepare plan and measures for flood mitigation immediately and more effectively (13).

CHAPTER III
RESEARCH METHODOLOGY

Concept of the model developed is based on the fact that flow rate is highly correlated to flow depth and high flow rate takes less travel time than that of low flow. As the equation of upstreamsites, flow elevation at downstream site can be calculated. In general, modeling hydrologic response, in this case flood elevation at interesting site, requires rainfall data as inputs to the model. However, in this study area, the watershed had been regulated by three large dams, Srinakarin Dam, Khaoleam Dam, and Maeklong Dam. Rainfall data can not be used in calculating model output any longer because the flow of water is now controlled by men, not by nature. Input data used in this study were flood elevation records at Maeklong Dam spillway. The water level data can represent to the quantity of water (Q). A rational equation is suitable for such case.

As previously discussed, the purpose of this study is to develop a mathematical model to predict flood areas. In order to acquire accurate results, specific methods must be accomplished. The methodology can be discussed as shown in Figure 3.1

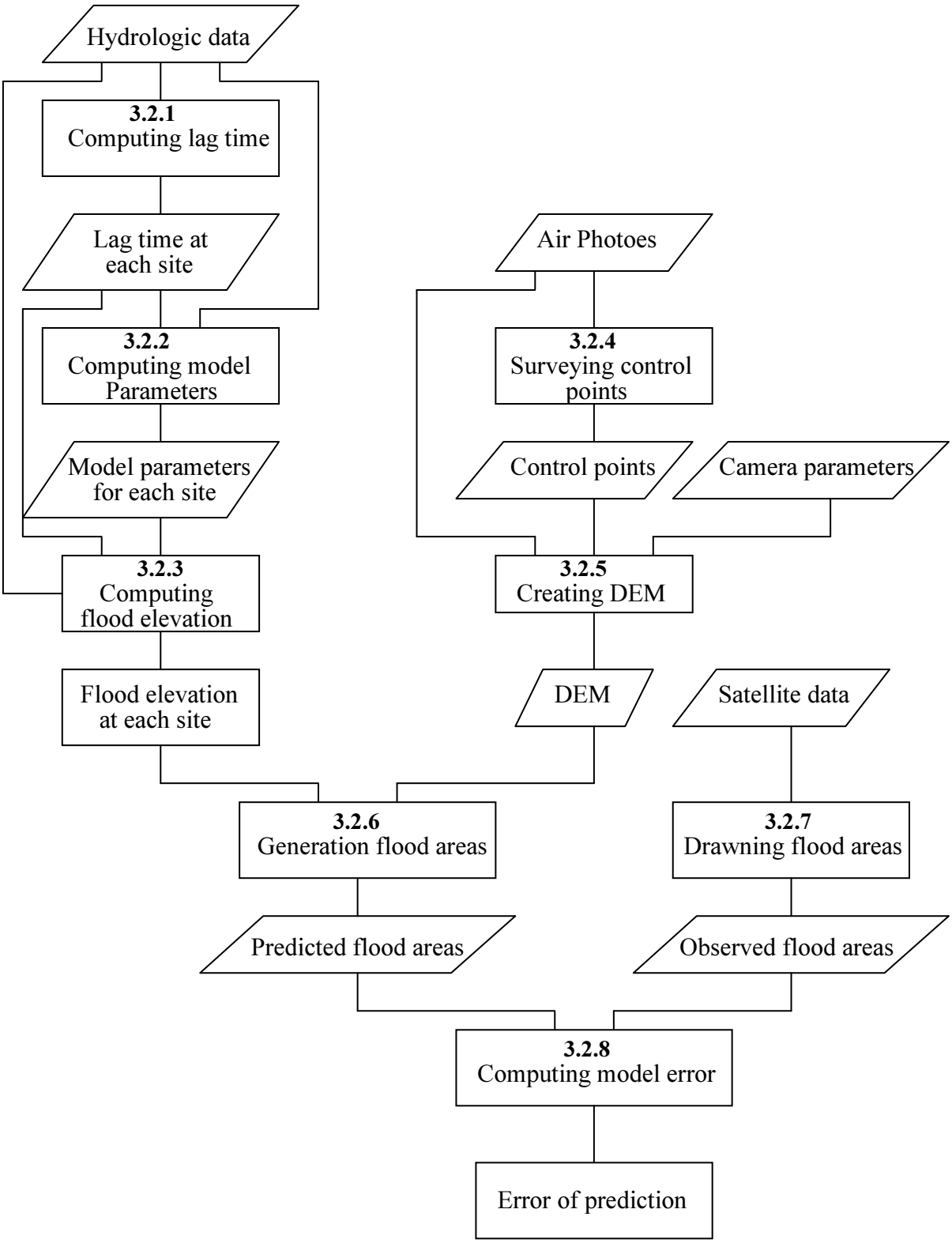


Figure 3.1: Flow Chart of Research Methodology

Steps of Research Methodology

3.1 Data Collection: data used in this research are explained as follows:

3.1.1 Hydrologic Data

The hydrologic data in this investigation have used the hydrograph records for five years. Those are described in chapter one in limitation of this investigation. Because of the water level is able to refer the of water (Q). Thus, this investigation, the used water elevation of Maeklong Dam is used for representation of the of water (Q). Those are described in chapter one in limitation of this investigation. The hydrograph records are shown at the following stations (Table3.1) and the location of these stations are shown in Figure 3.2

No.	Location	Province	Code	Month	Year	Recorded data type
1	Ban Wang Khanai, Amphur Tha Muang	Kanchanaburi	K11 A	September to November	1998 to 2003	Water level and Date
2	Amphur BanPong	Ratchaburi	K55	September to November	1998 to 2003	Water level and Date
3	Siriluk Bridge, Amphur Photharam	Ratchaburi	K56	September to November	1998 to 2003	Water level and Date
4	Amphur Maung	Ratchaburi	K2B	September to November	1998 to 2003	Water level and Date
5	Amphur Bangkhonthi	Samutsong kram	K57	September to November	1998 to 2003	Water level and Date

Table 3.1: Gauging Stations (Source: Royal Irrigation Department of Thailand)

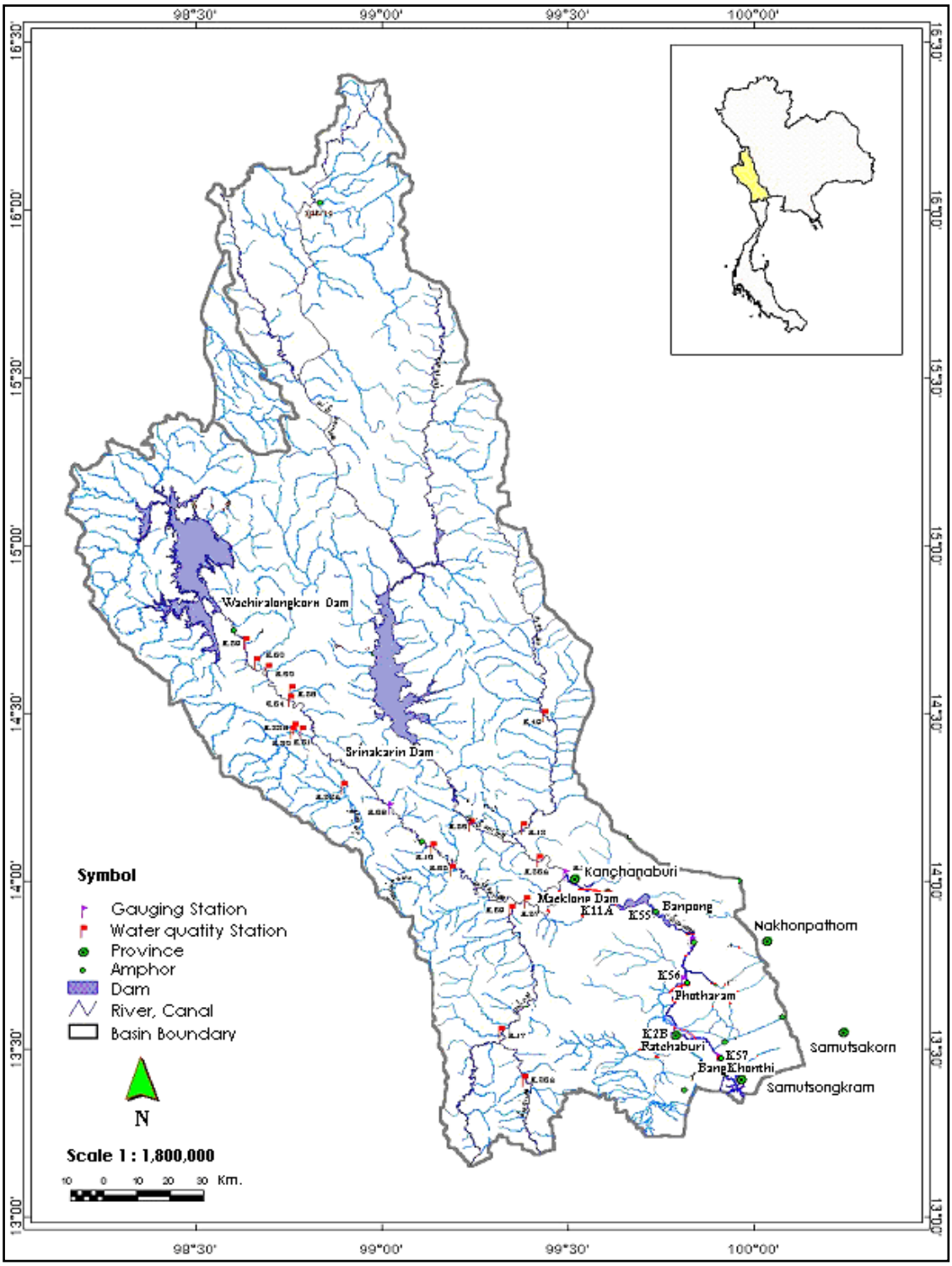


Figure 3.2: The Location of Gauging Stations in Maeklong River basin

Source: Royal Irrigation Department of Thailand (RID)

Hydrologic data were used to compute lag time, model parameters and flood elevation.

3.1.2 Air Photoes

The air photoes were used in digital format so that they could be processed by the software IMAGINE OrthoBASE Pro. Digital air photoes consist of camera parnameters data for creating DEM using the photogrammetric technique, camera parameters are needed. Camera parameters are constant values of the camera used in taking airphotoes, for example lense distortion value, principle point error, etc.

This investigation used the air photoes from Ministry of Agriculture and Cooperatives which have the following details:

- The air photoes of the lower Maeklong River Basin which were taken in Year 2002 on scale 1:25,000

3.1.3 Sattlelite Data

The used sattlelite data were LANDSAT 5 taken on 19 November 2003 in which high flood occurred. The flood areas were delineated manually to find flood boundaries. The boundaries were later used as observed flood areas to compare to those predicted by the model. Then error of prediction could be obtained.

3.2 Model Development

Model development consists of the following steps

3.2.1 Computing Lag Time

Lag time is the time required for the water to flow from one site to the other. For example, lag time of the station K 55 is 6 hours means the water requires 6 hours to flow from the station K11A to station K 55. In calculating lag time, a peak flood elevation of the station K11A was marked as the beginning of flow, then a peak

flood elevation of the sites downstream, for example K55 at the later time was marked. The time difference between the two peaks is the lag time of the station K55. Figure 3.3 explains lag time determination.

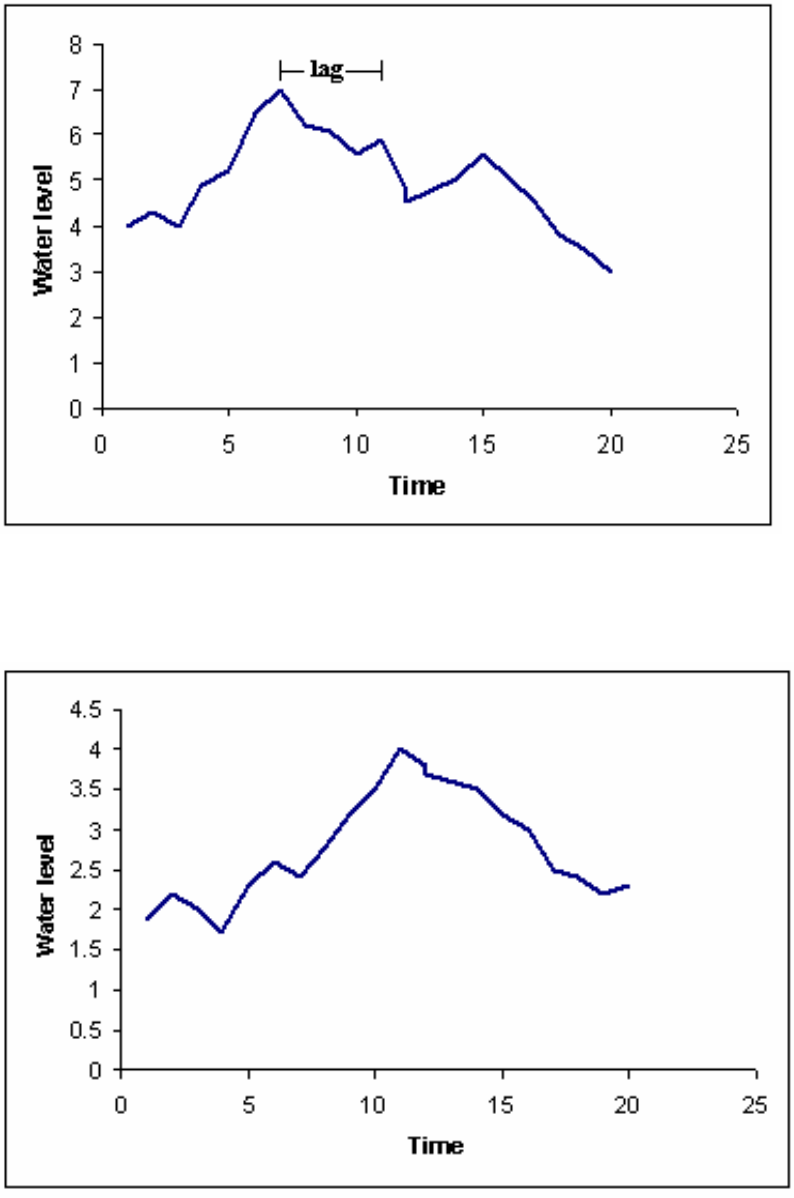


Figure 3.3: Lag Time Determination

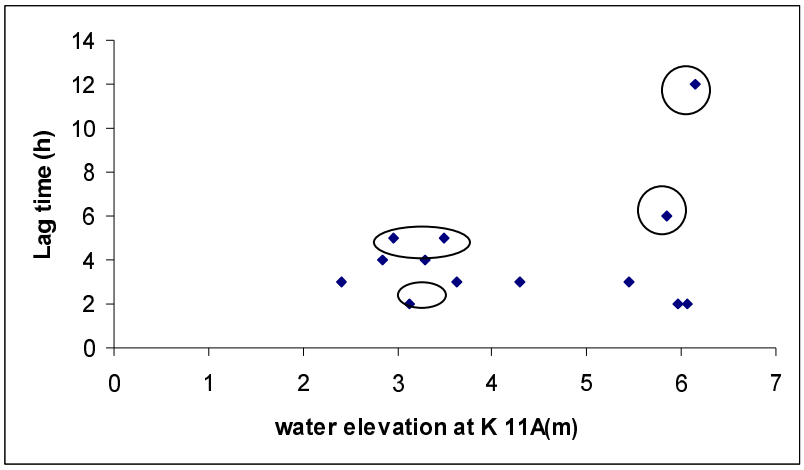
For more accurate results, serveral lag time values obtained from serveral peaks should be used in plotting a graph showing a relationship between lag time (as y-axis) and water elevation (x-axis). Incorrect points should be eliminated from the graph.

The incorrect points from lag time graph are eliminated using the following:

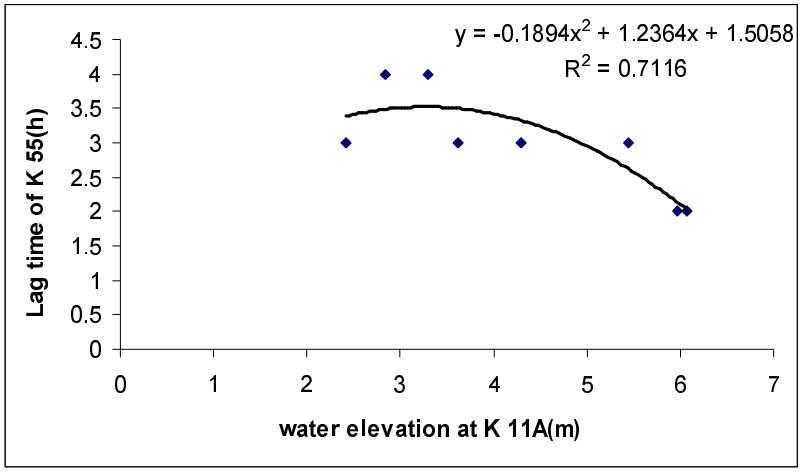
- The incorrect points do not follow natural flow processes. For example high water elevation should cause less lag time because the high water elevation results in high flow rate and that requires less flowing time and visa versa

- The relationship between the water level of K11A and lag time of each station (R-square) should be more than 0.7 for getting the data series which are able to calculate lag time equation accurately

Figure 3.4 (a) shows lag time before eliminating some incorrect points. Figure 3.4 (b) shows the improvement of lag time accuracy after elimimitating some incorrect points.



(a)



(b)

Figure 3.4: The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway: (a) Before Eliminating Incorrect Points; (b) After Eliminating Incorrect Points, the Accuracy Improves.

3.2.2 Computing Model Parameters

The mathematical model developed here consists of 4 rational equations (one for each site) as follows:

For Banpong (K55); $E1_{(t+l1)} = a_1 H^{b1}_{(t)}$ 3.1

For Photaram (K56); $E2_{(t+l2)} = a_2 H^{b2}_{(t)}$ 3.2

For Ratchaburi (K2B); $E3_{(t+l3)} = a_3 H^{b3}_{(t)}$ 3.3

For Bangkhonthi (K57); $E4_{(t+l4)} = a_4 H^{b4}_{(t)}$ 3.4

Where:

E_1, E_2, E_3 and E_4 = the water elevation at K55, K56, K2B and K57 respectively (m)
a_1, a_2, a_3 and a_4 = model parameters at K55, K56, K2B and K57 respectively
b_1, b_2, b_3 and b_4 = model parameters at K55, K56, K2B and K57 respectively
t = time stamped
l_1, l_2, l_3 and l_4 = lag time at K55, K56, K2B and K57 respectively (h)
H = water elevation at Maeklong Dam spillway (K11A)

In calculating model parameters a set of hydrologic data were used as inputs while the rest were kept for testing the model. In general, the number of hydrologic data used was larger than the number of unknowns in the equations. This situation is known as "over determined" case. Solving the over determined an equation requires the Least Square Approximation which can be discussed as follows:
For example from the equation:

$$E_{1(t+l_1)} = a_1 H_{(t)}^{\ b1}$$
$$\log (E_{1(t+l_1)}) = \log (a_1) + b_1 \log (H_{(t)})$$
$$y = c + b_1 x$$

Where:

$y = \log (E_{1(t+l_1)})$; $c = \log (a_1)$; and $x = \log (H_{(t)})$

Input the lag time data and hydrologic data, the solution of the equation is

$$b_1 = \frac{N(\Sigma xy) - (\Sigma xy)(\Sigma y)}{N(\Sigma x^2) - (\Sigma y^2)}$$
$$c = \frac{\Sigma y - b (\Sigma x)}{N}$$

Where:

N = the number of input records

Applying the antilog to c, the parameters a and b can be determined. Repeat the steps for other sites, then the parameters a_2, a_3, a_4, b_2, b_3 and b_4 can be calculated.

3.2.3 Computing Flood Elevation

Equation 3.1, 3.2, 3.3 and 3.4 with known parameters a_1, a_2, a_3, a_4, and b_1, b2, b_3 and b_4 were used to calculate flood elevation. A set of hydrologic data, apart from those used in calculating the model parameters, were used as inputs to these equations. Lag time was calculated by the lag time equations given in chapter four. Output of these equations was flood elevation: - the water elevation at each site that causes flooding. Flood elevation was used with DEM to find flood areas.

3.2.4 Surveying Control Point

Control points are needed for generating DEM using photogrammetry. Control points are the points that can be recognized in air photos and in the terrain and their coordinates in the air photos and in the terrain must be known.

The more number of control points, the more accuracy of DEM obtained. However, more control points requires more time and budget to work. A suitable number of control points for an air photo block should be used. In general, the suitable number of control point and the arrangement is shown in Figure 3.5(IMAGINE OrthoBASE User's guide, 2004)

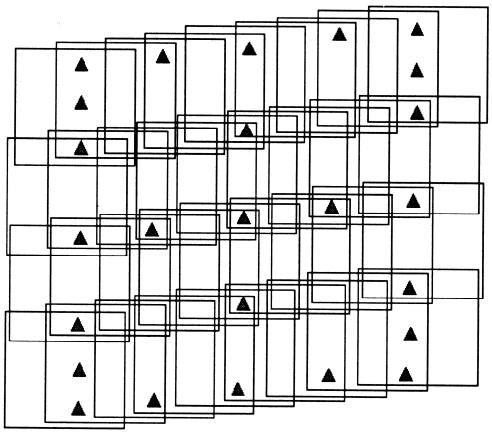


Figure 3.5: Suitable Number of Control Points

3.2.5 Generating DEM

Equations used in generating DEM are:

$$x = x_0 - f\left[\frac{m_{11}(X - X_0) + m12\,(Y - Y_0) + m13\,(Z - Z_0)}{m_{31}(X - X_0) + m_{32}\,(Y - Y_0) + m_{33}\,(Z - Z_0)}\right] \quad \ldots\ldots\ldots\ldots 3.5$$

$$y = y_0 - f\left[\frac{m_{21}(X - X_0) + m_{22}\,(Y - Y_0) + m_{23}\,(Z - Z_0)}{m_{31}(X - X_0) + m_{32}\,(Y - Y_0) + m_{33}\,(Z - Z_0)}\right] \quad \ldots\ldots\ldots\ldots 3.6$$

Where:

$m_{11} = \cos \phi \cos \kappa$

$m_{12} = \sin \omega \sin \phi \cos \kappa + \cos \omega \sin \kappa$

$m_{13} = \cos \omega \sin \phi \cos \kappa + \sin \omega \sin \kappa$

$m_{21} = \cos \phi \sin \kappa$

$m_{22} = \sin \omega \sin \phi \sin \kappa + \cos \omega \cos \kappa$

$m_{23} = \cos \omega \sin \phi \sin \kappa + \sin \omega \cos \kappa$

$m_{31} = \sin \phi$

m_{32} = $\sin \omega \cos \phi$

m_{33} = $\cos \omega \cos \phi$

If the number of control points is more than the minimum number of equations used, the Least Square Approximation is used. The values of x, y was obtained by air photo measurements, the values of X, Y, Z were obtained by control point survey. Therefore, the six parameters ω, ϕ, κ, X_0, Y_0 and Z_0 in the equation 3.5 and 3.6 were solved by the Least Square Approximation. The six parameters (ω, ϕ, κ, X_0, Y_0 and Z_0) were plugged in to the equations 3.5 and 3.6, then X, Y, Z of all pixels in the overlapped air photoes were calculated. The values of X, Y, Z are the DEM which were used in mapping flood area.

In this investigation, the processes of creating DEM was done by using the program IMAGINE OthoBASE Pro. The method of using the program is explained as follows:

Start the program IMAGINE OrthoBASE Pro, then choose create a new OrthoBASE project

1. Create New Block File
2. Select Geomatic Model
3. Block Property Setup
4. Add Image Frame
5. Computer Pyramid Layers
6. Loading the Existing, Camera Parameters
7. Entering Interior Orientation and Entering Exterior Orientation
8. Measuring Ground Control Points and Check Points
9. Performing Automatic Tie Points
10. Performing Aerial Triangulation
11. Loading Image for Generating DEM
12. Set Extraction Options
13. Run DEM

3.2.6 Generating Flood Areas

Data for generating flood area required are computed flood elevation and generated DEM The program ArcView is used to select all pixels having the values equal or less than the flood elevation. The process can be explained as follows:

Start the program ArcView 3.3, then

1. Create a New Project with a New View
2. Add Data Sources
3. Creating TIN from Features and Save Tin File
4. Convert TIN to Grid
5. Flood Areas Analysis

3.2.7 Drawing Flood Areas

Data required are remotely sensed data taken on the day having the highest level of water recorded at the Maeklong Dam spillway. Because water surface reflects less energy, therefore the pixels representing water surface have darker color than those of surrounding. The observed flood areas are boundaries of dark color pixels. These boundaries were drawn manually and were used to test the generated flood areas.

3.2.8 Computing Model Error

The difference between generated and observed areas can be visually compared to determine the error. However, a statistical method should be used to quantify the error rather than the visual comparison. There are two types of comparison: boundary comparison and area comparison. The boundary of flood area is the interface line between the water and the land. In this study the comparison between predicted and observed flood boundaries was done because it is easy to handle and yet gives good results. In other words, if the boundary difference is acceptable, then the

areas difference is also acceptable. The error of prediction can be calculated by equation 3.7

$$E = \frac{1}{NL} \sum_{i=1}^{N} |li| \qquad \text{……...…… 3.7}$$

Where:

E = error of prediction

N = total number of test points

L = the length of boundary line

$|li|$ = absolute values of the shortest distance between observed and predicted flood boundary

The application of equation 3.7 to flood boundaries can be visualised in Figure 3.6

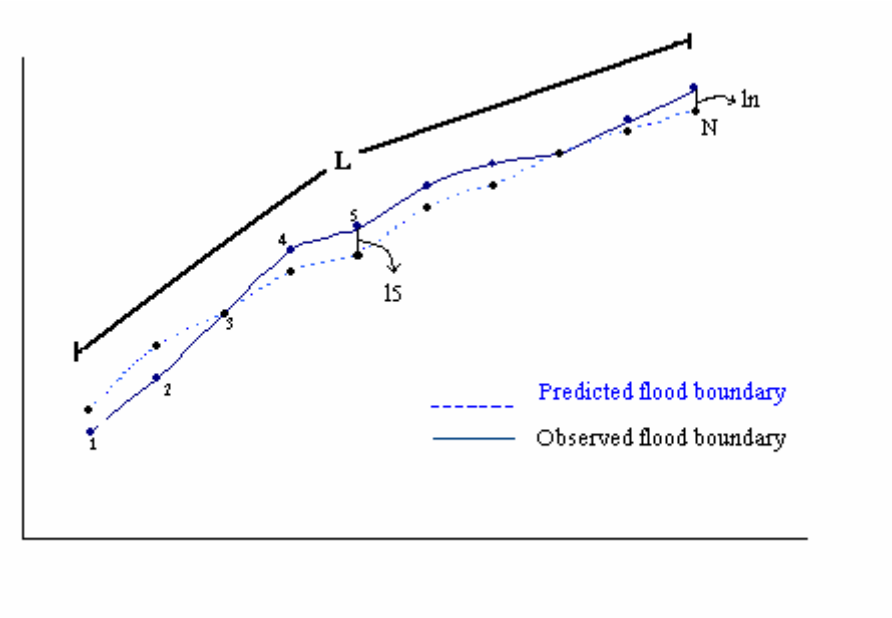


Figure 3.6: Predicted Flood Boundary and Observed Flood Boundary

The value of E can be expressed as, for example: 1/1,000, 1/25,000. The less value of E, the better model prediction.

3.3 Research Tool

3.3.1 Hardware Requirement

PC Computer **1** **Unit**

- CPU pentium III 1 GHz.
- HDD 20 GB
- RAM 256 MB
- Monitor 14 "

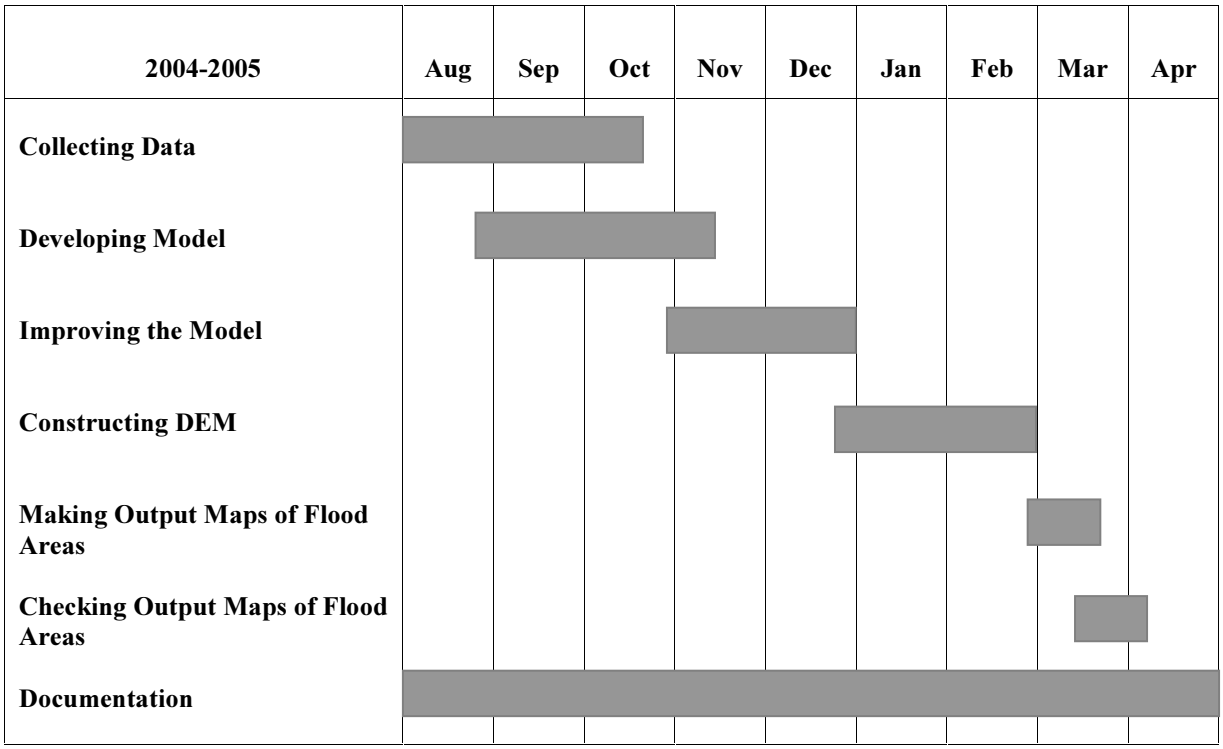
3.3.2 Software Requirement

1. ArcView GIS version 3.3
2. Spatial Analysis 1.2
3. 3D Analysis 2.0
4. IMAGINE OrthoBASE Pro 8.5.1

3.3.3 OS

1. Microsoft Window XP Professional

3.4 Time Line


2004-2005
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Collecting Data
Developing Model
Improving the Model
Constructing DEM
Making Output Maps of Flood Areas
Checking Output Maps of Flood Areas
Documentation

CHAPTER IV
RESULT

Research methodology has been discussed in Chapter three. It is expected that those who follow the methods described in Chapter three should get similar results shown here. However, in using a model, prediction error is unavoidable because no model can handle all natural processes. In order words, some natural processes must be skipped from the model and that causes prediction error. This chapter also discusses magnitude of error and methods to avoid it. Step of working are calculating lag time, calculating model parameters, calculating flood elevation, generating DEM, generating flood areas, creating actual flood map, computing model error. For better understanding, an example of calculation was shown.

4.1 Lag Time at Each Site

Data required for calculating lag time are flood elevation measured at Maeklong Dam spillway (K11A), Banpong (K55), Photaram (K56), Ratchaburi (K2B) and Bangkhonthi (K57) as shown in table 4.1, 4.2, 4.3, 4.4 and 4.5.

Table 4.1 : Maximum Water Level at Maeklong Dam Spillway (K 11A) During 1998 to 2002

Date	Time	Water Level at K 11A (m.)
7 Oct 98	24.00	5.84
4 Nov 98	04.00	3.12
25 Sep 99	06.00	2.41
27 Oct 99	12.00	5.97
4 Nov 99	05.00	6.07
8 Sep 00	15.00	3.62
8 Oct 00	09.00	4.3
1 Nov 00	11.00	3.29
2 Sep 01	12.00	3.49
16 Oct 01	05.00	2.95
3 Nov 01	06.00	2.84
25 Sep 02	22.00	6.14
9 Oct 02	07.00	5.45
27 Nov 02	19.00	3.23

Table 4.2 : Water Level at Banpong (K 55) During 1998 to 2002

Date	Time	Water Level at K 55 (m)
8 Oct 98	06.00	0.24
4 Nov 98	06.00	0.09
25 Sep 99	09.00	0.95
27 Oct 99	14.00	5.67
4 Nov 99	07.00	6.29
8 Sep 00	18.00	3.00
8 Oct 00	12.00	1.00
1 Nov 00	15.00	2.27
2 Sep 01	17.00	1.08
16 Oct 01	10.00	2.92
3 Nov 01	10.00	1.55
26 Sep 02	10.00	6.55
9 Oct 02	10.00	5.01
27 Nov 02	no data	no data

Table 4.3 : Water Level at Photaram (K 56) During 1998 to 2002

Date	Time	Water Level at K 56 (m)
8 Oct 98	12.00	5.30
4 Nov 98	09.00	2.00
25 Sep 99	15.00	1.60
27 Oct 99	16.00	5.10
4 Nov 99	10.00	5.82
9 Sep 00	08.00	2.86
8 Oct 00	18.00	2.80
1 Nov 00	18.00	2.70
2 Sep 01	no data	no data
16 Oct 01	12.00	2.20
3 Nov 01	12.00	1.95
26 Sep 02	10.00	5.84
9 Oct 02	12.00	5.27
27 Nov 02	no data	no data

Table 4.4 : Water Level at Ratchaburi (K 2B) During 1998 to 2002

Date	Time	Water Level at K2B (m)
8 Oct 98	15.00	2.70
4 Nov 98	15.00	1.00
25 Sep 99	18.00	1.02
27 Oct 99	18.00	2.70
4 Nov 99	12.00	3.16
9 Sep 00	06.00	0.85
8 Oct 00	18.00	1.20
2 Nov 00	09.00	1.45
2 Sep 01	no data	no data
16 Oct 01	18.00	1.52
3 Nov 01	15.00	0.95
26 Sep 02	12.00	3.34
9 Oct 02	12.00	2.91
27 Nov 02	no data	no data

Table 4.5 : Water Level at Bangkhonthi (K 57) During 1998 to 2002

Date	Time	Water Level at K 57 (m)
8 Oct 98	18.00	1.66
4 Nov 98	18.00	1.14
25 Sep 99	20.00	1.26
27 Oct 99	19.00	1.68
4 Nov 99	15.00	1.04
9 Sep 00	09.00	0.98
8 Oct 00	18.00	1.00
2 Nov 00	09.00	1.62
2 Sep 01	18.00	1.00
16 Oct 01	18.00	0.64
3 Nov 01	18.00	0.72
26 Sep 02	15.00	1.74
9 Oct 02	18.00	1.60
27 Nov 02	no data	no data

Graphs between lag time and surface water elevation at Maeklong Dam spillway can be plotted in Figure 4.1, 4.2, 4.3 and 4.4 repectively. Lag time, in this study, is the time required for the water to flow from Maeklong Dam to Banpong, Photaram, Ratchaburi and Bangkhonthi repectively. The graphs and their relationships between lag time and water elevation at Maeklong Dam spillway are shown in Figure 4.1(a), 4.2(a), 4.3(a) and 4.4(a). Their relationships between lag time and water elevation at Maeklong Dam spillway after taking at those wrong points are shown in Figure 4.1(b), 4.2(b), 4.3(c) and 4.4(b) respectively.

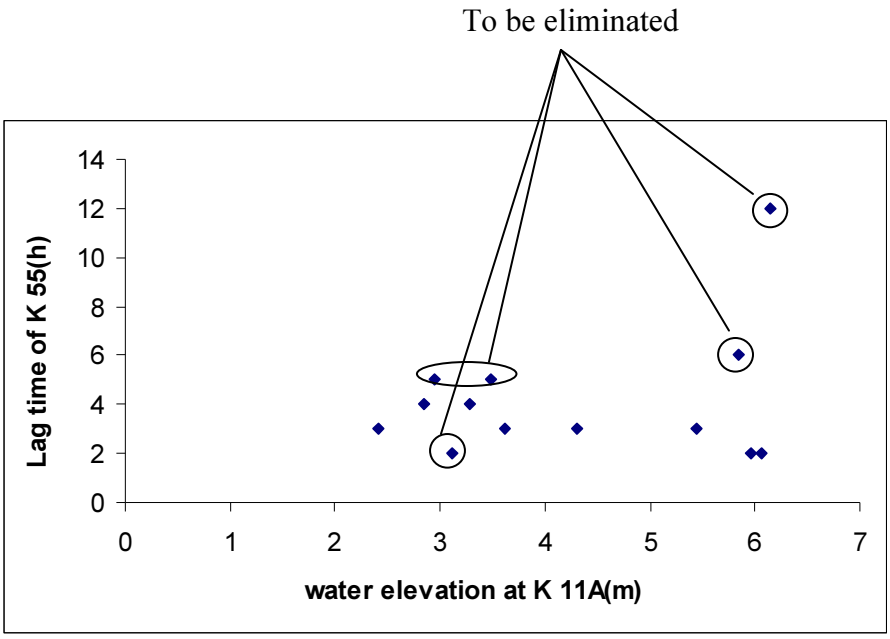


Figure 4.1(a): The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway of Banpong (K 55)

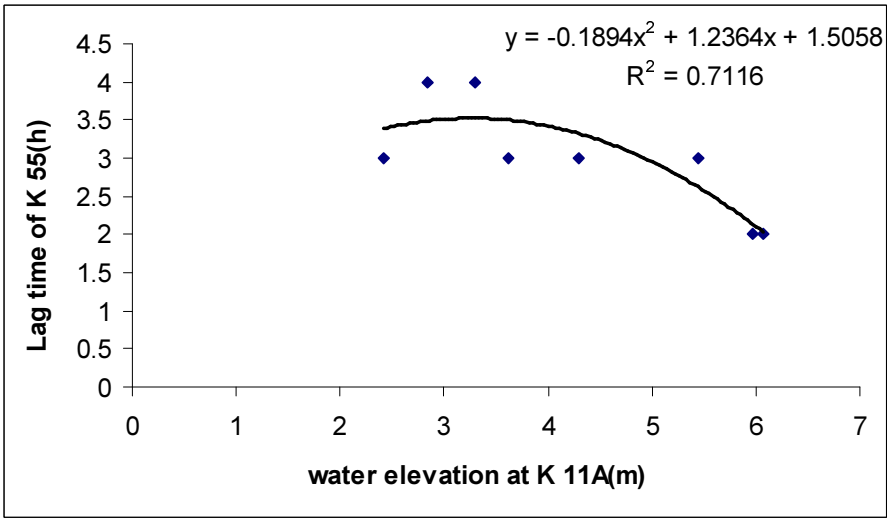


Figure 4.1(b) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway After Taking at those Wrong Points of Banpong

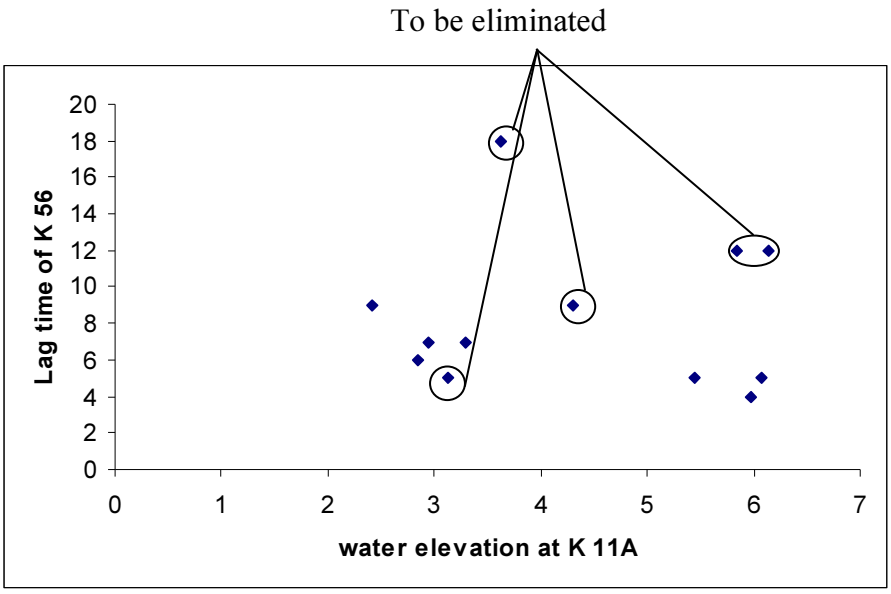


Figure 4.2(a) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway of Photaram (K 56)

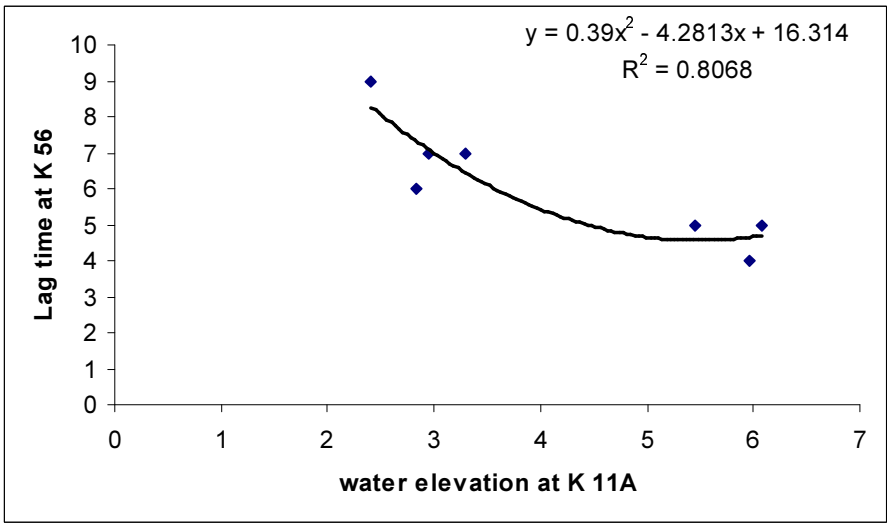


Figure 4.2(b) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway After Taking at those Wrong Points of Photharam

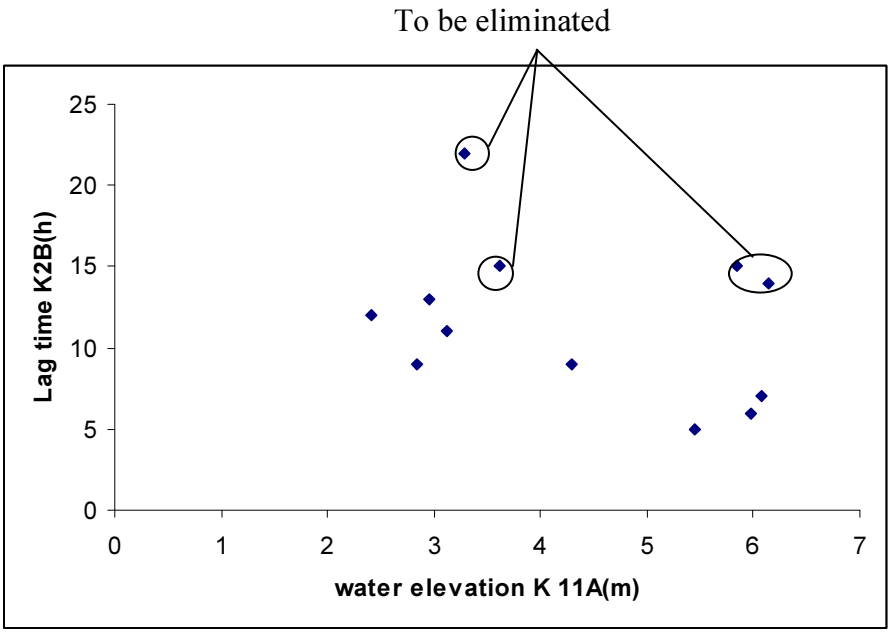


Figure 4.3(a) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway of Ratchaburi (K 2B)

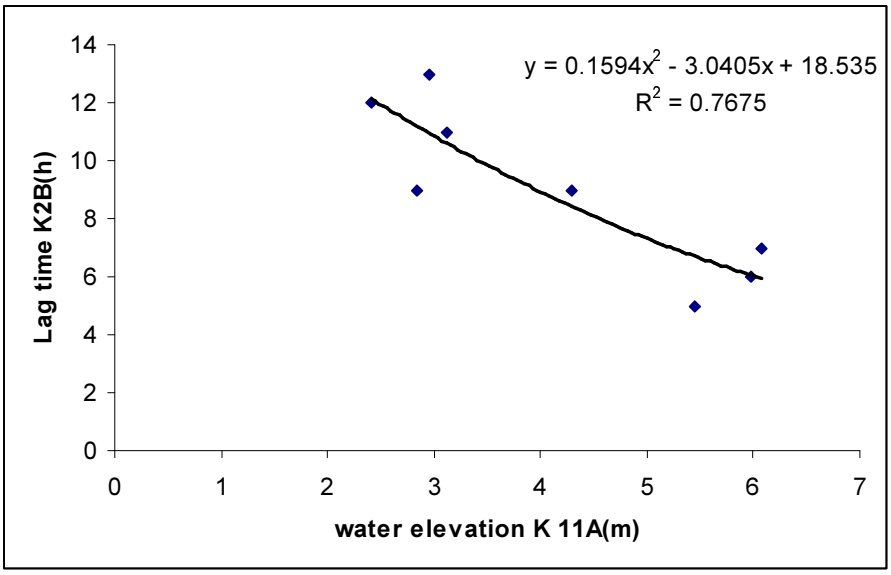


Figure 4.3(b) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway After Taking at those Wrong Points of Ratchaburi

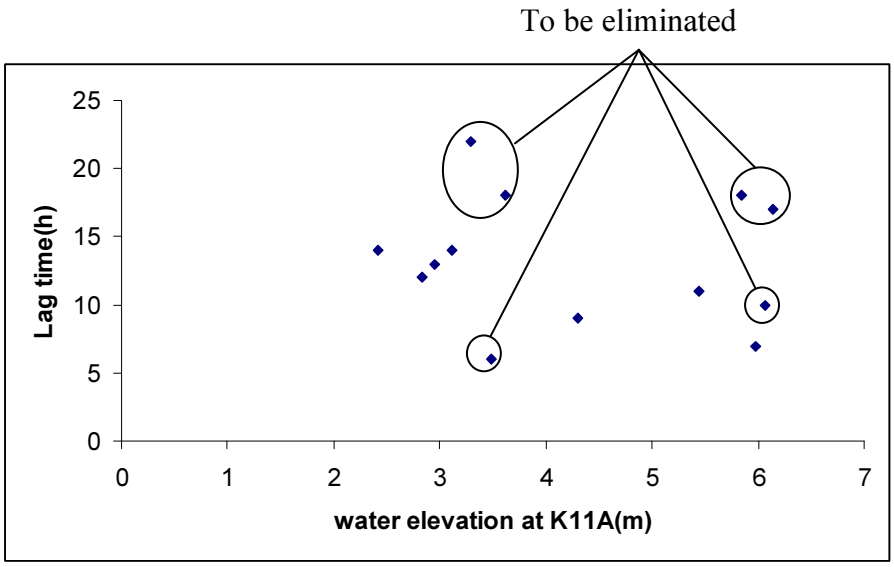


Figure 4.4(a) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway of Bangkhonthi (K 57)

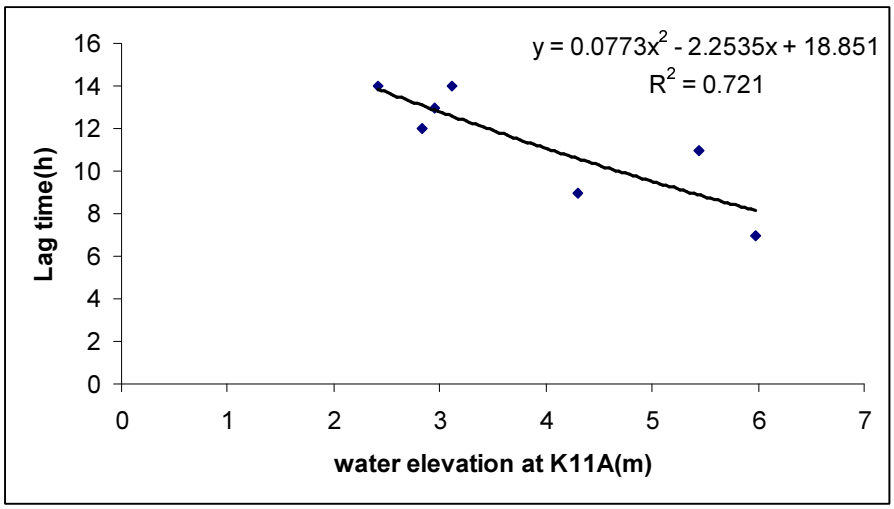


Figure 4.4(b) : The Relationship Between Lag Time and Water Elevation at Maeklong Dam Spillway After Taking at those Wrong Points of Bangkhonthi

The equation for computing lag time are:

For Banpong; $l_1 = -0.1894H_{(t)}^2 + 1.2364\ H_{(t)} + 1.5058$ ……4.1

For Photaram; $l_2 = 0.39\ H_{(t)}^2 - 4.2813\ H_{(t)} + 16.314$ ……4.2

For Ratchaburi; $l_3 = 0.1594\ H_{(t)}^2 - 3.0405\ H_{(t)} + 18.535$ ……4.3

For Bankhonthi; $l_4 = 0.0773\ H_{(t)}^2 - 2.2535\ H_{(t)} + 18.851$ ……4.4

4.2 Model Parameters

Data required for calculating model parameters are hydrographs at Maeklong Dam spillway (K11A), Banpong (K55), Photaram (K56), Ratchaburi (K2B) and Bangkhonthi (K57) as shown in Appendix in which the flowrate is represented by flood elevation. For model parameters accuracy, some incorrect points were eliminated using the same condition of computing lag time.

Figure 4.5 (a) to 4.8 (a) show the relationship between maximum water level at Maeklong Dam spillway and each site. Figure 4.5(b) to 4.8 (b) show the relationship between maximum water level at Maeklong Dam spillway and each site after taking at those wrong points.

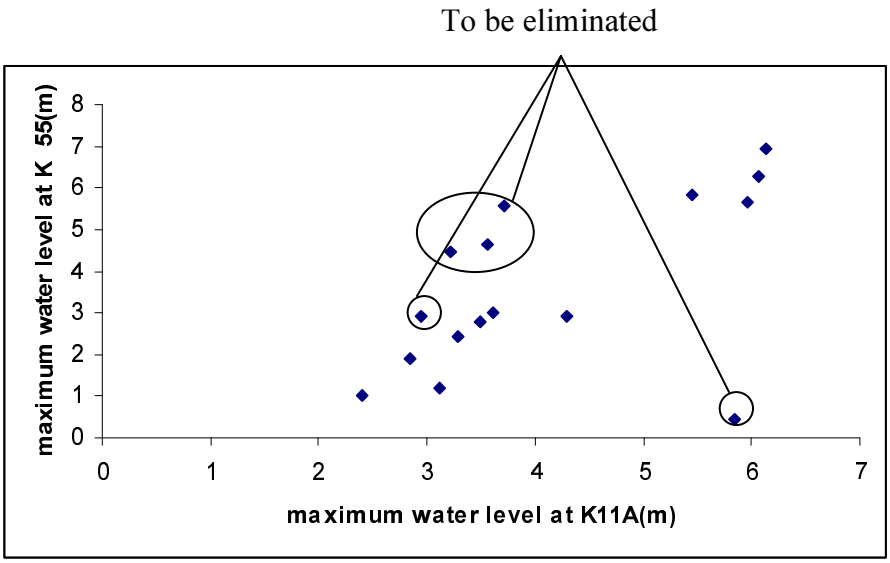


Figure 4.5(a): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Banpong (K55)

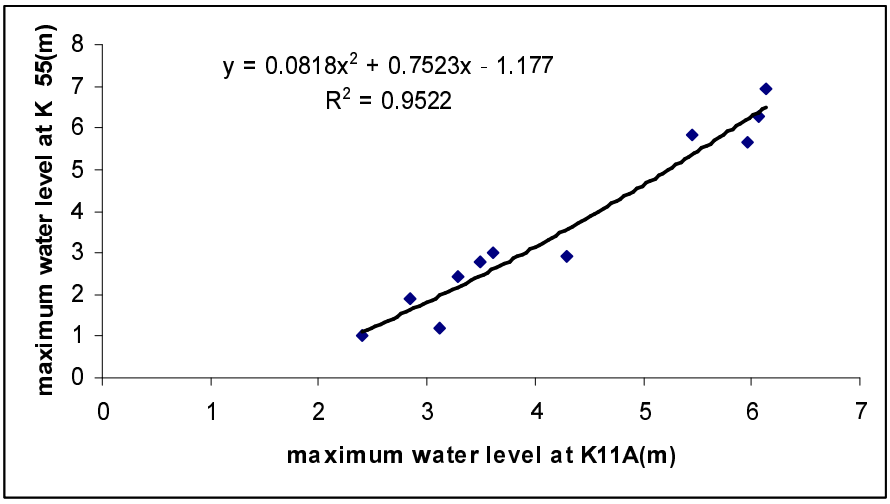


Figure 4.5(b): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Banpong After Taking at those Wrong Points

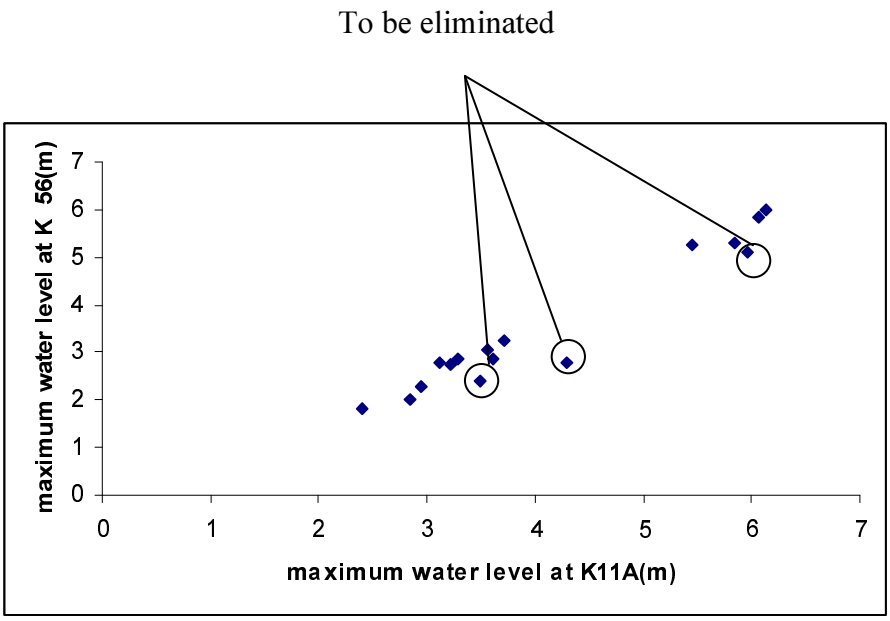


Figure 4.6(a): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Photaram (K56)

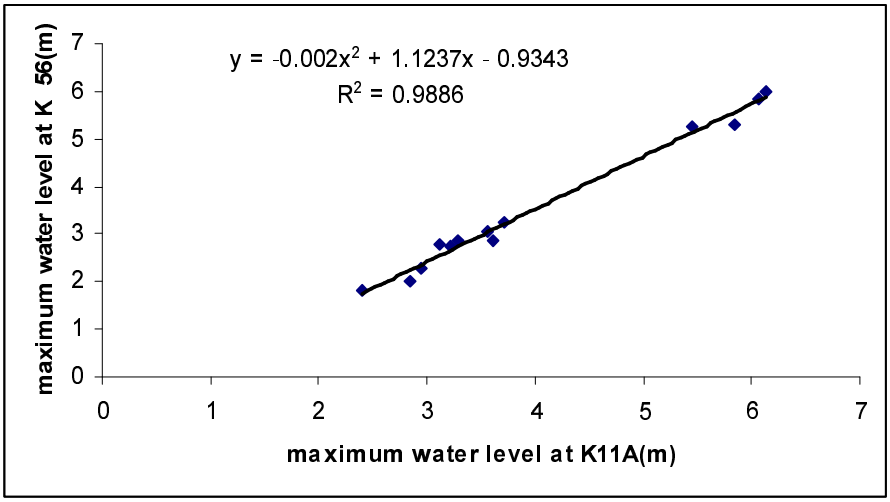


Figure 4.6(b): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Photaram (K56) After Taking at those Wrong Points

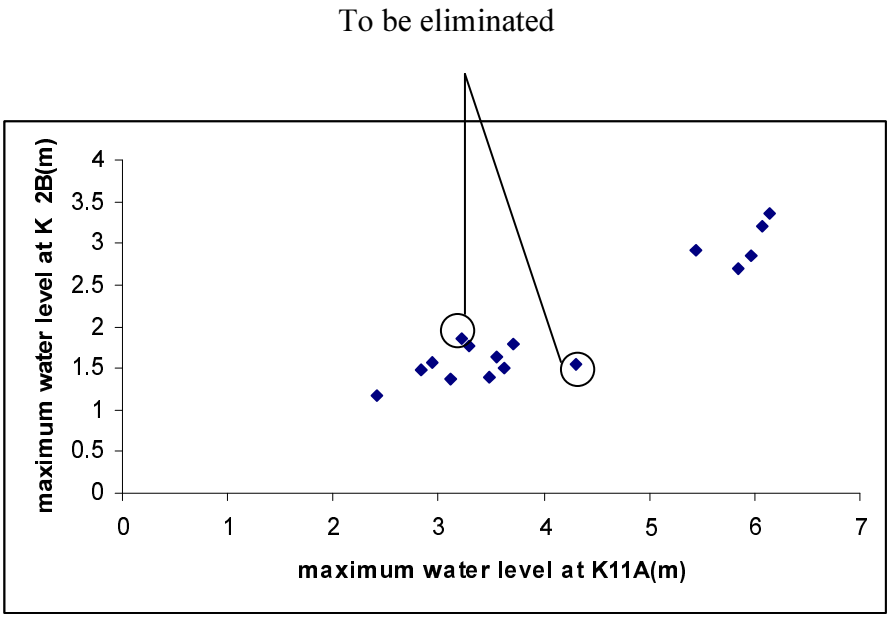


Figure 4.7(a): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Ratchaburi (K2B)

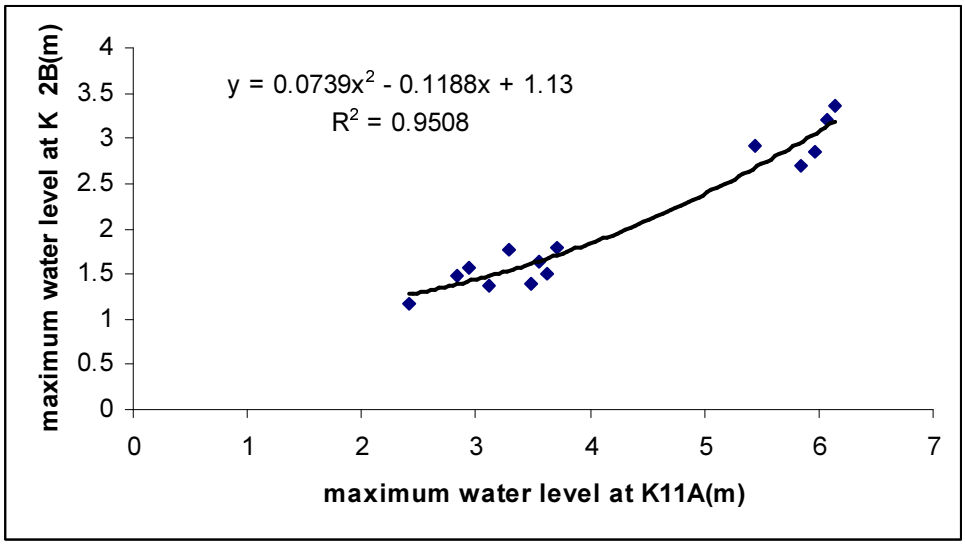


Figure 4.7(b): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Ratchaburi (K2B) After Taking at those Wrong Points

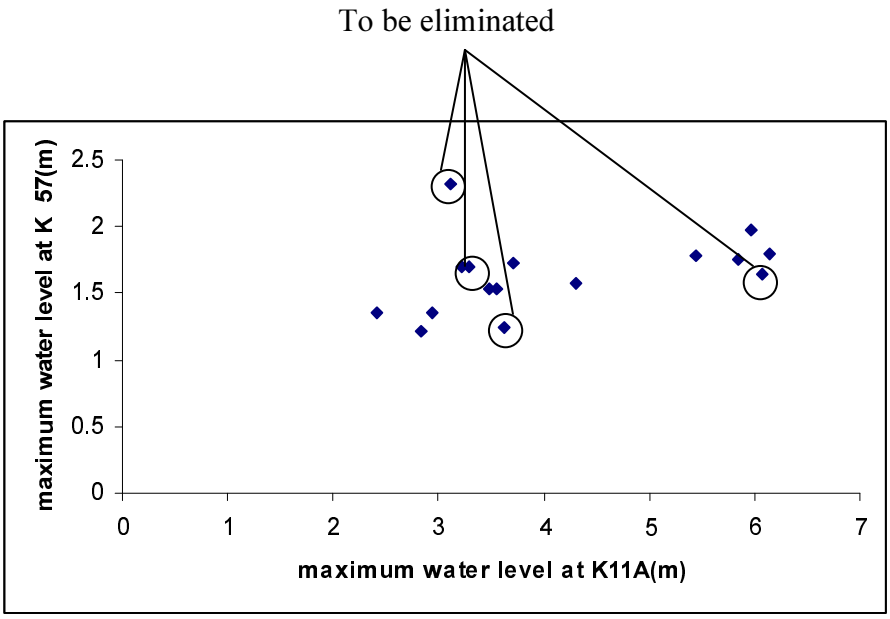


Figure 4.8(a): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Bangkhonthi (K57)

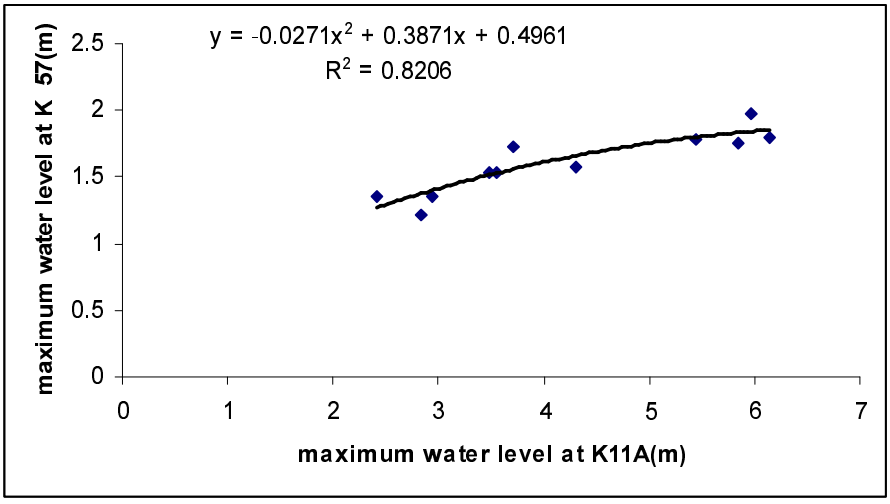


Figure 4.8(b): The Relationship Between Maximum Water Level at Maeklong Dam Spillway and Bangkhonthi (K57) After Taking at those Wrong Points

Applying the Method of Least Square Approximation, in this study the program Eview was used. The model parameters are shown in Table 4.6

Table 4.6: Model Parameters for Each Site Obtained by Using Least Square Approximation

Station	Parameter (a)	Parameter (b)	R-square
Banpong (K55)	$a_1 = 2.253362$	$b_1 = 0.522667$	0.935106
Photaram (K56)	$a_2 = 1.490174$	$b_2 = 0.793952$	0.986935
Ratchaburi(K2B)	$a_3 = 2.279033$	$b_3 = 0.854257$	0.942210
Bangkhonthi(K57)	$a_4 = 0.807758$	$b_4 = 0.786397$	0.807758

4.3 Flood Elevation at Each Site

Then the retional equation used in the mathematical model to calculate flood elevation become:

For Banpong ;

$$E_{1(t+l1)} = 2.253362 * Ht^{0.522667} \quad \text{……..……4.5}$$

For Photaram;

$$E_{2(t+l2)} = 1.490174 * Ht^{0.793952} \quad \text{……..……4.6}$$

For Ratchaburi;

$$E_{3(t+l3)} = 2.279033 * Ht^{0.854257} \quad \text{……..……4.7}$$

For Bangkhonthi;

$$E_{4(t+l4)} = 0.807758 * Ht^{0.786397} \quad \text{……..……4.8}$$

4.4 Control Points

Due to the limitation of time and budget, in this study three control points using in generating DEM were measured in the field with Trimble GPS 4400 set. This was the minimum of control points to be used to generate DEM. All these points were taken as the rover points, no base station was set, no adjustment was made. These errors are acceptable because they are still less than the resolation of the LANDSAT data (30 m.) used as observed flood areas. The 30 meters resolution means 30 meters error. The photoes and coordinates showing each control points are shown in Figure 4.9 and Table 4.7 respectively.

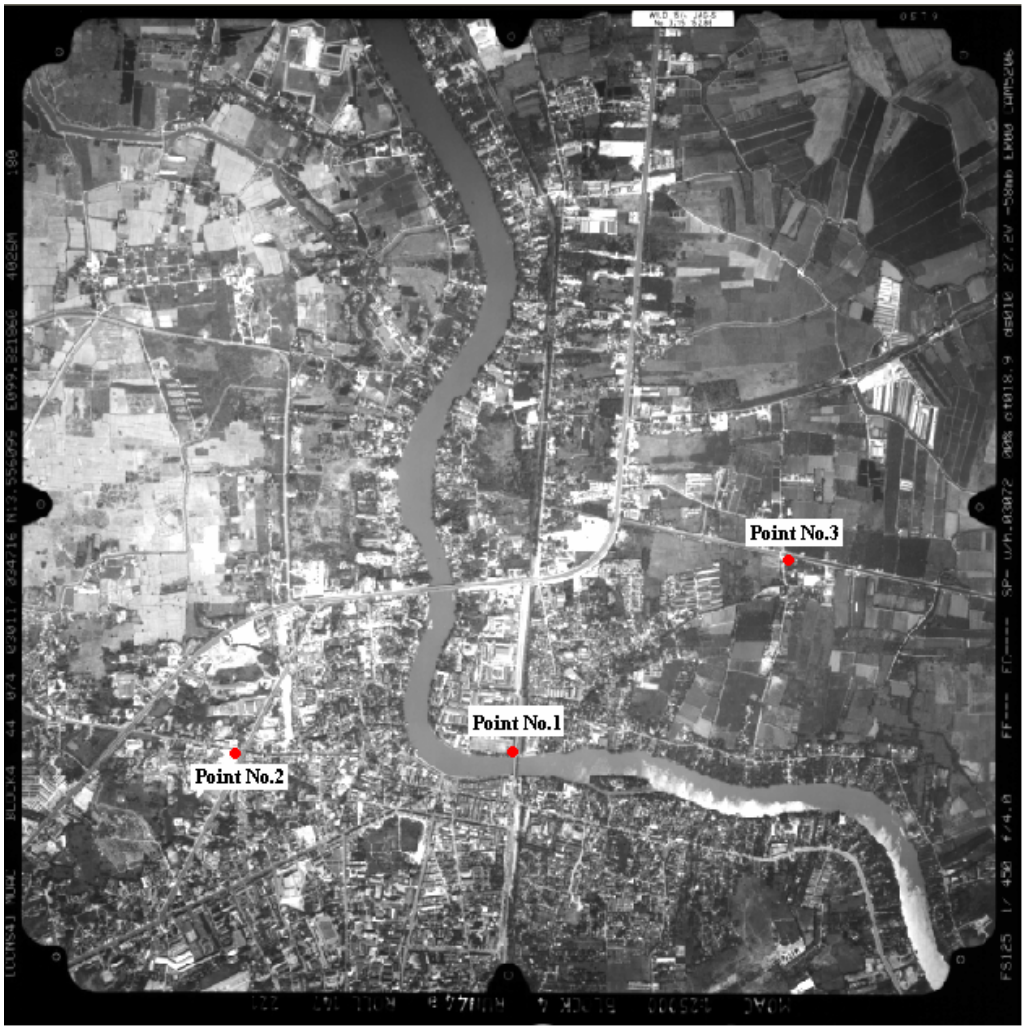


Figure 4.9: Locating the Control Points

Source: Ministry of Agriculture and Cooperatives

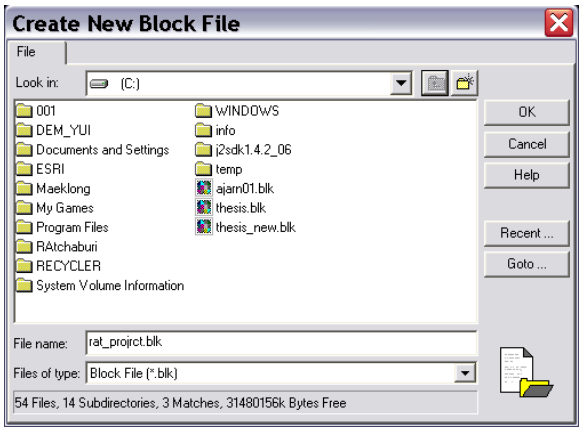
Table 4.7: The Used Coordinate of Control Points

Point No.	Northing (m)	Easting (m)
1	1,497,111.483	589,176.966
2	1,497,169.801	587,495.641
3	1,498,529.911	590,777.465

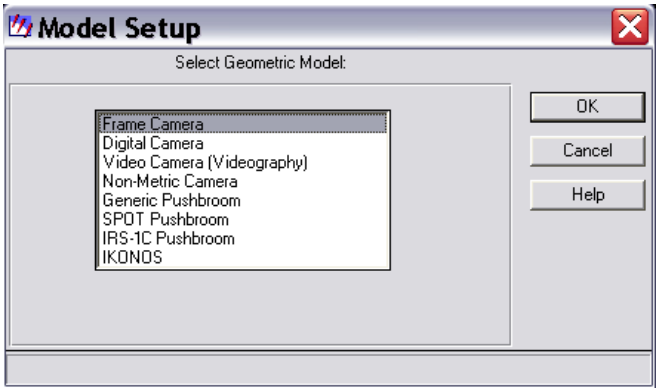
4.5 Digital Elevation Model (DEM)

The program IMAGINE OrthoBASE Pro was used to generate DEM. The program required following data: digital air photoes of the study area; control points and camera parameters. The method of using the program is explained as follows:

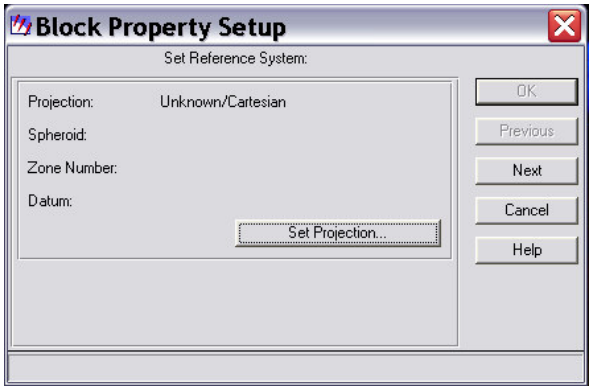
1. Start the program IMAGINE OrthoBASE Pro, then choose create a new OrthoBASE project



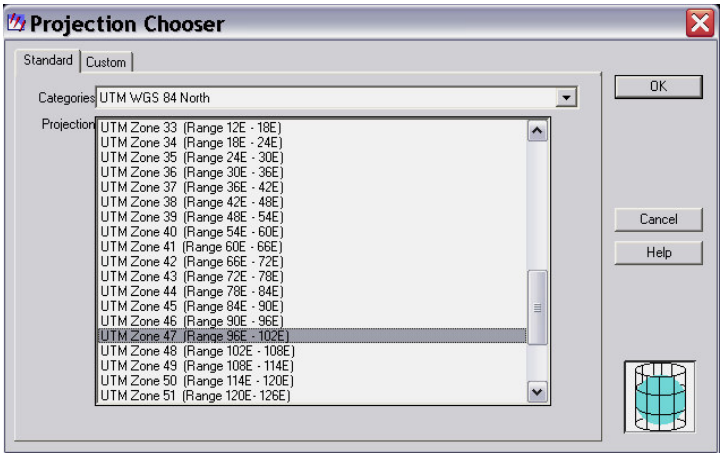
2. In the menu “Model Setup” select “Frame Camera”



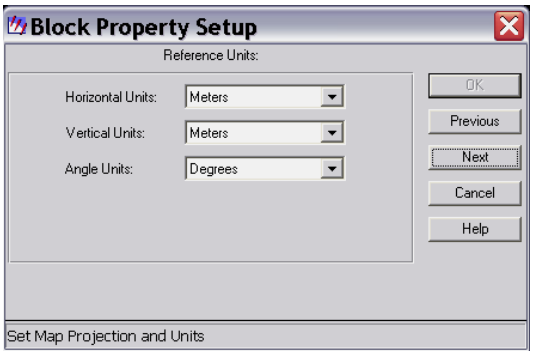
3. In the menu “Block Property Setup” select “Set Projection”



4. In the “Standard” Tab and enter “Spheroid, Datum, UTM Zone, North or South” then select “Next”

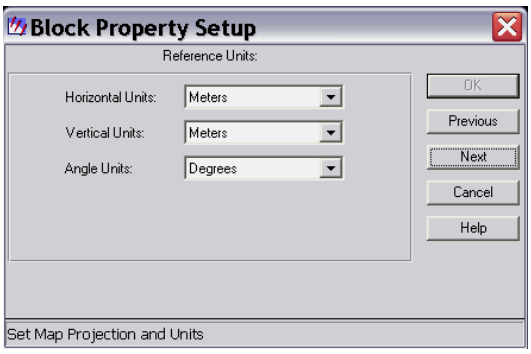


5. In the menu “ Reference Unit” Horizontal Unit, Vertical Unit, Angle Unit, then choose “Next”

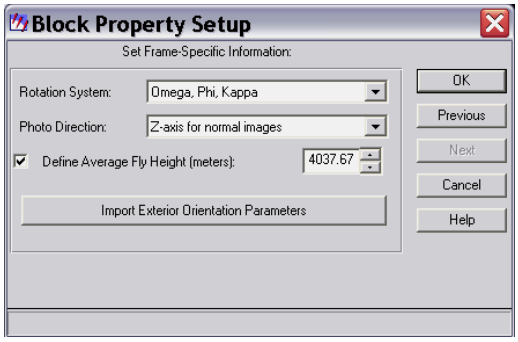


6. Inputting ratation parameter:

- In the menu “Block Property Setup” input “Reference Units” → Next

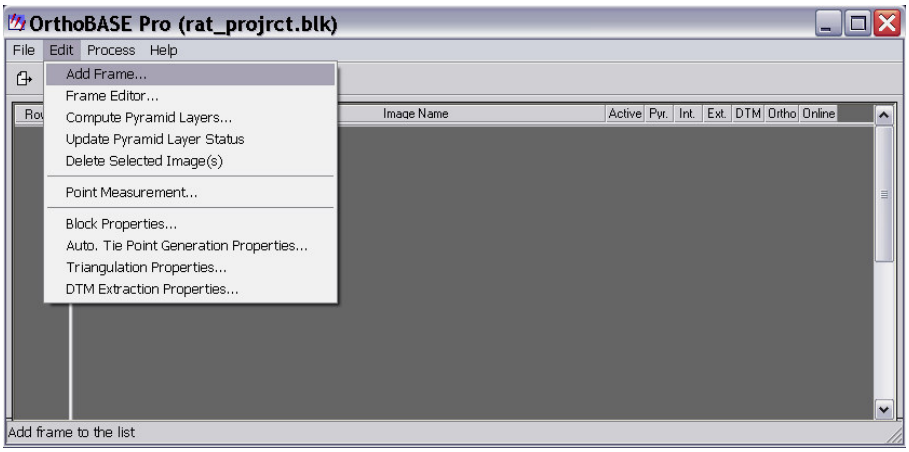


- Set Frame Specific Information" input rotation system: Omega, Phi, Kappa and Photo Direction: Z-axis for normal image and Average Fly Height: (read from air photo), then choose "OK"

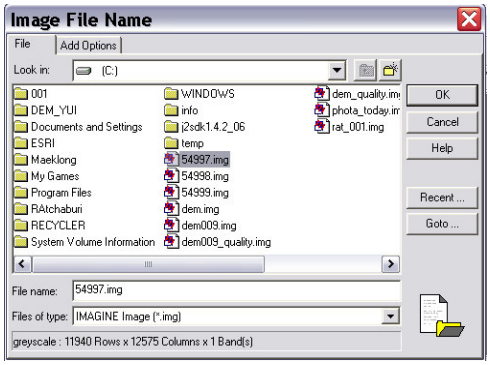


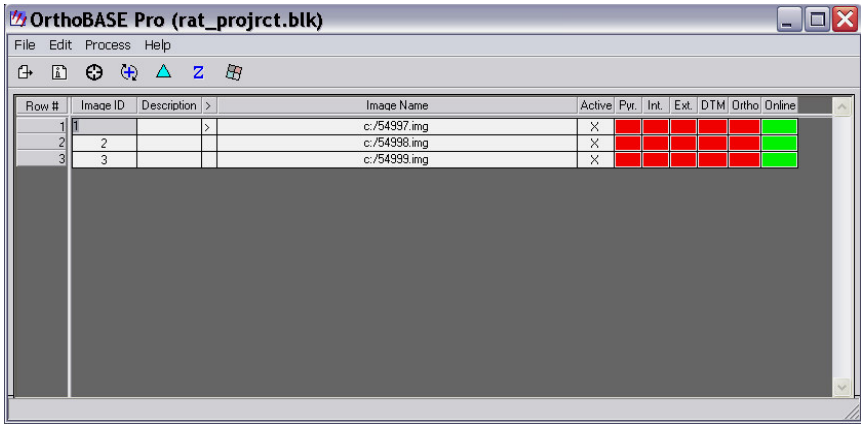
7. Adding images into the program:

- In the OrthoBASE dialog, select Edit → Add Frame

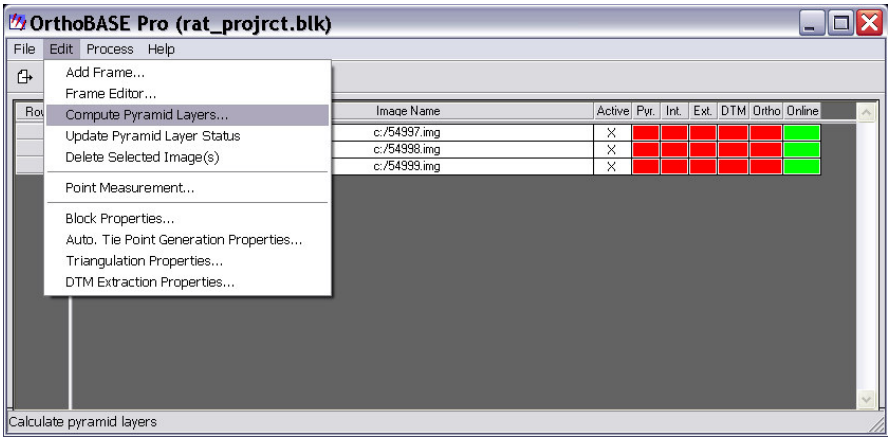


- Add required images into program, and then select “OK”

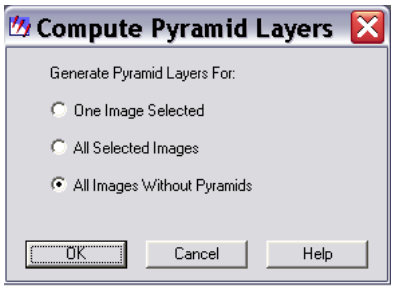




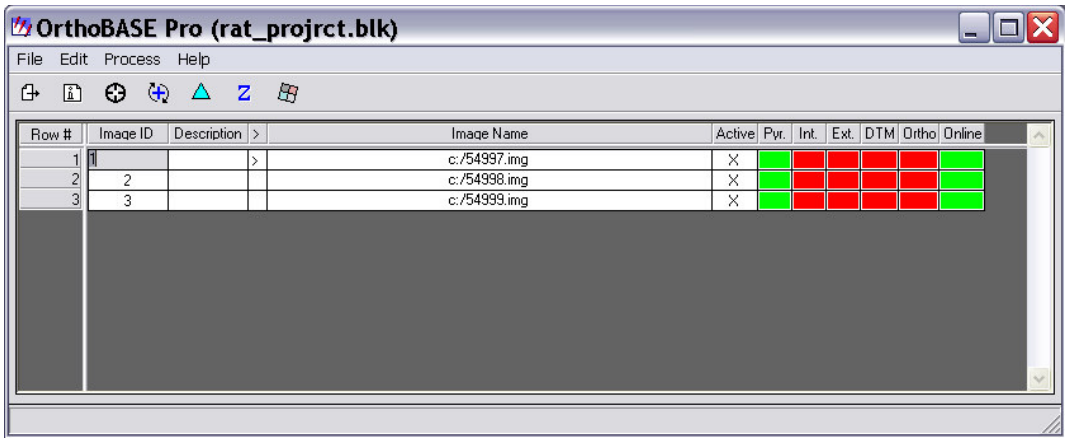
- Select “Edit” → “Compute Pyramid Layers”



- Select All Images Without Pyramids

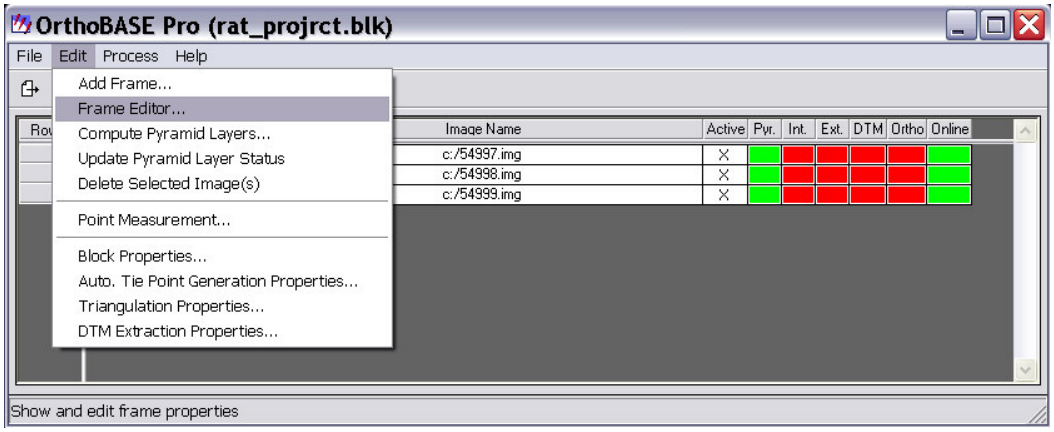


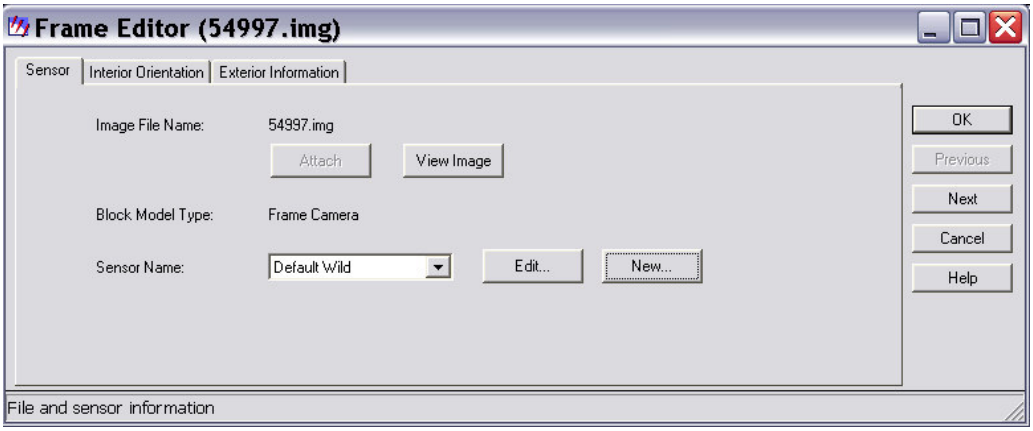
- The column “Pyr” is green.



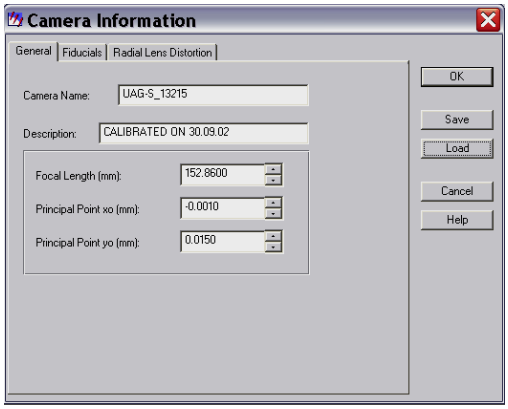
8. Loading the existing, camera parameters:

- Select “Edit” → “Frame Editor”



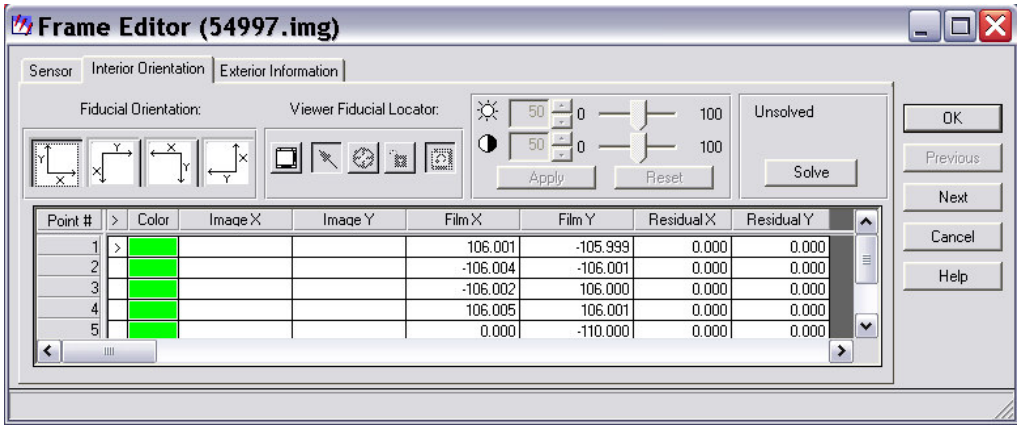


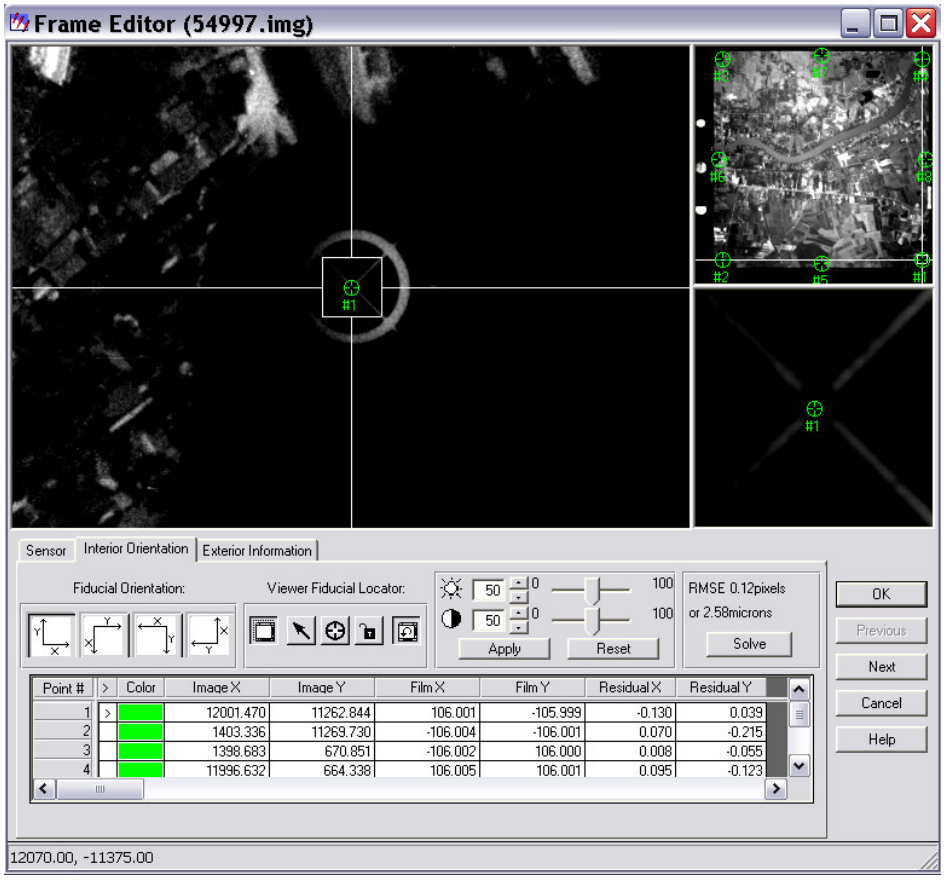
- In Sensor Tab, select “New” at “Sensor Name”to load camera file
- In Camera Information, select “Load” menu to load the existing camera file→ “OK”.



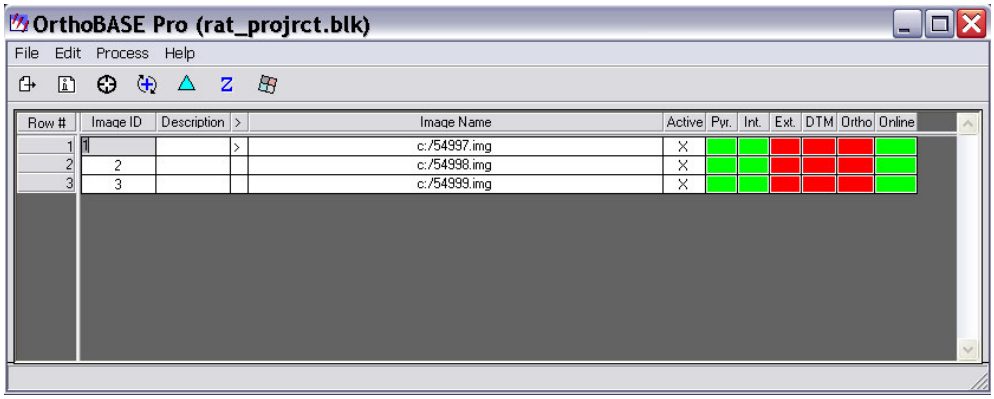
9. Entering interior orientation:

- From the Frame Editor dialog, select  and  icon in “Interior Orientation” tab, then move the currsor to the correct positions of fiducial masks


Frame Editor (54997.img)
Sensor
Interior Orientation
Exterior Information
Fiducial Orientation:
Viewer Fiducial Locator:
Apply
Reset
Unsolved
Solve
OK
Previous
Next
Cancel
Help
Point # | Color | Image X | Image Y | Film X | Film Y | Residual X | Residual Y
1 106.001 -105.999 0.000 0.000
2 -106.004 -106.001 0.000 0.000
3 -106.002 106.000 0.000 0.000
4 106.005 106.001 0.000 0.000
5 0.000 -110.000 0.000 0.000

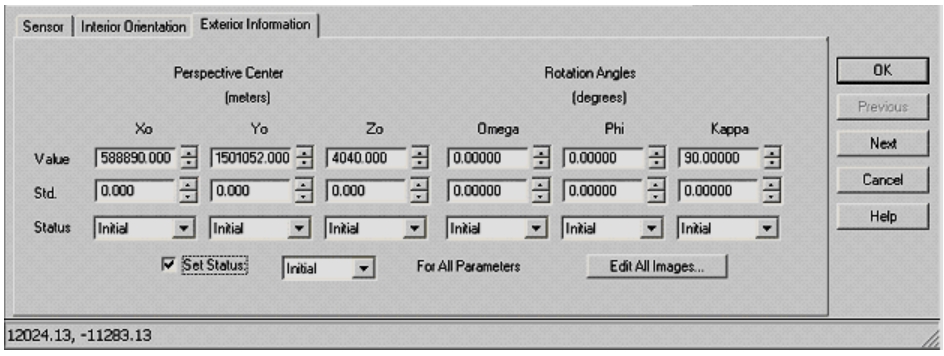

Frame Editor (54997.img)
Sensor
Interior Orientation
Exterior Information
Fiducial Orientation:
Viewer Fiducial Locator:
Apply
Reset
RMSE 0.12pixels
or 2.58microns
Solve
OK
Previous
Next
Cancel
Help
Point # | Color | Image X | Image Y | Film X | Film Y | Residual X | Residual Y
1 12001.470 11262.844 106.001 -105.999 -0.130 0.039
2 1403.336 11269.730 -106.004 -106.001 0.070 -0.215
3 1398.683 670.851 -106.002 106.000 0.008 -0.055
4 11996.632 664.338 106.005 106.001 0.095 -0.123
12070.00, -11375.00

- The column “Int” is green.



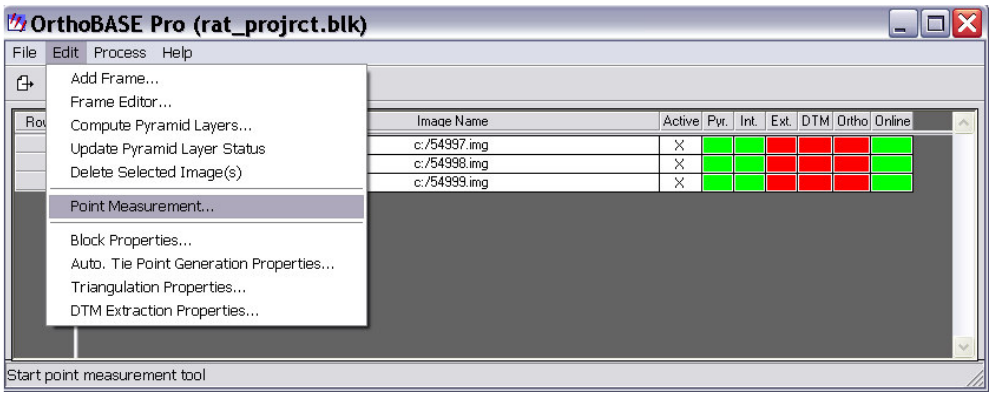
10. Entering exterior orientation:

- In the Frame Editor dialog, select “Exterior Orientation” tab, then input initial values of X_0, Y_0, Z_0, Omega, Phi, Kappa → “OK”

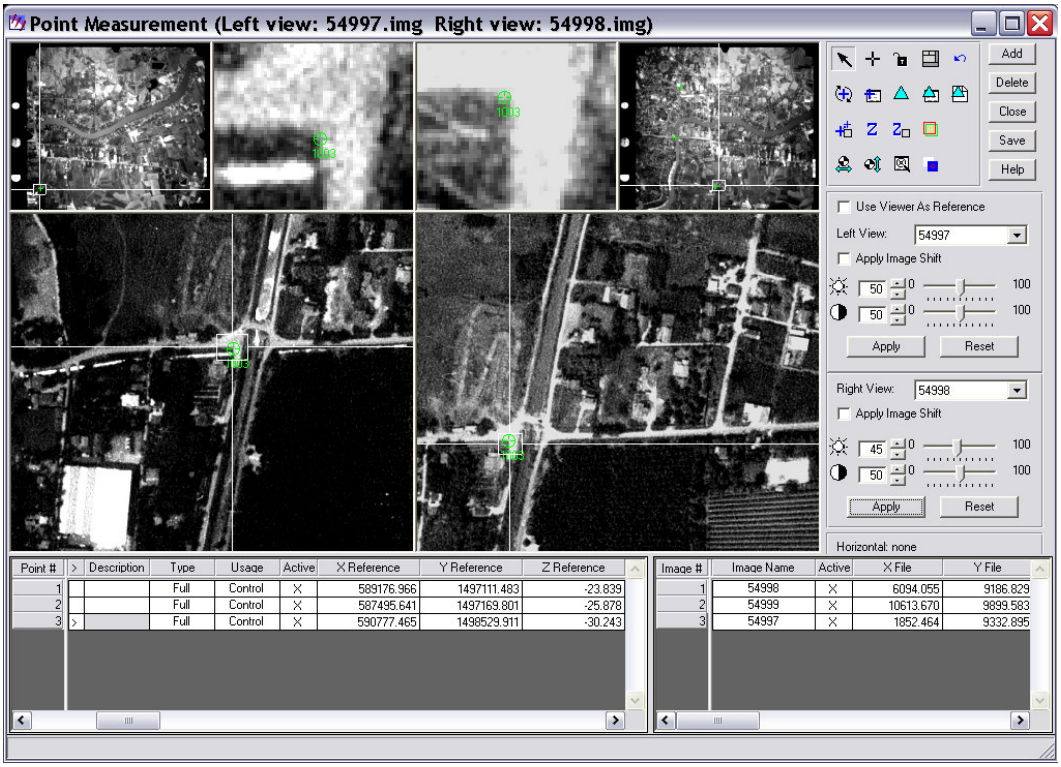


11. Measuring ground control points and check points:

- In the “OrthoBASE” dialog menu, select “Edit” → “Point Measurement”.

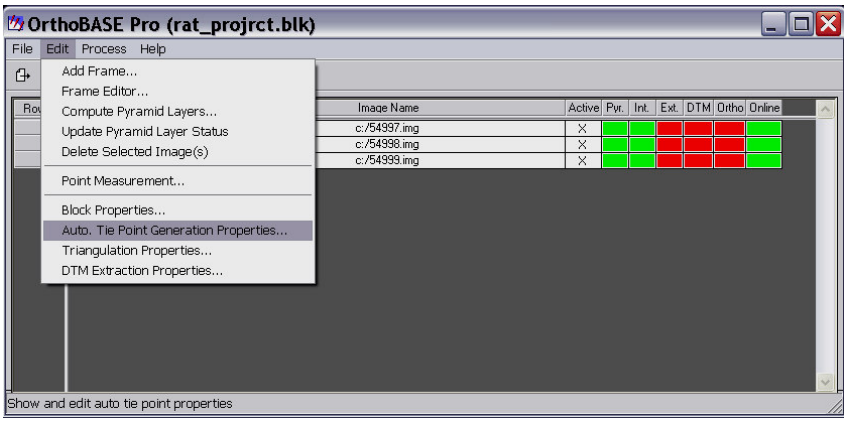


- The first two images are displayed collecting control points by selecting “Add” button then input X, Y, Z coordinates of ground control points until completed

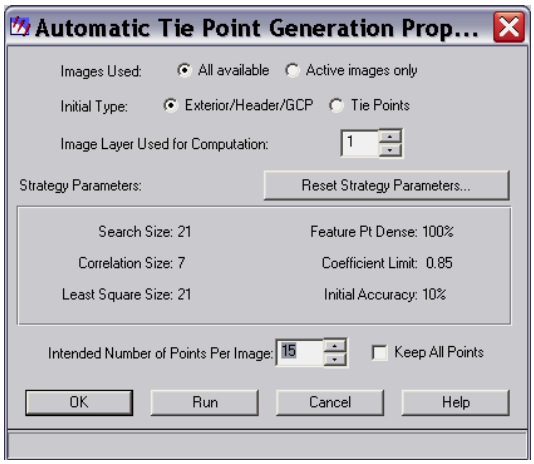


12. Performing automatic tie points:

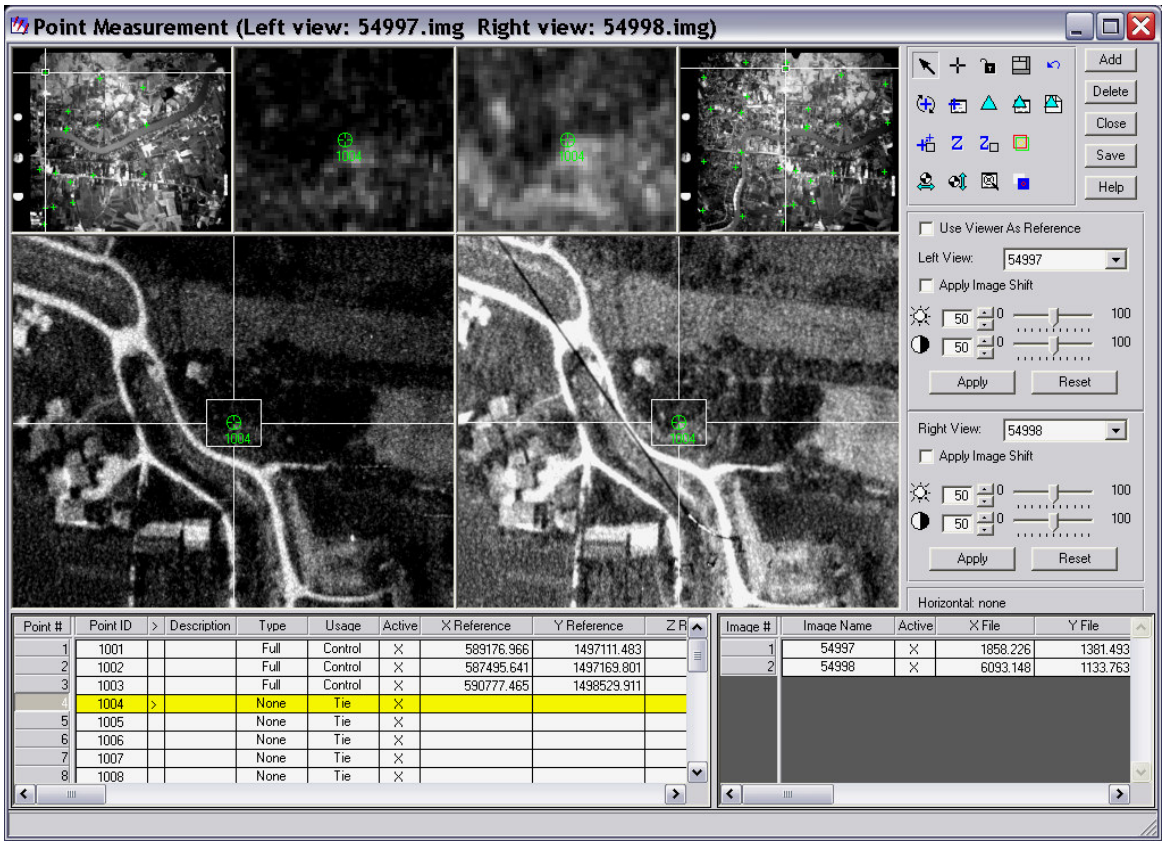
- After completing entering control point coordinates, perform automatic tie points by selecting “ Automatic Tie Point Collection Properties” in the “Point Measurement” tool



- Fill out the “Automatic Tie Point Generation Properties”, then select “Run”.

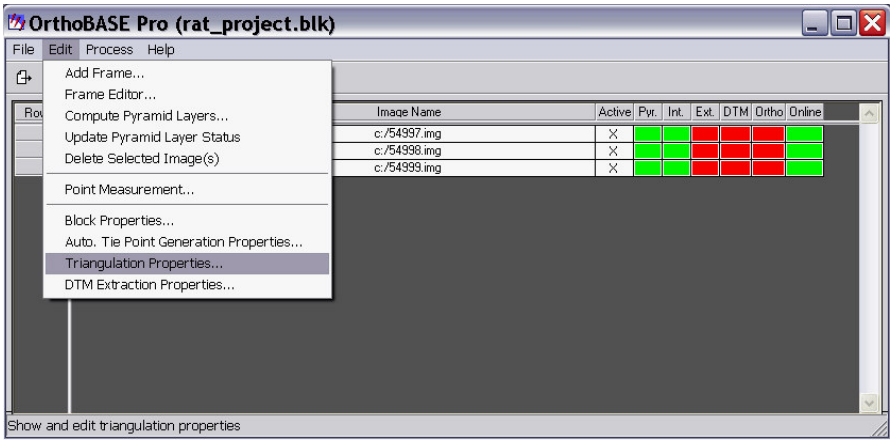


- After completion, adjust some tie points manually if necessary.

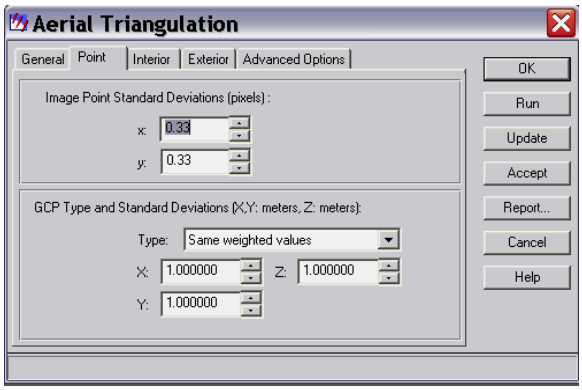


13. Performing aerial triangulation:- now that control points, check points and tie points are obtained and ready to perform aerial triangulation.

- In the “OrthoBASE” dialog, select “Edit” → “Triangulation Properties”

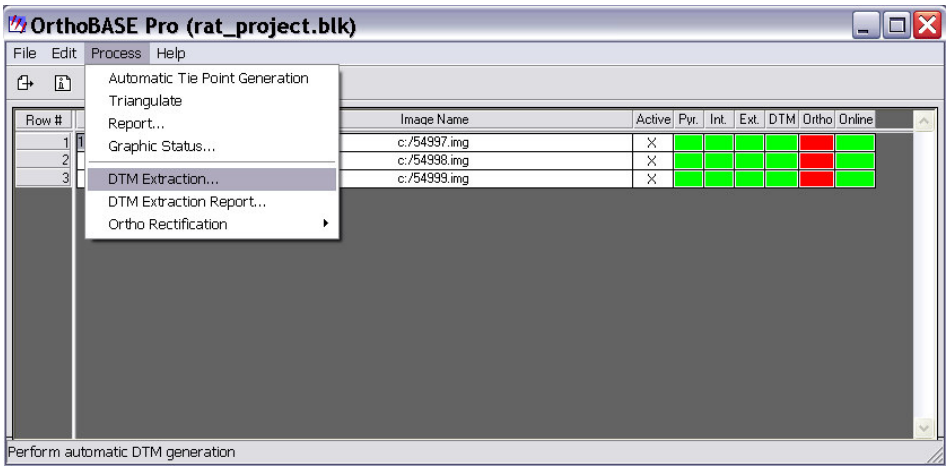


- Enter appropriate values, then “Run”. After completed, select “Update”, “Accept” and “Close”.

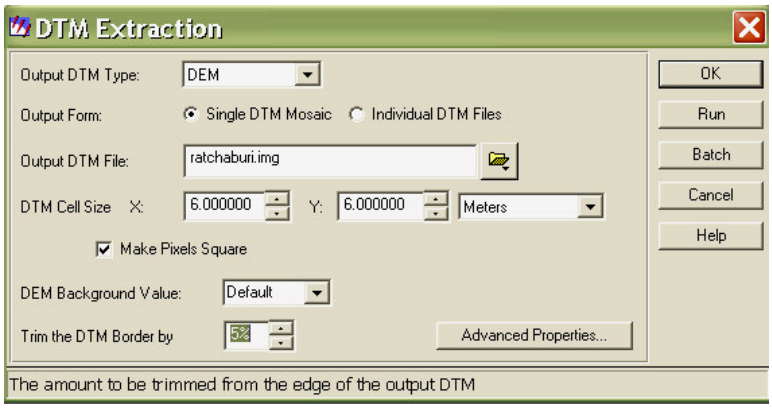


14. Set extraction options:

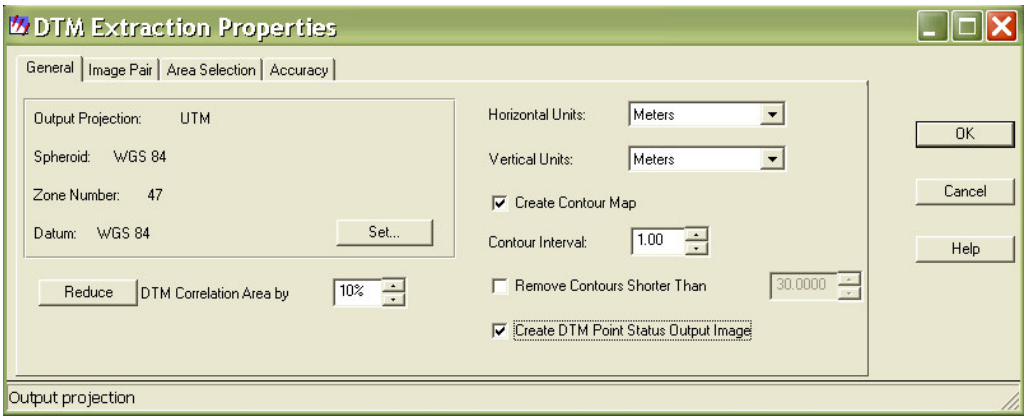
- Select DTM Extraction, enter appropriate values. Choose “Advanced Properties”



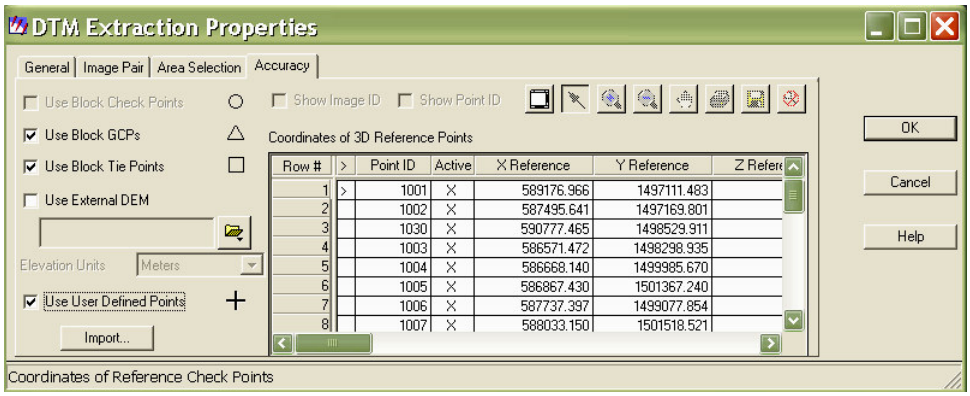
- Choose directory of Output DEM and appropriate values then select “Advanced Properties”



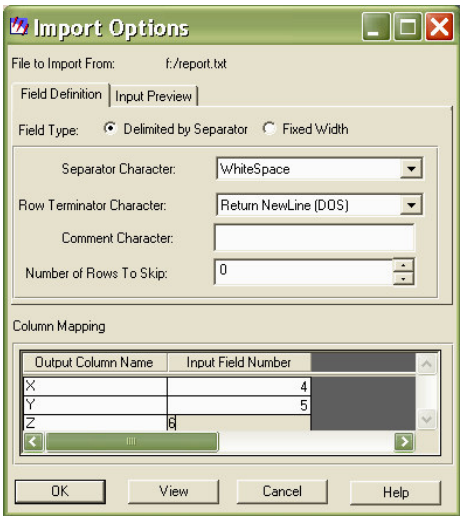
- When DTM Extraction Propoties dialog appears, in “General Tab” enter appropriate value



- In “Accuracy Tab” selects “Use Block GCPs”, “Use Block File Points” and “Use External DEM”



- Select “Import” to load report file



- Input Field Number for X, Y and Z then “OK”
- In DTM Extraction dialog select “Run”

The generated DEM is shown in Figure 4.10. The lighten tone represent the higher the elevation.

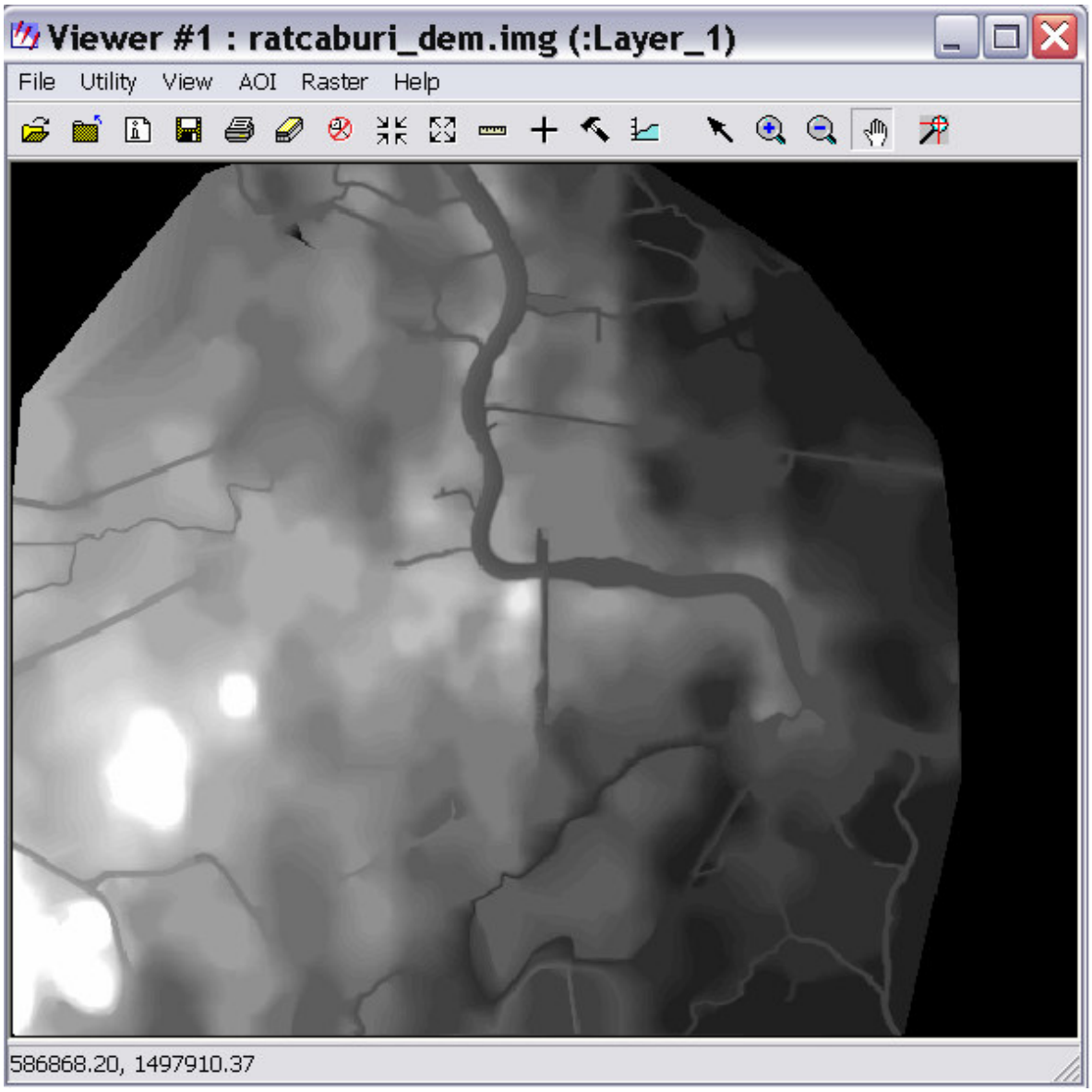


Figure 4.10: Generated DEM

4.6 Generated Flood Areas

For generated flood map, the value of maximum water elevation at Maeklong Dam spillway on 19 November 2003 (1.86 m.) is used for flood elevation calculation at each site. Flood elevation values were calculated by equation 4.5 to 4.8. Flood elevation values of each site are shown in Table 4.8.

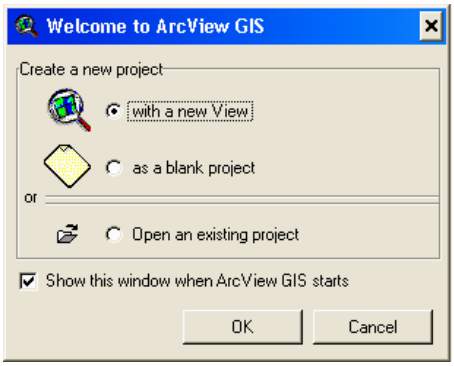
Table 4.8: Flood Elevation Values from Model of Each Site

Station	Input data at K11A (m) (Water Elevation)	Flood Elevation from Model (m)
Banpong	1.86	3.12
Photaram	1.86	2.44
Ratchaburi	1.86	3.87
Bangkhonthi	1.86	1.32

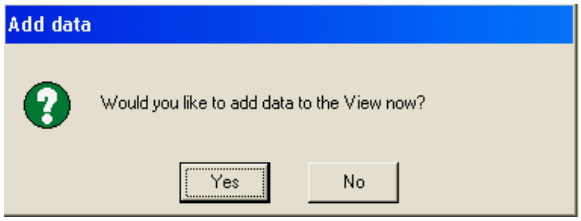
From generating DEM, the results of last step are DEM and contour line. Therefore, in generated flood areas uses contour product from DEM to make flood. The program ArcView is used to select all pixels having the values equal or less than the flood elevation. The process can be explained as follows:

Start the program ArcView 3.3, then

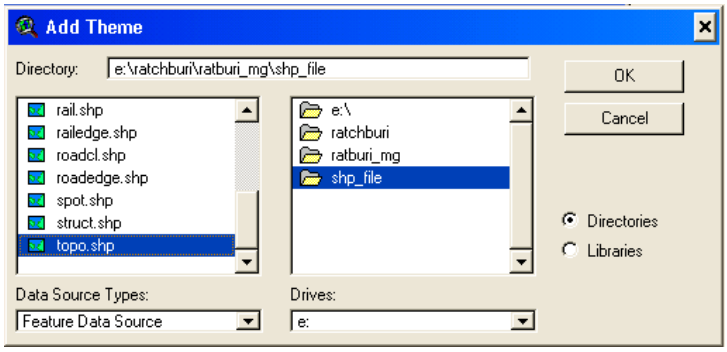
1. Start the program ArcView 3.3, from “choose create a new project” dialog, select “With a new view” then “OK”.

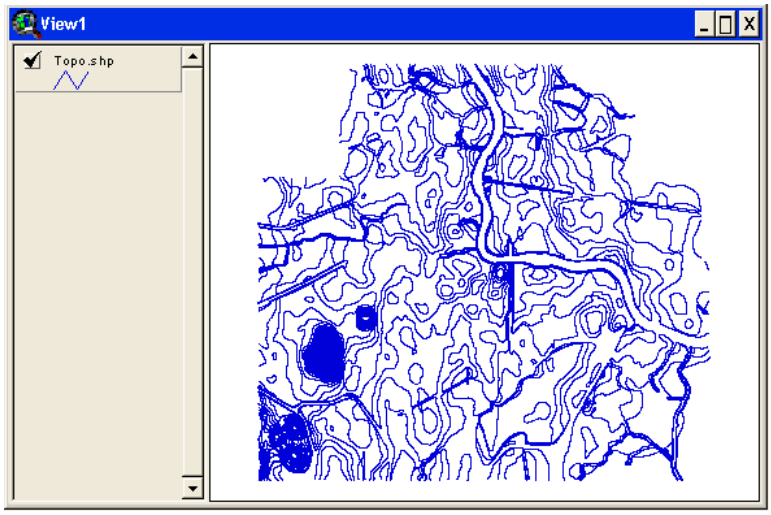


2. In the “Add data” dialog, select “Yes”.



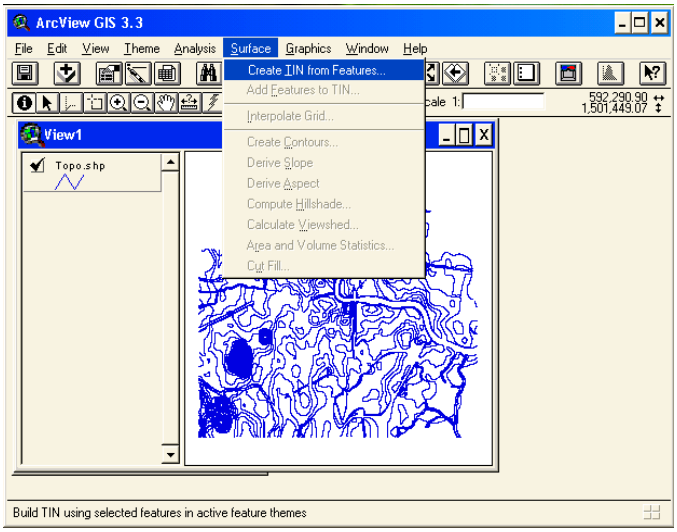
3. In the “Add theme” dialog, select “Directory” destination and “Data Sources Types” then “OK”



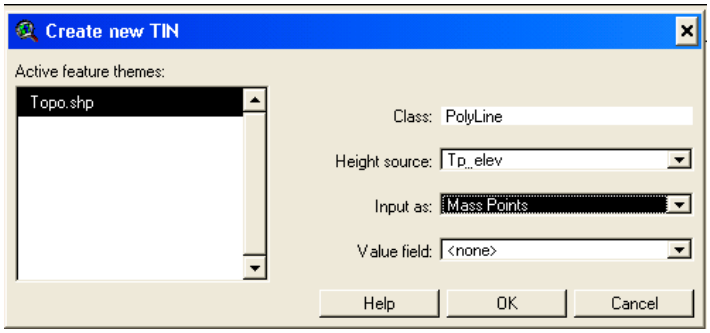


4. Creating TIN :

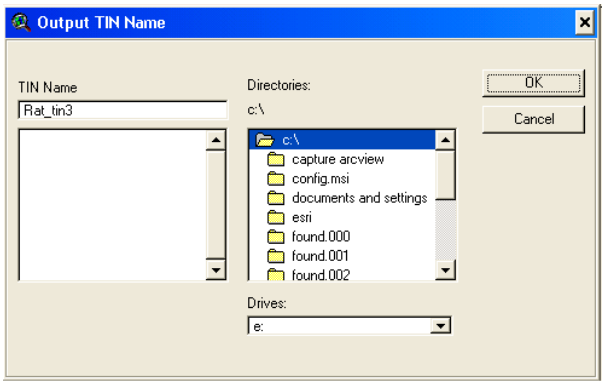
- In the menu “Surface” select “Create TIN from Features”

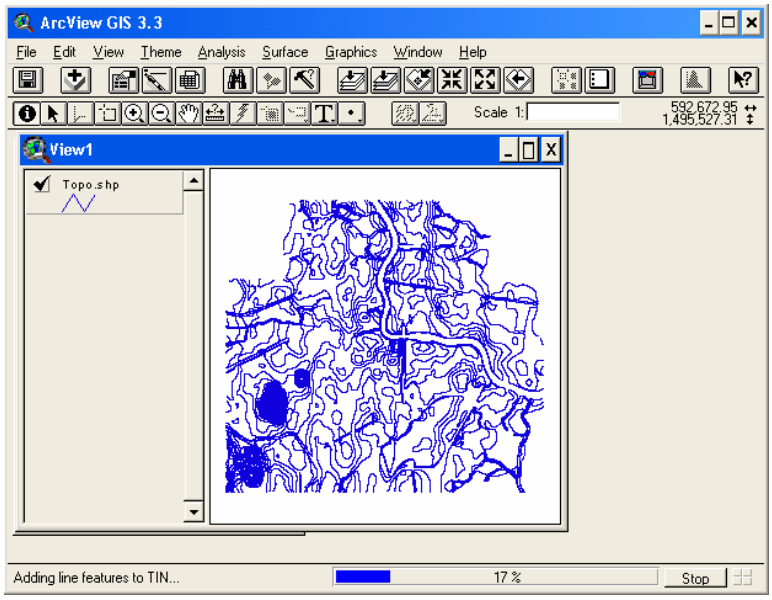


- When “Create new TIN” dialog appears, in the “Height Source” select required value, in the“Input as” select “Mass Points” then “OK”

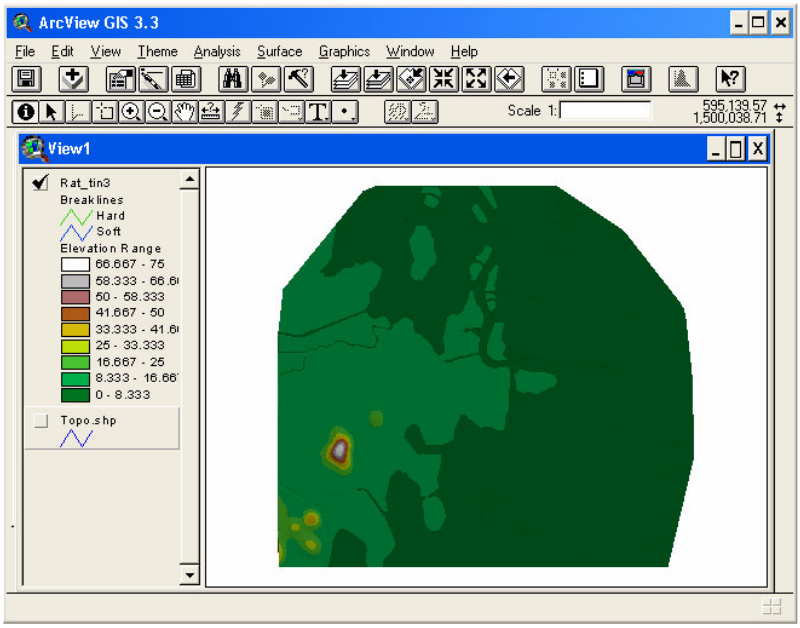


- When “Output TIN Name” dialog appears, in the “Directiroes” select required directory and in the “TIN Name” input “requirded TIN Name”.


Output TIN Name
TIN Name
Rat_tin3
Directories:
c:\
OK
Cancel
c:\
capture arcview
config.msi
documents and settings
esri
found.000
found.001
found.002
Drives:
e:

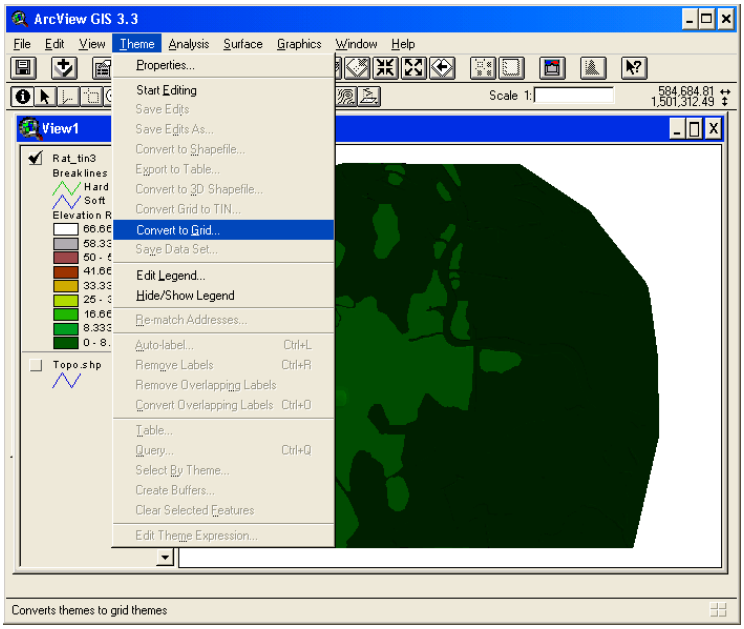

ArcView GIS 3.3
File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
592,672.95
1,495,527.31
View1
Topo.shp
Adding line features to TIN...
17 %
Stop

- Output TIN

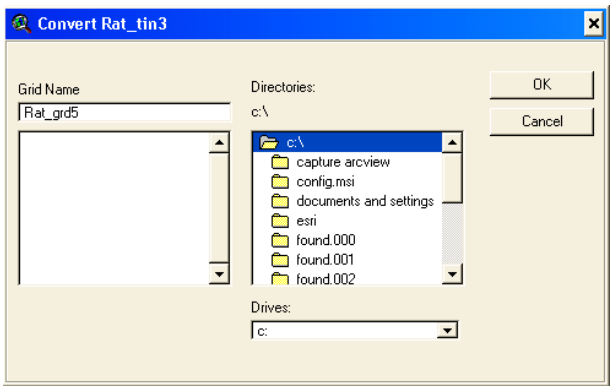


5. Convert to Grid:

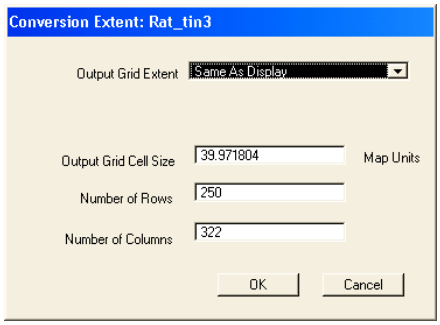
- In the menu “Theme” select “Convert to Grid”

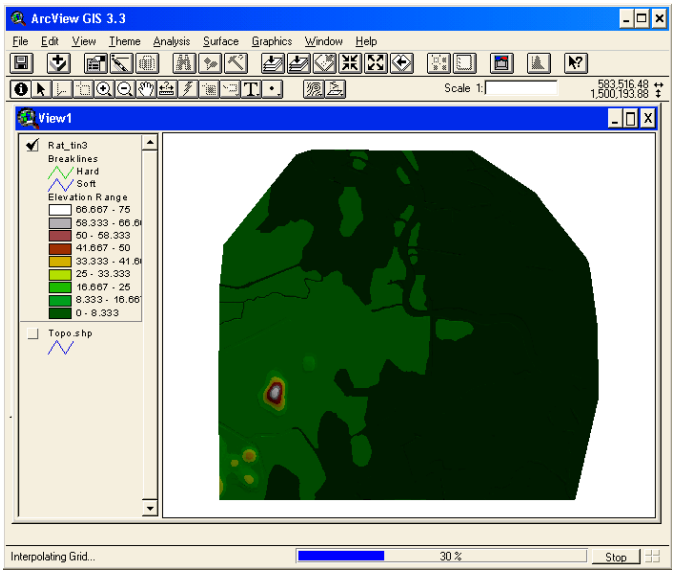


- When “Convert” dialog appears, in the “Directiroes” select requirded directory and in the “Grid Name” input “requirded Grid Name” then “OK”

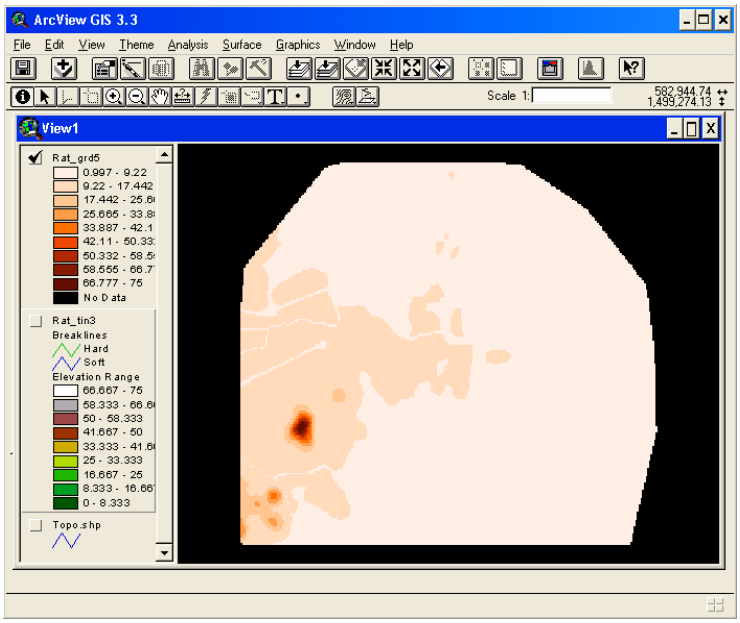


- In the “Conversion Extent” dialog input required value then “OK”



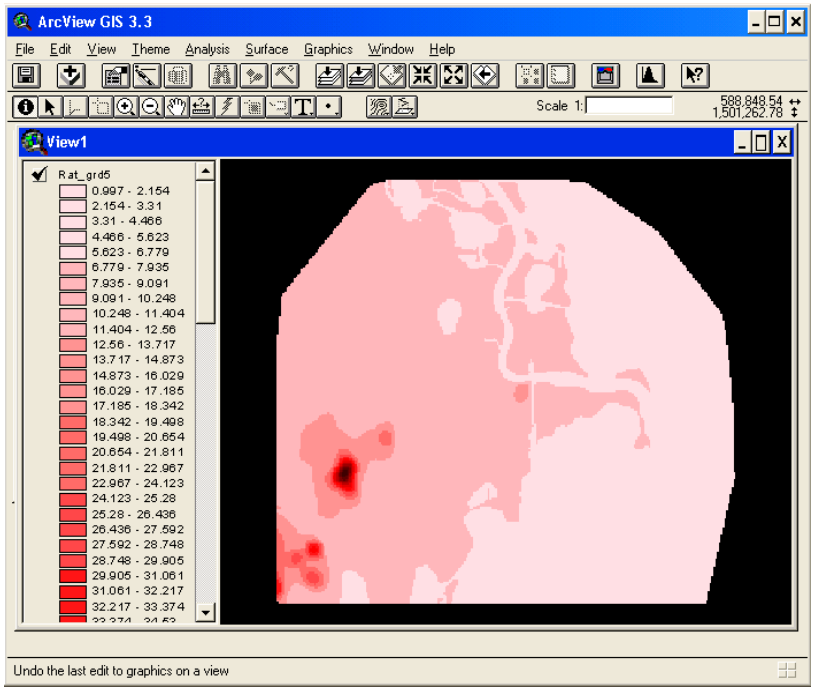


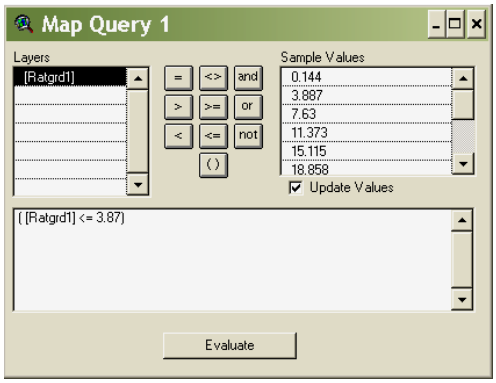
- When “Convert to Grid” dialog appear select “Yes”
- Output Grid



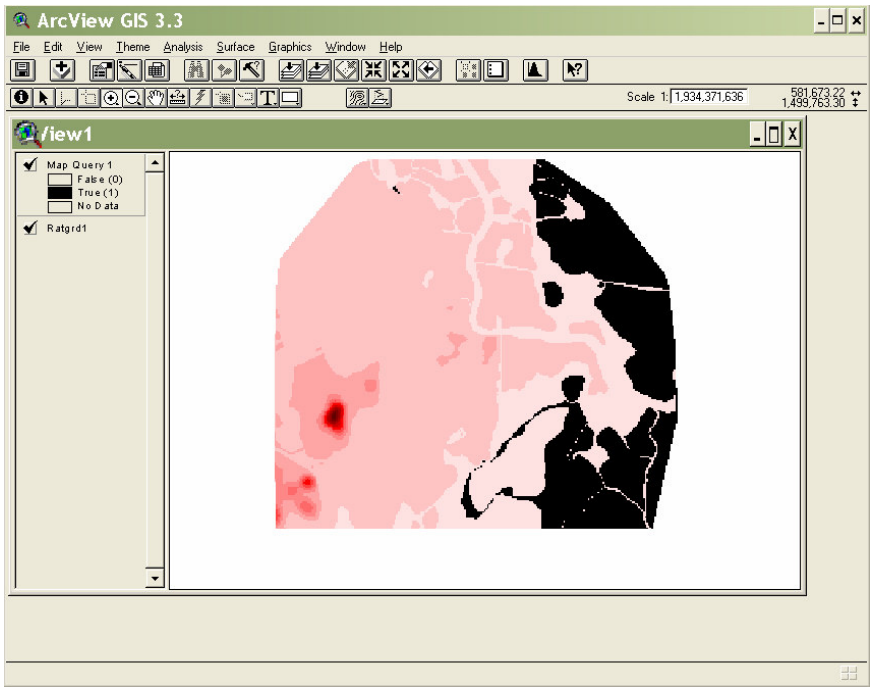
6. Flood areas:

- In the manu “Analysis” selects “Map Query” when “Map Query” dialog appears, in the “Layers” select “Grid from step 6”, in the “Condition Menu” selects required condition then input “required value”

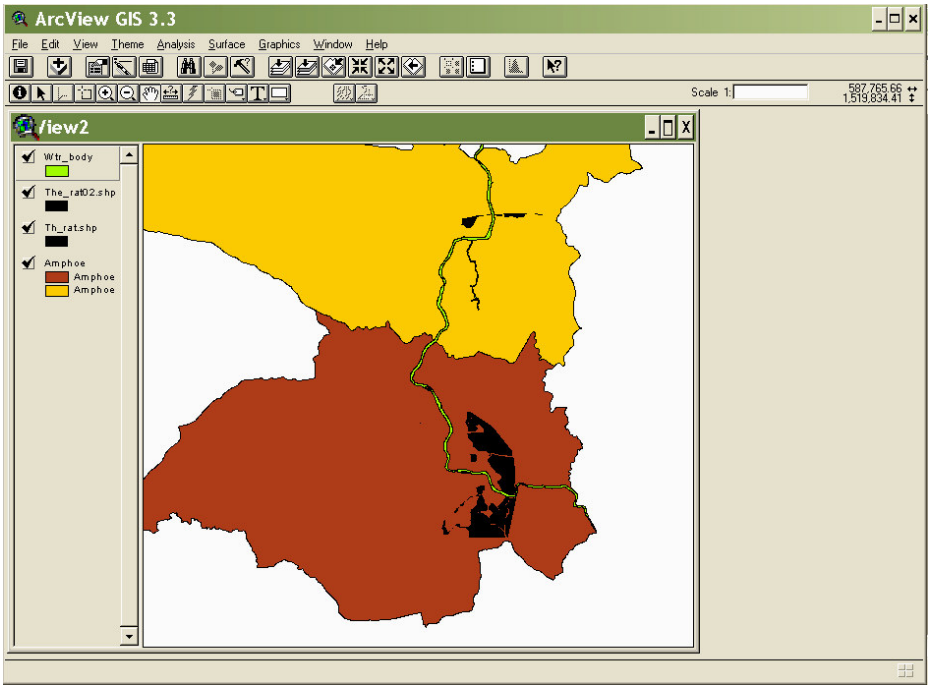




7. Flood boundaries are shown as layer in project.



8. Flood boundaries of Photaram and Ratchaburi



The generated flood boundaries are shown in Figure 4.11.

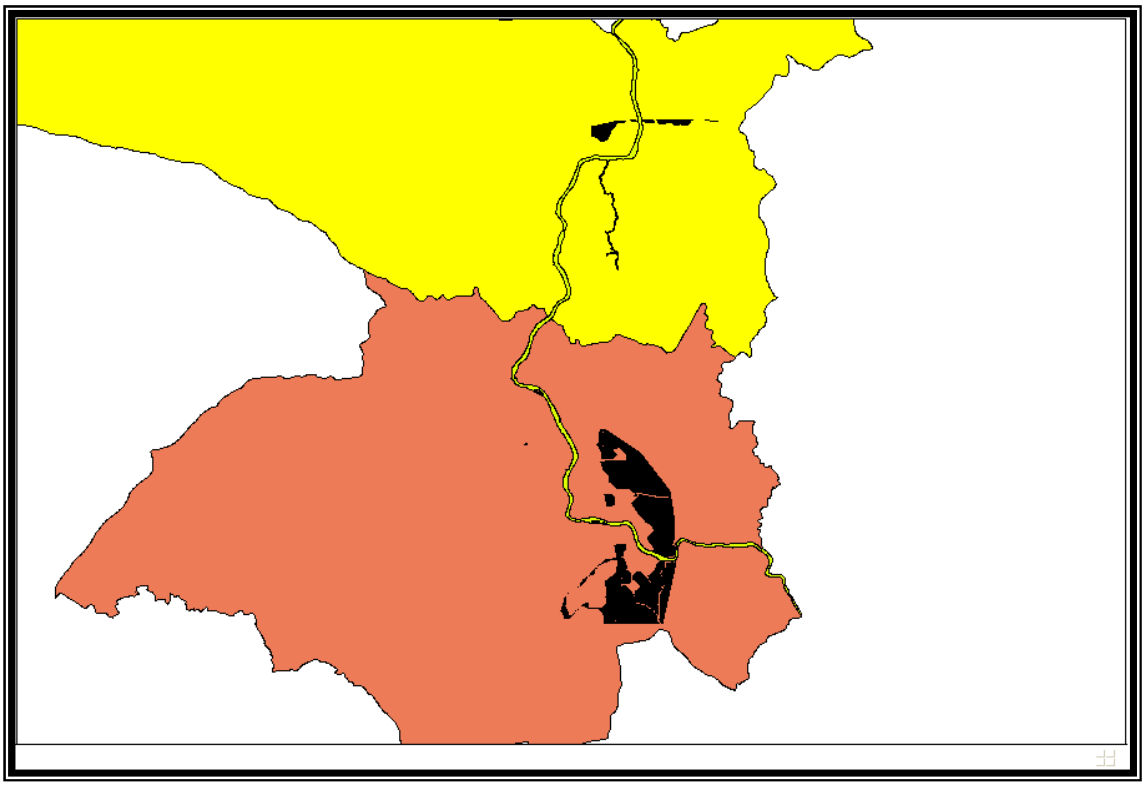


Figure 4.11: Generated Flood Map of Ratchaburi and Photharam

4.7 Observed Flood Areas

The observed flood areas was created from the drawning observed flood areas which using satellite date taken on 19 November 2003. Because the flood boundaries were clearly seen on the satellite data therefore no field checking was done. The observed map and the comparison between predicted flood and observed flood are shown in Figure 4.12 and Figure 4.13 respectively.

Figure 4.12: Observed Flood Map

Figure 4.13: The Comparison Between Predicted Flood and Observed Flood Areas

4.8 Computing Model Error

The error of prediction between predicted and observed flood boundaries was done using the boundary comparison method which can be calculated using equation 3.7. The used points and data for computing model error were shown in Table 4.9 and Figure 4.14 respectively.

$$E = \frac{1}{NL} \sum_{i=1}^{N} |li| \qquad \text{..... 3.7}$$

Where:

N = 23 and L = 28947.73

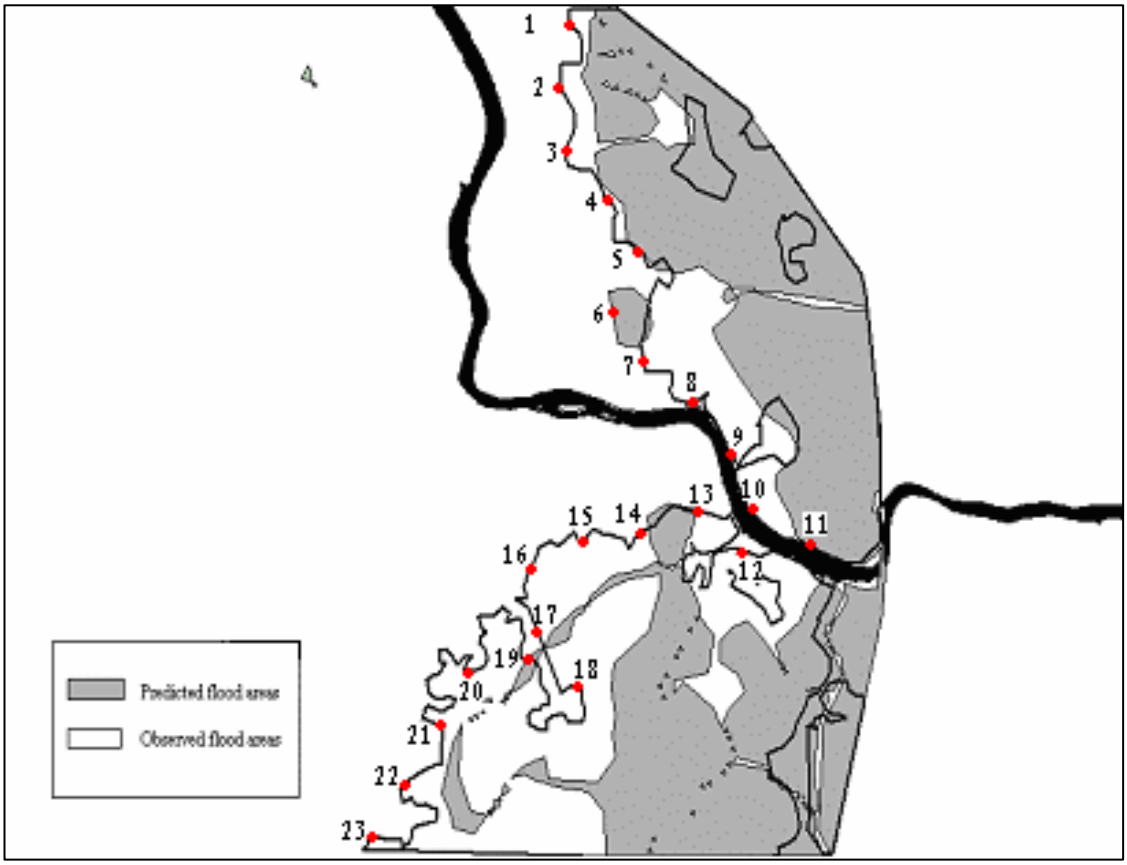


Figure 4.14: The Used Points for Computing Model Error

Table 4.9 : The Used Data for Computing Model Error

l(i)	Length (m)
l_1	274.25
l_2	383.95
l_3	383.95
l_4	109.7
l_5	0
l_6	0
l_7	713.05
l_8	658.2
l_9	822.75
l_{10}	438.8
l_{11}	54.85
l_{12}	822.75
l_{13}	54.85
l_{14}	109.7
l_{15}	548.5
l_{16}	713.05
l_{17}	109.7
l_{18}	493.65
l_{19}	0
l_{20}	548.5
l_{21}	164.55
l_{22}	493.65
l_{23}	1097
$\sum \lvert li \rvert$	**8995.4**

The error result between predicted flood and observed flood is 0.0135 or 1.35 %

CHAPTER V
DISCUSSION

The objective of this investigation is to develop the mathematical model to locate flooded areas in the lower Maeklong River Basin using the simple relational equation. There are two major abilities of the mathematical model as follows:

- The mathematical model can compute flood elevation which will occur flood at Banpong, Photharam, Ratchaburi and Bangkhonthi site.
- The mathematical model can compute lag time which flooding will occur at Banpong , Photharam, Ratchaburi and Bangkhonthi site.

Flooding map of the lower Maeklong River area was generated using Digital Elevation Model (DEM) and Geographic Information System (GIS) to see flooded areas easily.

The study found advantages, limitations in developing the mathematical model as the followings:

5.1 The Advantage of the Mathematical Model

1. The model can be used by users who have not hydraulics knowledge.
2. The relational equation from this investigation is easier to use than other hydrologic models. It does not require rainfall and quantity of water data (Q) which are important data for hydrologic model and the computing procedure is not too complex.
3. The model input only requires the water level at Maeklong Dam Spillway, which can read directly using a gage measurement at Maeklong Dam station (K11A). The model can compute flood elevation and lag time of Banpong , Photharam, Ratchaburi and Bangkhonthi site immediately .

5.2 The Limitations of the Mathematical Model

1. The mathematical model in this investigation can calculate flooding elevation at Banpong, Photharam, Ratchaburi and Bangkhonthi site only.
2. The mathematical model can calculate flooding elevation in September, October and November only.
3. The water use situation in the lower Maeklong River Basin has to be normal.
4. The mathematical model can not compute flooding elevation at downstream sites, if some downstream sites are raining but at Maeklong Dam Spillway is not raining.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The mathematical model from this investigation is able to implement for calculating flood elevation in Banpong, Photharam, Ratchaburi and Bangkhonthi. The official government at Maeklong Dam station (K11A) is able to know in advance of when and where the flooding will occur using maximum water level at Maeklong station. Flood protection measurements could be done efficiently to people who live in the lower Maeklong River. Some computed flood elevation from model using water level at Maeklong Dam sation as 1, 2, 3, 4, 5 and 6 meters are shown in Figure 5.1.

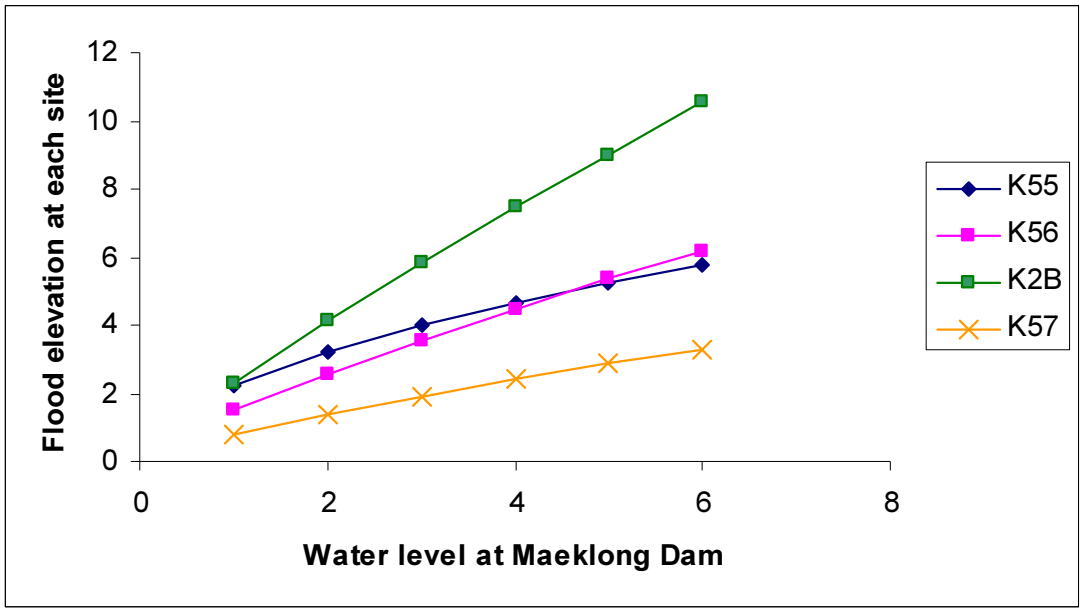


Figure 6.1: Some Flood Elevation from Mathematical Model Using Water Level at Maeklong Dam

6.2 Recommendation

1. The quantity of water (Q) of the intersesting sites and Maeklong Dam Spillway are able to be used for computing flood elevation instead of the maximum water level of Maeklomg Dam.
2. If Royal Irrigation Department (RID) is able to measure hourly water level in the lower Maeklong River sites, lag time computing procedure should be able to compute accurately more than lag time in this investigation.
3. The different lag time computing is able to be computed using lag time between downstream sites. For example; lag time between Banpong (K55) and Photharam (K56).
4. The accurate Digital Elevation Model (DEM) is able to be generated using more than the numerous control points.
5. Flood elevation of each site is able to implement easier than this using developed program which can compute and link flood elevation of each site directly using user interface between developed program and Arcview.

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APPENDIX

HYDROLOGIC DATA

RID Computer Center WLEVEL/MAXDLY K.11A
Station : Ban Wang Khanai, A. Tha Muang, Kanchanaburi, (K.11A) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 1998

Daily Max. Gage Height In Meter (MSL.) April 1, 1998 To March 31, 1999

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	11.39	12.66	11.10	12.37	11.69	10.92	12.08	10.82	11.53	11.81	11.10	10.77	
2	11.76	11.74	12.04	12.13	10.97	10.93	12.93	10.82	11.38	11.09	11.05	10.77	
3	11.94	12.21	12.09	11.52	10.95	10.93	12.75	12.54	11.38	11.06	11.19	10.77	
4	11.94	12.45	11.81	11.97	10.95	10.90	12.08	12.93	12.20	11.06	11.31	10.77	
5	12.37	12.26	12.29	11.65	10.93	11.17	11.25	11.81	11.42	11.43	11.17	11.01	
6	12.03	12.18	12.44	11.65	11.03	10.72	11.19	11.81	11.49	11.57	11.05	11.04	
7	11.16	12.12	11.88	12.05	11.49	10.71	15.65	11.17	11.19	11.73	11.05	11.04	
8	11.09	11.92	11.96	12.66	11.33	10.71	15.65	11.17	11.45	11.59	11.87	10.83	
9	11.07	11.76	11.72	12.24	11.02	10.71	13.95	11.16	11.63	11.50	11.22	10.98	
10	11.61	11.99	12.23	11.75	10.89	10.71	13.34	11.16	11.41	11.17	11.22	11.14	
11	11.08	11.70	12.59	11.51	10.74	10.71	12.81	11.16	11.24	11.81	11.20	11.15	
12	11.26	12.04	12.67	11.72	10.74	10.71	13.52	11.16	11.58	11.52	11.05	11.06	
13	11.89	12.21	12.61	11.72	10.74	10.71	13.97	11.16	11.27	11.73	11.05	11.06	
14	11.26	12.06	12.38	11.81	11.16	10.71	13.97	11.18	11.13	11.57	11.07	11.09	
15	10.90	11.81	12.42	12.28	12.52	10.71	13.40	11.16	11.10	11.73	11.06	11.09	
16	10.90	12.29	12.22	12.28	12.49	10.87	13.11	11.18	11.10	11.42	10.90	11.05	
17	10.90	12.19	12.80	12.03	11.53	11.45	12.35	11.45	11.08	11.39	10.90	11.05	
18	12.04	11.78	12.51	11.88	11.33	11.83	12.44	11.09	11.12	11.09	10.90	11.05	
19	11.90	12.23	12.85	11.43	12.50	11.61	12.22	11.51	11.86	11.55	11.06	11.05	
20	12.09	11.97	12.77	11.16	11.98	11.25	12.39	11.60	11.19	11.52	11.06	11.19	
21	12.42	11.95	12.60	11.10	11.92	11.85	12.29	11.62	11.19	11.32	11.06	11.38	
22	12.54	12.10	11.86	11.57	11.93	11.99	12.26	11.46	11.19	11.14	11.13	10.79	
23	12.18	12.24	12.17	11.82	11.40	11.96	11.26	11.14	11.71	10.99	11.06	11.17	
24	12.39	11.58	12.52	11.69	11.31	12.04	11.22	11.33	11.25	10.99	11.11	11.18	
25	12.46	11.41	12.47	11.46	11.06	12.40	10.86	11.86	11.59	10.99	11.06	11.51	
26	12.54	12.00	12.39	11.38	12.24	12.52	10.85	11.63	11.24	10.99	11.06	11.17	
27	12.39	12.46	12.22	10.93	12.72	12.18	10.84	11.57	11.28	10.99	11.06	11.17	
28	12.42	12.46	11.62	10.91	12.82	12.18	10.83	11.01	11.24	10.99	11.06	11.17	
29	12.47	12.24	11.42	10.90	11.92	12.00	10.83	10.95	11.07	11.16		10.80	
30	12.52	12.11	11.19	11.86	11.86	12.16	10.82	10.95	11.06	11.18		10.79	
31		11.20		12.05	10.98		10.82		11.06	11.22		10.79	
Max.	12.54	12.66	12.85	12.66	12.82	12.52	15.65	12.93	12.20	11.81	11.87	11.51	15.65 M.

Zero Gage At Bottom Elevation 9.813 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.11A
Station : Ban Wang Khanai, A. Tha Muang, Kanchanaburi, (K.11A) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 1999

Daily Max. Gage Height In Meter (MSL.) April 1, 1999 To March 31, 2000

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	10.89	13.53	10.98	11.77	11.54	11.06	11.88	14.24	11.18	11.35	12.87	11.58	
2	10.89	13.53	10.97	11.74	11.54	11.08	11.85	15.25	12.28	11.35	11.97	11.95	
3	11.49	13.41	10.97	11.93	11.21	11.09	11.19	15.85	11.50	11.78	12.38	11.79	
4	11.41	12.51	10.97	11.01	11.93	11.09	11.71	15.88	11.64	11.97	12.25	12.09	
5	10.97	12.49	10.97	10.90	12.57	11.14	12.14	15.43	11.50	12.06	11.85	11.99	
6	10.97	11.19	10.97	10.89	12.97	11.12	12.22	14.69	11.34	12.02	11.81	11.73	
7	10.97	11.83	10.97	11.50	12.77	11.41	12.41	14.01	11.34	12.20	11.71	11.77	
8	10.98	11.76	10.97	11.52	12.51	10.97	12.31	13.59	11.32	11.86	11.93	11.76	
9	10.98	11.63	10.98	11.63	12.88	10.92	11.96	13.12	11.82	12.02	11.95	12.40	
10	10.98	11.28	10.98	11.71	12.97	11.56	11.46	12.73	11.89	11.65	12.41	11.93	
11	10.98	11.77	11.83	11.36	12.43	11.66	11.21	12.37	11.89	11.61	12.41	11.85	
12	12.01	11.71	12.14	11.06	12.13	11.21	11.10	12.12	11.71	11.95	12.30	11.66	
13	12.11	11.63	12.05	11.06	11.40	11.11	11.69	12.54	11.71	11.88	11.85	11.31	
14	11.26	11.59	11.97	11.06	11.46	11.08	12.30	12.29	11.46	11.88	11.81	11.23	
15	11.33	11.24	12.09	11.06	11.68	11.55	12.30	12.31	11.95	11.82	11.89	12.01	
16	11.41	11.35	11.84	11.06	11.69	11.81	12.56	12.44	11.87	11.82	12.12	12.08	
17	11.35	11.08	11.91	11.06	11.84	11.90	12.38	12.18	11.54	11.82	12.15	12.29	
18	11.35	11.53	11.75	11.06	12.65	12.12	13.23	12.35	11.78	11.83	11.88	12.06	
19	11.00	11.23	11.75	11.06	12.40	11.80	13.23	11.88	11.81	11.80	11.91	12.00	
20	11.36	11.39	11.27	11.24	12.37	11.42	13.51	11.84	11.82	11.99	11.73	11.35	
21	11.72	11.42	11.74	11.73	12.30	11.12	13.11	12.03	11.54	11.75	11.39	11.47	
22	11.22	11.53	11.67	11.22	11.62	12.18	12.48	12.38	11.55	11.72	11.65	11.82	
23	11.37	11.51	11.26	11.15	11.62	11.96	12.47	11.38	11.67	11.66	11.68	11.97	
24	11.47	11.10	11.57	10.91	11.24	11.75	12.24	11.96	11.76	11.55	11.72	11.99	
25	10.81	11.15	11.81	10.90	11.61	12.22	12.24	11.97	11.76	11.84	11.90	11.82	
26	10.78	11.15	12.06	10.89	11.29	12.08	14.34	11.96	11.73	11.95	12.08	11.79	
27	10.78	11.00	11.24	10.89	11.68	11.32	15.78	12.35	11.35	11.99	11.45	11.18	
28	11.79	10.99	11.24	11.36	11.12	11.30	14.94	12.03	11.35	11.75	11.30	11.54	
29	11.82	10.99	11.78	11.74	11.12	11.83	14.55	12.24	11.35	11.88	11.52	11.18	
30	12.99	10.99	11.59	11.81	11.10	11.93	14.53	12.39	11.35	11.61		11.84	
31		10.99		11.89	11.06		14.43		11.35	11.31		12.20	
Max.	12.99	13.53	12.14	11.93	12.97	12.22	15.78	15.88	12.28	12.20	12.87	12.40	15.88 M.

Zero Gage At Bottom Elevation 9.813 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.11A
Station : Ban Wang Khanai, A. Tha Muang, Kanchanaburi, (K.11A) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2000

Daily Max. Gage Height In Meter (MSL.) April 1, 2000 To March 31, 2001

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	11.61	12.29	11.75	12.55	10.97	12.60	12.30	13.10	12.60	11.15	11.93	11.58	
2	11.78	12.36	11.56	12.47	11.02	12.62	12.28	12.80	12.60	11.15	12.50	11.77	
3	11.36	12.37	11.48	12.37	11.07	12.49	12.28	12.66	12.42	11.15	12.09	11.72	
4	11.60	12.58	11.60	12.14	11.08	12.57	13.07	12.07	12.67	11.91	12.10	11.50	
5	11.54	12.14	11.61	12.34	11.11	12.64	12.71	11.79	11.91	11.67	11.57	11.13	
6	11.97	12.36	11.60	12.22	11.11	13.14	12.90	11.30	12.04	11.73	11.80	11.13	
7	11.41	12.36	11.95	12.09	11.11	13.14	12.67	11.41	12.77	11.38	12.39	11.69	
8	11.85	12.74	12.01	12.09	11.11	13.43	14.11	12.01	12.90	11.35	12.41	12.10	
9	11.37	12.74	12.09	12.11	11.11	13.16	12.04	12.01	12.97	11.93	11.89	12.07	
10	11.32	12.59	12.26	12.11	11.21	12.57	12.00	11.66	12.64	11.79	11.91	12.07	
11	11.41	12.77	12.10	12.00	11.59	11.81	12.31	11.66	12.02	11.67	12.12	12.45	
12	11.91	12.78	11.90	12.20	11.85	12.21	12.00	11.21	12.58	11.94	12.03	12.29	
13	11.41	12.78	12.33	12.23	11.07	12.91	11.22	11.18	12.62	11.59	11.79	12.26	
14	11.21	12.78	12.39	11.92	10.98	12.66	11.20	11.14	12.67	11.99	11.91	12.65	
15	11.21	12.36	12.04	11.92	10.97	12.89	11.20	11.14	12.21	11.74	11.93	12.46	
16	11.21	12.33	12.12	11.92	10.97	12.66	11.22	11.29	12.03	11.61	11.46	12.52	
17	11.21	12.49	12.12	11.92	10.97	12.38	11.68	11.64	12.01	11.61	11.52	12.29	
18	12.02	12.04	12.01	11.77	11.95	12.38	12.10	11.64	12.13	11.69	11.54	11.83	
19	12.84	12.06	12.31	11.78	11.38	12.37	12.13	11.71	12.26	11.78	11.34	11.60	
20	12.52	12.35	12.31	11.97	11.85	13.12	12.19	11.42	12.20	11.81	11.34	12.08	
21	12.67	11.86	12.28	11.97	11.55	12.64	12.32	11.16	11.87	11.56	11.21	12.44	
22	12.55	11.37	12.41	11.81	11.77	13.08	12.13	11.16	12.13	11.31	11.62	12.78	
23	12.73	11.69	12.51	11.77	12.09	12.89	11.79	11.48	11.85	11.31	11.64	12.41	
24	12.68	12.01	12.70	11.44	12.01	12.06	11.32	11.98	11.77	11.70	11.41	12.50	
25	12.51	12.22	12.44	11.09	12.33	12.31	11.30	12.06	12.06	11.77	11.28	11.96	
26	12.70	12.40	12.44	11.08	12.01	12.42	11.31	12.34	11.65	12.12	11.27	11.93	
27	12.74	12.24	12.44	11.57	12.02	12.56	11.75	12.66	11.66	12.78	11.29	11.55	
28	12.74	12.30	12.63	11.30	11.86	12.57	11.79	12.35	11.82	12.43	11.27	12.34	
29	12.95	11.12	12.55	11.00	11.91	12.64	11.70	12.64	11.89	11.60		12.21	
30	12.79	11.69	12.55	10.99	13.17	12.69	12.06	12.56	11.17	11.69		12.24	
31		11.85		10.99	12.63		12.79		11.15	12.08		12.07	
Max.	12.95	12.78	12.70	12.55	13.17	13.43	14.11	13.10	12.97	12.78	12.50	12.78	14.11 M.

Zero Gage At Bottom Elevation 9.813 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.11A
Station : Ban Wang Khanai, A. Tha Muang, Kanchanaburi, (K.11A) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2001

Daily Max. Gage Height In Meter (MSL.) April 1, 2001 To March 31, 2002

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	12.10	11.74	11.87	11.92	11.71	13.26	12.12	12.33	12.28	11.11	11.76	11.25	
2	11.65	11.36	11.78	11.37	11.76	13.30	12.25	12.55	11.66	11.11	11.50	11.05	
3	11.73	11.39	12.04	11.25	11.83	12.98	12.63	12.65	11.68	11.14	11.50	11.59	
4	11.89	11.65	11.80	11.65	12.82	12.60	12.42	12.05	11.85	11.16	11.30	11.21	
5	12.59	12.01	11.81	11.91	12.19	12.15	12.45	12.18	12.02	11.75	11.65	11.21	
6	12.51	12.06	11.80	12.08	12.28	12.36	12.45	12.37	12.13	12.34	11.45	12.23	
7	11.17	11.16	11.83	11.99	12.63	12.38	11.97	12.18	12.59	11.77	11.50	11.71	
8	12.06	11.55	12.01	11.80	12.63	12.37	12.02	11.84	12.32	11.33	11.38	11.27	
9	11.82	11.81	12.09	12.43	12.49	12.68	12.21	11.67	12.61	11.34	11.82	11.26	
10	11.59	11.95	12.26	12.51	12.38	12.48	12.65	11.54	12.49	11.34	11.46	11.25	
11	12.67	11.75	11.83	12.51	12.54	12.65	12.23	11.81	12.31	11.55	11.48	11.26	
12	13.10	11.77	11.70	12.56	12.08	12.49	12.22	11.54	12.26	11.14	11.20	11.74	
13	11.45	11.43	12.18	12.53	11.81	12.56	12.43	11.63	12.23	11.59	10.98	12.51	
14	11.37	11.46	12.30	12.45	11.73	12.49	12.34	11.18	11.96	11.43	11.14	12.26	
15	11.25	11.24	12.42	12.47	12.71	12.58	12.73	11.26	12.06	11.65	11.14	12.25	
16	11.16	11.57	12.43	11.95	12.61	12.53	12.76	11.05	11.82	11.47	11.80	12.24	
17	11.50	11.59	12.32	12.10	12.40	12.65	12.73	11.05	11.95	11.69	11.50	12.55	
18	11.87	11.64	11.97	12.36	12.25	12.57	12.54	11.20	12.04	11.85	11.42	11.76	
19	12.03	11.62	11.80	12.19	12.56	12.77	12.50	11.20	12.50	11.75	11.44	12.33	
20	12.03	11.65	12.10	12.11	11.65	12.81	12.52	11.21	12.28	11.68	11.21	12.33	
21	11.86	11.15	11.92	11.64	12.21	12.40	12.37	11.54	12.30	11.75	11.47	12.39	
22	11.55	11.36	11.65	11.72	12.27	12.39	12.13	11.55	12.06	11.88	11.33	12.23	
23	11.35	11.93	11.79	11.20	13.04	11.95	12.12	11.54	11.80	11.93	11.13	11.73	
24	10.94	11.93	12.03	11.26	13.05	12.49	11.82	11.57	11.43	11.93	11.01	11.57	
25	10.93	11.77	11.56	11.38	12.65	12.49	12.08	11.31	11.44	11.95	11.10	11.23	
26	11.54	11.73	11.55	11.79	12.77	12.75	12.36	11.10	11.44	11.77	11.04	11.27	
27	11.70	11.79	11.56	11.39	11.81	12.44	12.65	11.07	11.81	12.06	11.04	11.23	
28	12.25	11.84	11.56	11.60	11.95	12.43	12.19	11.35	11.85	12.34	11.04	12.36	
29	12.11	11.80	11.68	11.55	12.07	12.46	12.24	12.13	11.55	12.34		12.37	
30	11.61	12.09	11.92	11.57	12.29	12.43	12.33	12.14	11.67	12.34		12.36	
31		11.93		11.44	12.41		12.50		11.42	11.93		12.36	
Max.	13.10	12.09	12.43	12.56	13.05	13.30	12.76	12.65	12.61	12.34	11.82	12.55	13.30 M.

Zero Gage At Bottom Elevation 9.813 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.11A
Station : Ban Wang Khanai, A. Tha Muang, Kanchanaburi, (K.11A) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2002

Daily Max. Gage Height In Meter (MSL.) April 1, 2002 To March 31, 2003

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	11.16	11.27	11.98	11.69	12.29	13.42	14.86	12.63	13.03	12.17	12.46	11.83	
2	11.51	11.27	12.09	11.85	12.27	12.67	14.71	12.63	12.81	12.22	12.00	11.93	
3	11.90	11.20	11.64	12.46	12.34	13.24	14.56	12.64	12.77	12.46	12.39	11.90	
4	11.85	11.33	12.01	12.31	12.54	13.83	14.12	12.86	12.87	12.37	12.46	11.67	
5	11.53	11.33	11.83	12.21	12.31	14.17	14.00	12.97	12.77	11.97	12.59	12.39	
6	11.43	11.36	11.79	12.00	12.28	14.45	14.15	12.84	13.01	12.19	12.58	12.06	
7	11.95	11.36	11.85	11.98	12.28	14.32	14.71	12.88	13.09	12.34	12.46	12.35	
8	11.77	12.25	11.98	11.92	12.47	14.16	15.11	12.86	13.21	12.88	12.35	11.91	
9	11.89	12.27	11.90	12.04	12.38	13.76	15.26	12.81	13.05	12.83	12.41	11.90	
10	12.11	12.01	11.59	12.39	12.40	14.22	14.68	12.60	13.05	12.77	12.41	11.41	
11	12.17	11.96	12.17	12.06	12.62	14.45	14.24	12.64	12.89	12.85	12.09	11.12	
12	11.98	11.96	12.22	12.06	12.32	14.47	13.85	12.41	12.81	12.88	12.31	11.63	
13	11.30	11.90	11.93	11.84	11.32	14.81	13.52	12.59	12.55	12.66	12.17	12.16	
14	11.23	11.87	12.20	12.02	11.97	14.71	13.37	12.57	12.82	12.74	12.11	12.11	
15	11.24	11.96	12.32	12.03	13.14	14.56	13.07	12.69	12.56	12.92	12.08	12.41	
16	11.24	12.01	12.46	12.03	12.87	13.66	13.28	12.50	12.38	12.95	12.11	12.17	
17	11.24	11.54	12.31	12.09	12.48	13.66	13.19	12.39	12.69	12.84	11.99	12.06	
18	11.46	11.98	12.31	11.66	13.08	13.58	13.19	12.34	12.70	12.79	11.99	11.97	
19	11.53	11.95	12.72	11.62	13.41	13.57	13.12	12.62	12.90	12.80	11.97	12.07	
20	11.27	11.95	12.46	11.88	14.09	13.81	13.13	12.64	13.10	12.77	11.95	12.09	
21	11.25	14.06	11.88	11.90	14.34	13.31	12.94	12.88	13.18	12.60	11.87	12.12	
22	11.63	14.05	11.88	11.74	13.52	14.33	12.81	12.92	12.86	12.78	11.96	11.87	
23	11.79	12.91	12.10	11.16	13.60	14.54	13.19	12.92	12.72	12.67	11.91	11.83	
24	11.80	12.65	11.81	11.58	13.94	15.32	12.91	12.91	12.62	12.62	11.75	11.81	
25	11.80	12.27	11.84	11.96	13.71	15.95	12.93	12.93	12.60	12.73	11.52	11.95	
26	11.26	12.39	12.61	12.38	13.45	15.86	12.93	12.97	12.60	12.64	11.87	12.01	
27	11.26	11.48	12.11	12.79	13.80	15.55	12.93	13.04	12.61	12.55	11.89	12.11	
28	11.26	11.31	11.96	12.20	13.82	15.21	12.76	13.00	12.61	12.68	11.67	12.25	
29	11.27	11.30	11.73	12.40	13.49	15.11	12.79	13.03	12.61	12.87		12.45	
30	11.28	11.32	12.11	11.85	13.48	15.10	12.90	13.03	12.32	12.81		12.77	
31		11.55		11.88	13.61		12.81		12.29	12.82		12.53	
Max.	12.17	14.06	12.72	12.79	14.34	15.95	15.26	13.04	13.21	12.95	12.59	12.77	15.95 M.

Zero Gage At Bottom Elevation 9.813 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.11A
Station : Ban Wang Khanai, A. Tha Muang, Kanchanaburi, (K.11A) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2003

Daily Max. Gage Height In Meter (MSL.) April 1, 2003 To March 31, 2004

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	12.02	11.67	12.21	12.17	12.45	12.41	12.99	11.75	12.14	11.82	12.21	11.38	
2	12.47	11.69	12.03	12.34	12.75	12.09	13.08	11.94	12.11	11.51	12.24	11.37	
3	12.28	11.46	11.45	12.62	12.65	11.92	13.03	11.21	12.28	11.86	12.00	11.73	
4	12.39	11.44	11.90	12.74	11.99	11.88	13.24	11.26	12.31	12.21	12.06	12.11	
5	12.42	11.23	12.09	12.67	11.94	11.92	13.31	11.20	12.32	12.08	12.06	11.94	
6	12.17	11.92	12.33	12.85	12.28	11.76	12.94	11.99	12.40	12.17	11.75	11.94	
7	12.12	12.20	12.22	12.59	12.31	11.71	13.08	12.01	11.90	12.29	11.99	11.38	
8	12.02	12.20	12.26	12.38	12.07	11.18	13.53	11.57	12.36	12.34	12.06	11.36	
9	12.01	12.11	12.10	12.59	12.53	11.18	13.35	12.05	12.41	12.36	11.70	11.31	
10	12.17	12.07	12.42	12.89	12.54	11.61	13.12	12.00	12.55	12.32	11.76	11.31	
11	12.11	11.29	12.76	12.47	12.46	11.64	12.87	11.88	12.58	12.63	12.01	11.32	
12	12.02	11.91	12.78	12.65	11.83	11.71	12.94	11.88	12.38	12.75	11.92	12.08	
13	12.00	11.91	12.67	12.47	11.82	11.76	13.00	11.71	12.40	12.75	12.01	12.07	
14	11.81	12.25	12.63	12.01	12.33	11.47	12.83	11.56	12.30	12.25	11.81	11.93	
15	11.39	12.26	12.63	12.30	12.36	11.04	12.88	11.47	12.17	12.25	11.71	12.26	
16	11.50	12.17	12.60	12.62	12.66	11.04	12.99	11.25	12.14	12.25	11.35	11.79	
17	11.23	12.09	12.33	12.82	12.71	11.40	12.89	11.24	11.91	12.25	11.35	11.87	
18	11.21	12.41	12.70	12.93	11.95	12.01	12.76	11.24	11.76	12.25	11.35	11.75	
19	11.21	12.31	12.67	12.55	12.27	11.54	12.90	11.67	12.11	12.00	11.83	11.75	
20	11.73	12.58	12.34	12.82	12.32	11.61	12.85	11.85	11.94	12.25	12.07	11.75	
21	11.33	12.21	12.67	12.28	12.16	11.29	12.55	11.84	11.65	12.12	12.07	11.75	
22	11.57	12.21	12.73	11.76	12.46	11.31	12.55	11.97	11.66	11.93	12.28	11.60	
23	11.82	12.42	12.51	11.90	12.24	12.43	12.03	11.86	11.70	11.29	11.26	11.60	
24	11.78	12.33	12.33	12.42	11.87	12.55	11.24	11.34	11.82	12.19	11.86	11.90	
25	11.98	12.47	12.29	12.29	11.87	13.37	11.97	12.03	11.96	12.07	11.62	11.75	
26	11.99	12.04	12.39	12.77	11.09	13.30	12.85	11.92	11.98	11.61	11.70	11.75	
27	11.47	12.29	12.23	13.29	12.20	13.24	13.52	12.08	12.00	11.26	11.60	11.75	
28	11.46	12.37	12.34	13.31	12.51	13.29	12.90	11.89	11.95	12.09	11.52	11.90	
29	11.44	12.31	12.47	13.12	12.58	13.33	12.86	11.85	12.05	12.34	11.38	11.75	
30	11.67	12.47	12.34	12.90	12.52	12.83	12.45	12.27	11.86	12.34		11.45	
31		12.69		12.80	12.49		12.46		11.91	12.34		11.60	
Max.	12.47	12.69	12.78	13.31	12.75	13.37	13.53	12.27	12.58	12.75	12.28	12.26	13.53 M.

Zero Gage At Bottom Elevation 9.813 M. (MSL.)

RID Computer Center
Station : K.55, (K.55)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.55
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 1998

Daily Max. Gage Height In Meter (MSL.) April 1, 1998 To March 31, 1999

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	*******	*******	*******	*******	*******	*******			0.07	0.05	0.07	0.14	0.13	0.13
2	*******	*******	*******	*******	*******	*******			0.10	0.05	0.10	0.14	0.13	0.13
3	*******	*******	*******	*******	*******	*******			0.44	0.05	0.44	0.25	0.13	0.13
4	*******	*******	*******	*******	*******	*******			0.15	1.00	0.15	0.28	0.13	0.13
5	*******	*******	*******	*******	*******	*******			0.35	1.20	0.35	0.45	0.13	0.13
6	*******	*******	*******	*******	*******	*******			0.45	1.00	0.45	0.79	0.13	0.13
7	*******	*******	*******	*******	*******	*******			0.40	0.75	0.40	0.80	0.13	0.13
8	*******	*******	*******	*******	*******	*******			0.24	0.28	0.24	0.98	0.13	0.13
9	*******	*******	*******	*******	*******	*******			0.24	0.24	0.24	0.98	0.13	0.13
10	*******	*******	*******	*******	*******	*******			0.24	0.25	0.24	0.26	0.13	0.13
11	*******	*******	*******	*******	*******	*******			0.23	0.25	0.23	0.41	0.13	0.13
12	*******	*******	*******	*******	*******	*******			0.21	0.25	0.21	0.43	0.13	0.13
13	*******	*******	*******	*******	*******	*******			0.21	0.24	0.21	0.43	0.13	0.13
14	*******	*******	*******	*******	*******	*******			0.19	0.24	0.19	0.35	0.13	0.13
15	*******	*******	*******	*******	*******	*******			0.17	0.24	0.17	0.35	0.13	0.14
16	*******	*******	*******	*******	*******	*******			0.17	0.24	0.17	0.35	0.13	0.14
17	*******	*******	*******	*******	*******	*******			0.20	0.24	0.20	0.29	0.13	0.14
18	*******	*******	*******	*******	*******	*******			0.17	0.08	0.17	0.30	0.13	0.14
19	*******	*******	*******	*******	*******	*******			0.17	0.48	0.17	0.30	0.13	0.15
20	*******	*******	*******	*******	*******	*******			0.17	0.52	0.17	0.30	0.13	0.15
21	*******	*******	*******	*******	*******	*******			0.17	0.40	0.17	0.33	0.13	0.15
22	*******	*******	*******	*******	*******	*******			0.17	0.35	0.17	0.25	0.13	0.11
23	*******	*******	*******	*******	*******	*******			0.17	0.24	0.17	0.25	0.13	0.11
24	*******	*******	*******	*******	*******	*******			0.17	0.14	0.17	0.20	0.13	0.05
25	*******	*******	*******	*******	*******	*******			0.16	0.25	0.16	0.19	0.13	0.05
26	*******	*******	*******	*******	*******	*******			0.15	0.71	0.15	0.18	0.13	0.05
27	*******	*******	*******	*******	*******	*******			0.15	0.43	0.15	0.18	0.13	0.05
28	*******	*******	*******	*******	*******	*******			0.15	0.30	0.15	0.15	0.13	0.05
29	*******	*******	*******	*******	*******	*******			0.14	0.25	0.14	0.15		0.03
30	*******	*******	*******	*******	*******	*******			0.14	0.12	0.14	0.13		0.03
31		*******		*******	*******				0.14		0.14	0.13		0.03
Max.	*******	*******	*******	*******	*******	*******			0.45	1.20	0.45	0.98	0.13	0.15	1.20 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.55
Station : K.55, (K.55) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 1999

Daily Max. Gage Height In Meter (MSL.) April 1, 1999 To March 31, 2000

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	0.05	2.75	0.13	1.67	1.53	0.04	1.00	4.47	0.34	0.57	0.15	0.45	
2	0.07	2.84	0.13	1.56	1.30	0.04	0.84	4.26	0.95	0.67	0.94	1.00	
3	0.07	1.85	0.13	1.13	1.13	0.17	0.65	5.84	0.05	0.75	1.17	1.00	
4	0.10	1.84	0.13	0.55	0.05	0.17	0.63	6.29	0.50	0.77	1.52	0.85	
5	0.11	1.43	0.10	0.15	1.70	0.19	0.35	6.01	0.51	0.84	0.60	0.74	
6	0.12	0.55	0.10	0.15	2.23	0.21	0.75	5.03	0.37	0.87	1.00	0.75	
7	0.12	1.00	0.10	1.10	2.05	0.24	1.00	4.27	0.34	0.87	0.87	0.45	
8	0.14	0.64	0.10	1.50	2.07	0.24	1.60	3.54	0.35	0.87	0.62	0.57	
9	0.14	0.65	0.10	1.57	2.07	0.14	1.00	2.87	0.40	0.87	1.00	1.00	
10	0.14	0.20	1.55	1.55	2.35	0.11	0.65	2.30	0.70	0.96	1.57	0.54	
11	0.14	0.45	1.70	1.10	1.75	0.11	0.50	2.03	0.98	1.00	1.63	0.50	
12	0.25	0.85	1.75	0.04	1.67	0.05	0.35	1.44	0.94	1.00	1.25	0.30	
13	0.37	0.50	1.75	0.04	1.53	0.05	0.43	1.88	0.75	0.98	0.62	0.23	
14	0.41	0.19	1.74	0.04	1.30	0.15	1.00	1.63	0.49	0.97	0.64	0.31	
15	0.44	0.14	1.85	0.04	0.20	0.17	1.30	1.45	0.57	0.86	0.90	0.30	
16	0.83	0.40	1.68	0.04	0.64	0.87	1.92	1.73	1.00	0.75	0.85	1.00	
17	0.75	0.25	1.71	0.04	0.64	0.89	1.92	1.00	0.57	0.72	1.00	1.31	
18	0.43	0.22	1.75	0.04	1.53	0.89	2.50	1.44	0.99	0.67	0.95	0.47	
19	0.14	0.30	1.69	0.04	1.64	0.75	2.95	1.47	0.90	0.65	0.97	1.00	
20	0.54	0.30	1.35	0.04	1.95	0.60	3.00	1.00	0.85	0.75	0.55	0.24	
21	0.55	0.30	1.53	0.04	1.80	0.89	3.00	0.70	0.41	0.75	0.24	0.24	
22	0.15	0.27	1.75	0.04	1.75	0.87	2.10	1.50	0.34	0.80	0.50	0.21	
23	0.27	0.25	1.13	1.12	1.00	0.74	2.08	0.59	0.59	0.84	0.25	0.75	
24	0.14	0.25	1.70	1.05	0.60	1.00	1.41	0.80	0.77	0.87	0.65	1.00	
25	0.09	0.25	1.54	0.04	0.44	0.95	1.43	1.00	0.87	0.95	0.85	0.95	
26	0.07	0.17	1.54	0.04	0.39	0.75	0.95	1.00	*******	1.00	0.55	0.85	
27	0.03	0.15	1.54	0.04	0.10	0.43	5.67	1.32	0.35	1.01	0.46	0.35	
28	0.49	0.13	1.14	0.04	0.05	0.43	5.20	1.42	0.35	0.94	0.46	0.32	
29	0.54	0.13	1.30	0.04	0.05	0.43	4.77	1.25	0.30	0.90	0.54	0.20	
30	1.47	0.13	1.31	1.64	0.04	1.00	4.75	1.31	0.37	0.78		0.30	
31		0.13		1.34	0.04		4.67		0.37	0.55		0.71	
Max.	1.47	2.84	1.85	1.67	2.35	1.00	5.67	6.29	1.00	1.01	1.63	1.31	6.29 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.55, (K.55)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.55
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 2000

Daily Max. Gage Height In Meter (MSL.) April 1, 2000 To March 31, 2001

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	0.49	1.00	0.97	1.55	0.05	1.84	1.67	2.30	1.84	0.20	0.94	*******	
2	0.31	0.97	0.48	1.35	0.05	1.75	0.75	2.45	2.04	0.18	0.74	*******	
3	0.35	1.69	0.45	1.35	0.05	1.00	0.59	2.03	1.74	0.18	0.75	*******	
4	0.44	1.00	0.45	1.27	0.07	1.00	2.00	1.05	2.01	0.75	0.97	*******	
5	0.45	1.95	0.48	1.55	0.14	2.04	2.90	0.95	2.01	0.14	0.75	*******	
6	0.75	1.85	0.50	1.35	0.15	2.42	2.00	0.75	1.07	0.14	0.35	*******	
7	0.45	1.00	0.57	1.00	0.15	2.64	2.17	0.30	1.35	0.14	0.60	*******	
8	0.45	1.97	1.00	1.35	0.15	3.00	1.00	0.84	2.15	0.18	0.84	*******	
9	0.35	2.35	1.00	1.00	0.14	2.79	1.35	1.08	1.90	0.75	0.84	*******	
10	0.45	2.00	1.00	1.55	0.25	2.35	1.30	0.90	2.10	0.35	0.89	*******	
11	0.35	2.17	1.00	1.17	0.25	1.41	1.26	1.00	1.31	0.14	0.75	*******	
12	0.80	2.24	1.00	1.25	0.75	1.00	1.24	0.25	2.20	0.14	0.64	*******	
13	0.50	1.97	1.00	1.27	0.54	2.04	1.21	0.25	1.77	0.14	0.30	*******	
14	0.57	1.55	1.48	1.25	0.75	2.29	1.20	0.25	1.84	0.35	0.57	*******	
15	0.27	1.27	0.99	0.96	0.10	2.04	1.16	0.25	1.35	0.85	0.84	*******	
16	0.25	1.50	1.10	0.96	0.05	2.82	1.13	0.25	0.25	0.18	0.38	*******	
17	0.25	1.50	1.35	0.98	0.05	1.62	1.01	0.25	1.87	0.15	0.40	*******	
18	0.38	0.75	1.00	0.50	0.12	1.63	1.00	0.87	2.20	0.40	0.35	*******	
19	1.97	1.57	1.00	0.85	0.25	1.97	1.43	0.84	0.91	0.37	0.37	*******	
20	1.84	1.70	1.62	0.98	0.24	2.00	1.43	0.54	1.00	0.74	0.15	*******	
21	1.87	1.00	1.45	1.00	0.50	2.04	1.00	0.22	1.00	0.42	0.14	*******	
22	2.02	1.00	1.64	0.85	0.84	2.16	0.98	0.22	1.32	0.35	0.25	*******	
23	2.01	0.28	1.87	0.85	1.00	2.14	0.97	0.22	1.00	0.35	0.57	*******	
24	2.35	0.45	2.00	0.72	1.00	1.00	0.46	1.27	0.99	0.20	0.72	*******	
25	2.00	1.53	1.79	0.13	1.00	1.00	0.44	1.27	0.67	0.14	0.14	*******	
26	1.97	1.17	1.74	0.12	1.00	1.39	0.44	1.30	0.57	0.54	0.14	*******	
27	2.14	1.00	1.74	0.13	1.00	2.00	0.50	1.72	0.40	0.90	0.14	*******	
28	2.09	1.17	2.00	0.25	1.00	1.81	0.67	1.92	0.80	0.95	0.14	*******	
29	2.24	0.87	2.00	0.05	1.67	1.75	0.73	1.75	0.38	0.47		*******	
30	2.14	1.00	1.73	0.05	2.00	2.00	1.00	2.04	0.38	1.00		*******	
31		0.99		0.05	1.41		1.47		0.38	0.75		*******	
Max.	2.35	2.35	2.00	1.55	2.00	3.00	2.90	2.45	2.20	1.00	0.97	*******	3.00 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.55
Station : K.55, (K.55) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 2001

Daily Max. Gage Height In Meter (MSL.) April 1, 2001 To March 31, 2002

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	0.44	0.97	0.92	1.02	1.80	1.80	1.08	1.08	1.55	1.06	1.08	1.08	
2	0.36	1.27	0.62	0.92	1.92	1.80	1.08	1.08	1.55	1.08	1.06	1.06	
3	0.41	1.62	0.64	0.74	1.80	1.05	1.08	1.55	1.55	1.08	1.55	1.06	
4	0.44	1.07	0.57	0.88	1.80	1.80	1.92	1.35	1.55	1.92	1.08	1.45	
5	0.45	1.80	0.55	0.88	1.80	1.06	1.08	1.92	1.55	1.92	1.08	1.35	
6	0.62	1.72	0.38	1.04	1.80	1.61	1.08	1.92	1.54	1.08	1.08	1.55	
7	0.39	0.99	0.73	0.86	1.80	1.55	1.08	1.54	1.08	2.61	1.54	1.08	
8	0.33	1.72	1.04	1.07	1.80	1.60	1.34	1.92	1.55	1.45	1.45	1.06	
9	0.32	2.23	0.99	1.06	1.80	1.60	1.35	1.35	1.55	1.34	1.55	1.06	
10	0.44	1.88	0.99	1.44	1.08	1.61	1.34	1.92	1.55	1.92	1.92	2.08	
11	0.41	2.00	1.00	1.64	1.60	2.10	1.35	1.92	1.92	1.08	2.55	1.43	
12	0.81	2.18	1.03	1.68	1.80	1.07	1.08	1.45	1.55	1.34	2.08	1.55	
13	0.40	1.88	1.04	1.78	1.80	1.07	1.08	1.55	1.45	1.92	1.08	1.45	
14	0.60	1.47	1.64	1.56	1.80	1.61	1.34	1.45	1.45	1.34	1.55	1.92	
15	0.38	1.12	1.75	1.51	1.92	1.61	1.92	1.55	1.08	1.54	1.55	2.08	
16	0.22	1.33	1.60	1.05	1.80	1.07	2.92	1.45	1.45	1.92	1.09	1.06	
17	0.26	0.92	1.34	1.14	1.92	2.07	2.45	1.06	1.55	1.34	2.55	1.43	
18	0.40	0.77	1.06	1.42	1.80	2.61	1.45	1.06	1.55	1.92	1.42	1.55	
19	1.34	1.32	1.05	1.18	1.80	2.61	1.08	1.08	1.61	1.45	1.06	1.92	
20	1.77	1.50	1.22	1.16	1.80	2.50	2.54	1.55	1.92	1.48	1.08	2.55	
21	1.88	0.72	0.88	0.90	1.80	2.61	2.08	1.10	1.45	1.92	1.08	1.43	
22	2.07	1.36	0.60	0.84	1.80	1.80	1.42	1.91	1.08	1.45	1.06	1.06	
23	2.08	0.50	0.79	0.72	1.80	1.61	1.55	1.55	1.55	2.61	2.08	1.08	
24	2.40	0.64	1.15	0.76	1.80	2.61	1.35	1.54	1.05	1.92	2.08	1.45	
25	2.04	1.48	1.29	0.50	1.80	2.80	2.08	1.55	1.55	1.08	1.08	2.45	
26	1.98	1.04	1.06	0.32	1.60	1.06	1.08	1.08	1.45	2.08	1.06	1.43	
27	2.08	0.98	0.98	0.30	1.92	1.06	1.08	1.08	1.45	1.55	1.55	1.45	
28	2.00	1.12	0.90	0.26	1.80	1.06	1.08	1.92	1.45	1.55	1.06	1.08	
29	2.09	1.00	0.90	0.08	1.80	1.06	1.92	1.92	1.55	1.54		1.45	
30	1.84	1.01	1.20	0.07	1.80	1.06	2.55	1.08	1.43	2.05		1.45	
31		0.95		0.05	1.80		1.55		1.08	1.92		1.08	
Max.	2.40	2.23	1.75	1.78	1.92	2.80	2.92	1.92	1.92	2.61	2.55	2.55	2.92 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.55, (K.55)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.55
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 2002

Daily Max. Gage Height In Meter (MSL.) April 1, 2002 To March 31, 2003

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.06	1.06	1.08	1.08	1.08	1.08	5.08	3.10	2.08	3.45	1.08	1.06	
2	1.08	1.08	1.08	1.08	1.08	1.92	5.08	3.92	2.92	3.55	1.45	1.08	
3	1.06	1.08	1.05	1.07	1.08	1.92	4.90	3.92	3.08	2.45	1.08	1.55	
4	1.08	1.06	1.08	1.08	1.07	2.01	5.82	3.09	3.45	2.92	2.08	1.08	
5	1.06	1.06	1.08	1.07	1.06	2.92	4.06	3.55	3.08	2.06	2.55	1.07	
6	1.08	1.45	1.61	1.08	1.06	3.92	3.08	3.08	3.08	1.08	2.92	1.45	
7	1.08	2.06	1.55	1.08	1.08	4.55	3.92	3.08	3.55	1.06	2.08	1.06	
8	1.09	2.91	1.55	1.05	1.06	4.08	4.92	3.55	3.45	2.08	2.09	1.08	
9	1.06	2.55	1.06	1.08	1.06	4.54	5.08	3.08	3.54	3.55	2.06	2.08	
10	1.08	2.10	1.61	1.06	1.06	3.92	4.06	3.92	3.92	3.55	2.45	2.09	
11	1.07	2.55	2.10	1.08	1.06	3.92	4.70	2.45	2.08	3.08	1.08	2.09	
12	1.08	2.45	1.07	1.06	1.08	4.57	4.08	1.92	2.54	3.06	1.45	3.08	
13	1.06	2.55	1.07	1.06	1.05	4.78	3.92	2.08	2.54	4.08	1.09	3.09	
14	1.08	2.45	1.61	1.08	1.08	4.65	3.55	3.45	2.54	2.06	1.08	3.55	
15	1.06	2.08	1.07	1.08	1.08	3.92	3.07	3.08	2.54	2.08	1.92	1.08	
16	1.06	2.55	1.07	1.06	2.06	3.08	3.06	2.09	2.54	3.92	2.08	2.09	
17	1.08	2.45	2.07	1.06	2.10	3.92	3.55	3.08	2.54	2.06	2.55	2.08	
18	1.06	2.55	2.55	1.06	2.20	3.92	3.55	3.55	2.92	1.08	2.08	1.07	
19	1.06	2.45	2.61	1.08	3.30	2.55	3.92	3.08	2.54	1.55	2.45	1.55	
20	1.08	2.92	2.06	1.08	3.55	2.92	2.08	3.55	2.08	1.55	2.08	1.08	
21	1.06	3.45	2.61	1.10	4.92	3.55	3.06	3.55	1.92	2.08	1.45	1.55	
22	1.08	3.55	1.80	1.08	3.60	3.55	3.01	3.55	1.45	2.92	1.06	1.08	
23	1.06	1.55	1.61	1.07	3.92	3.92	2.55	3.08	2.61	2.55	1.45	1.45	
24	1.05	1.08	2.61	1.06	2.06	4.92	3.06	3.45	1.92	3.08	1.06	1.55	
25	1.08	1.92	2.80	1.06	2.10	6.92	3.92	3.55	1.08	5.05	1.05	2.55	
26	1.06	1.06	2.00	1.08	2.20	6.55	2.45	3.45	2.08	3.08	1.06	1.55	
27	1.08	1.55	1.06	1.08	4.61	6.20	2.08	3.92	1.55	2.06	1.05	1.08	
28	1.05	1.45	1.06	1.08	3.30	5.92	2.92	3.45	1.55	2.55	2.06	1.55	
29	1.06	2.05	1.55	1.08	3.06	4.92	2.55	3.92	1.54	1.96		1.55	
30	1.08	2.91	1.08	1.08	3.14	5.45	2.92	4.45	2.05	1.08		1.55	
31		2.55		1.06	2.50		3.06		1.54	1.09		1.08	
Max.	1.09	3.55	2.80	1.10	4.92	6.92	5.82	4.45	3.92	5.05	2.92	3.55	6.92 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.55, (K.55)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.55
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 2003

Daily Max. Gage Height In Meter (MSL.) April 1, 2003 To March 31, 2004

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	2.73	2.73	2.73	5.20	3.57	2.73	4.74	2.73	2.73	2.73	3.57	2.10	
2	2.73	3.57	3.57	5.20	3.20	2.71	4.74	3.20	2.73	3.20	3.20	2.12	
3	3.57	3.20	3.73	4.73	2.73	2.71	4.73	2.73	2.73	3.57	2.14	2.20	
4	3.20	2.73	4.20	4.73	3.10	2.73	4.73	3.20	3.57	2.73	3.20	2.30	
5	3.20	3.20	3.73	4.94	3.20	2.71	4.73	3.20	2.73	2.73	2.21	2.75	
6	2.73	3.73	5.20	3.94	2.71	3.20	4.73	2.73	2.73	3.57	2.21	3.07	
7	3.73	4.57	5.20	4.10	2.71	3.20	4.74	3.57	3.57	2.73	2.23	3.07	
8	4.20	3.73	3.73	4.20	3.20	3.20	5.10	2.73	2.73	4.57	2.23	2.75	
9	3.71	4.20	3.74	3.74	2.73	3.20	5.20	3.10	2.73	4.20	2.63	2.20	
10	4.20	3.75	3.73	4.57	2.71	3.20	4.73	2.73	3.57	4.57	2.52	2.19	
11	4.73	3.20	3.75	3.57	2.66	3.70	5.20	2.73	2.73	2.73	2.15	2.20	
12	2.72	3.57	4.57	3.20	2.66	3.71	5.20	3.57	2.73	3.57	2.20	2.20	
13	2.71	3.20	3.73	3.10	3.20	3.73	5.20	3.10	3.57	2.73	2.25	2.05	
14	3.20	3.57	4.20	3.20	3.20	3.71	5.10	3.20	2.73	3.57	2.10	2.09	
15	2.73	2.73	3.75	2.73	3.20	3.71	5.20	2.73	2.73	2.73	2.13	2.44	
16	3.20	3.73	4.73	3.73	2.73	3.10	5.57	2.73	3.57	2.73	2.10	2.41	
17	2.73	4.20	5.10	4.10	2.73	3.20	5.10	2.71	2.73	3.57	2.04	2.32	
18	2.73	3.73	4.71	4.57	3.20	3.10	4.57	2.71	2.73	2.73	2.07	2.31	
19	3.20	4.20	5.20	4.10	2.73	3.20	3.73	2.71	3.57	2.71	2.10	2.25	
20	2.73	3.73	4.73	5.10	2.73	2.70	3.73	2.72	2.73	3.57	2.24	2.25	
21	2.73	4.73	4.70	3.71	3.73	2.73	3.73	2.73	3.57	4.73	2.71	2.14	
22	3.10	5.57	3.73	3.74	3.73	3.66	3.71	2.73	2.73	4.73	2.70	2.20	
23	3.20	4.71	4.57	2.73	3.73	3.74	3.73	2.71	2.73	5.57	2.20	2.15	
24	3.73	4.20	4.10	3.73	3.71	2.74	3.73	2.71	2.73	4.73	3.57	2.20	
25	3.70	3.73	3.73	4.70	3.10	3.20	3.73	2.71	2.73	4.73	2.28	2.55	
26	4.20	2.73	4.73	5.57	3.20	3.71	3.73	3.20	2.73	2.71	2.12	2.43	
27	3.73	3.20	5.57	4.73	3.10	3.71	4.25	2.73	2.73	3.20	2.10	2.70	
28	3.73	2.73	4.73	3.73	3.20	3.71	3.71	2.71	3.57	1.94	2.11	2.73	
29	2.73	3.57	3.73	4.20	3.10	4.66	4.20	2.73	2.74	2.57	2.14	3.11	
30	2.73	3.57	4.20	2.73	3.20	4.66	3.10	2.73	2.73	2.73		2.52	
31		3.20		2.73	3.10		2.73		2.73	3.57		2.04	
Max.	4.73	5.57	5.57	5.57	3.73	4.66	5.57	3.57	3.57	5.57	3.57	3.11	5.57 M.

Zero Gage At Bottom Elevation 1.647 M. (MSL.)

RID Computer Center
Station : K.56, (K.56)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.56
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 1998

Daily Max. Gage Height In Meter (MSL.) April 1, 1998 To March 31, 1999

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	*******	*******	*******	*******	*******	*******			1.54	1.00	0.95	*****	1.08	1.27
2	*******	*******	*******	*******	*******	*******			1.95	1.00	1.00	*****	0.70	0.87
3	*******	*******	*******	*******	*******	*******			2.40	1.10	1.20	1.00	1.04	1.00
4	*******	*******	*******	*******	*******	*******			1.58	2.80	1.40	1.20	1.24	0.60
5	*******	*******	*******	*******	*******	*******			1.40	1.70	1.56	1.20	1.36	1.00
6	*******	*******	*******	*******	*******	*******			1.16	1.60	1.00	1.20	*****	1.00
7	*******	*******	*******	*******	*******	*******			1.26	1.30	1.40	1.30	*****	0.73
8	*******	*******	*******	*******	*******	*******			5.30	1.00	1.20	1.36	0.86	0.63
9	*******	*******	*******	*******	*******	*******			3.89	1.30	1.30	1.30	0.80	0.65
10	*******	*******	*******	*******	*******	*******			3.56	1.36	0.80	1.00	0.95	0.73
11	*******	*******	*******	*******	*******	*******			2.76	1.50	0.80	1.00	1.00	0.75
12	*******	*******	*******	*******	*******	*******			2.50	1.20	1.00	1.04	1.20	0.73
13	*******	*******	*******	*******	*******	*******			3.40	*****	1.10	1.05	1.12	0.70
14	*******	*******	*******	*******	*******	*******			3.80	1.06	0.80	1.30	1.10	0.68
15	*******	*******	*******	*******	*******	*******			3.10	1.00	0.70	1.38	1.10	1.00
16	*******	*******	*******	*******	*******	*******			2.90	1.06	0.96	1.50	0.70	1.10
17	*******	*******	*******	*******	*******	*******			2.00	1.00	1.00	1.40	1.00	1.15
18	*******	*******	*******	*******	*******	*******			1.90	1.10	1.00	1.10	0.80	1.07
19	*******	*******	*******	*******	*******	*******			1.80	1.10	0.86	1.10	1.00	0.85
20	*******	*******	*******	*******	*******	*******			1.60	1.30	0.95	1.20	0.90	0.90
21	*******	*******	*******	*******	*******	*******			2.10	1.25	0.90	1.30	1.20	1.10
22	*******	*******	*******	*******	*******	*******			1.80	1.35	1.26	1.04	1.20	0.95
23	*******	*******	*******	*******	*******	*******		*****	1.15	1.26	1.30	1.25	0.97	
24	*******	*******	*******	*******	*******	*******		*****	1.06	1.05	1.00	1.00	0.97	
25	*******	*******	*******	*******	*******	*******			1.00	1.30	1.00	1.00	0.85	0.80
26	*******	*******	*******	*******	*******	*******			0.80	1.20	0.50	1.00	1.10	0.80
27	*******	*******	*******	*******	*******	*******			0.80	*****	1.00	0.90	1.00	1.12
28	*******	*******	*******	*******	*******	*******			1.00	*****	1.20	0.90	1.25	0.97
29	*******	*******	*******	*******	*******	*******			0.90	0.40	1.00	0.90		0.80
30	*******	*******	*******	*******	*******	*******			1.10	1.00	0.98	1.15		1.00
31		*******		*******	*******				1.10		*****	1.30		0.96
Max.	*******	*******	*******	*******	*******	*******			5.30	2.80	1.56	1.50	1.36	1.27	5.30 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.56
Station : K.56, (K.56) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 1999

Daily Max. Gage Height In Meter (MSL.) April 1, 1999 To March 31, 2000

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.15	2.70	0.66	1.00	1.10	0.73	1.50	4.37	1.10	1.40	1.80	1.60	
2	0.90	3.00	0.67	1.20	1.10	0.75	1.50	4.24	1.20	1.35	1.30	1.52	
3	0.85	2.30	0.66	*****	0.68	0.75	1.27	5.41	1.10	1.40	1.60	1.70	
4	1.00	1.94	0.68	0.85	1.00	0.45	1.19	5.83	1.30	1.39	*****	1.61	
5	0.86	2.00	0.67	0.60	1.80	0.77	1.46	5.66	1.08	1.40	1.36	1.48	
6	*****	1.56	0.58	0.58	2.80	0.69	1.90	4.92	1.10	1.50	1.60	1.48	
7	0.72	0.92	0.68	0.55	2.80	0.73	1.76	4.34	1.28	1.60	1.39	1.41	
8	0.74	1.26	0.58	0.76	2.80	0.68	1.90	3.68	1.28	1.58	1.50	1.30	
9	*****	1.30	0.67	0.87	2.65	0.61	1.60	3.08	*****	1.60	1.50	1.14	
10	****	1.00	0.56	0.85	2.80	0.50	1.55	2.53	*****	1.40	1.80	1.58	
11	****	1.32	0.60	0.69	2.08	1.00	1.20	2.30	1.50	1.55	1.80	1.50	
12	****	1.40	1.36	0.60	1.80	1.20	1.22	1.90	1.40	1.55	1.85	1.26	
13	1.70	1.80	1.30	0.47	1.40	0.83	1.10	1.82	1.31	1.30	*****	0.82	
14	1.30	1.55	1.26	0.64	0.86	0.81	1.90	1.92	1.20	1.33	1.40	1.10	
15	1.46	1.40	1.46	0.47	0.97	0.83	2.42	*****	0.81	1.40	1.32	1.20	
16	1.50	1.02	1.28	0.43	1.25	1.00	2.10	1.98	*****	1.53	1.30	1.55	
17	1.40	1.10	1.20	0.73	1.38	1.45	2.45	1.46	1.16	1.50	1.65	1.20	
18	1.20	1.02	1.18	*****	1.85	1.30	2.50	*****	1.20	1.60	1.60	0.97	
19	1.05	1.00	1.25	*****	1.80	1.16	3.10	*****	*****	1.29	*****	1.40	
20	0.90	1.00	1.00	0.62	1.35	1.15	3.20	1.62	1.32	1.59	0.90	1.24	
21	0.95	1.10	0.86	0.90	1.76	0.70	3.00	1.35	1.22	1.60	1.20	0.75	
22	0.76	1.06	*****	0.80	1.08	0.95	2.40	*****	1.28	*****	1.00	0.90	
23	0.72	1.30	0.75	0.58	1.15	0.95	2.10	1.32	1.40	1.49	0.90	1.00	
24	0.78	1.08	0.80	0.50	0.70	0.90	1.80	1.39	1.30	1.20	1.10	1.66	
25	0.68	1.00	1.30	0.30	0.73	1.80	1.80	1.66	1.40	1.00	1.00	1.40	
26	0.55	0.70	1.30	0.28	0.78	1.30	1.90	1.71	1.08	1.30	1.63	1.70	
27	0.70	0.76	0.75	0.30	0.72	1.25	5.10	1.36	1.32	*****	1.13	1.34	
28	0.75	0.75	0.79	0.40	0.76	1.27	4.92	1.88	1.30	0.88	1.10	1.16	
29	0.86	0.65	0.90	0.73	0.90	1.15	4.67	1.50	0.83	*****	1.20	0.85	
30	2.00	0.70	0.90	1.30	1.00	1.50	4.60	1.60	*****	1.32		0.88	
31		0.68		1.10	1.70		4.55		*****	*****		1.30	
Max.	2.00	3.00	1.46	1.30	2.80	1.80	5.10	5.83	1.50	1.60	1.85	1.70	5.83 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.56
Station : K.56, (K.56) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 2000

Daily Max. Gage Height In Meter (MSL.) April 1, 2000 To March 31, 2001

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.12	1.80	1.31	1.96	0.65	1.98	1.65	2.70	2.00	0.70	1.46	1.23	
2	1.10	1.75	1.00	2.00	0.82	2.00	1.56	2.85	2.40	0.70	1.80	1.32	
3	1.10	2.00	0.87	*****	0.74	1.78	1.88	2.35	1.98	1.50	1.46	1.48	
4	1.15	1.85	1.21	1.70	0.67	1.70	1.90	1.60	1.70	1.35	1.77	1.48	
5	*****	2.00	1.10	1.57	0.72	2.00	2.50	*****	1.70	1.30	1.52	1.48	
6	1.18	1.42	1.10	1.80	0.70	*****	2.00	1.20	1.66	1.45	1.39	1.50	
7	1.30	1.90	1.20	1.55	0.76	2.74	2.40	0.53	1.70	1.40	1.57	1.45	
8	1.20	1.90	1.50	1.55	*****	2.35	2.80	1.50	2.00	1.58	1.61	*****	
9	1.30	2.36	1.70	*****	0.88	2.86	1.98	1.60	2.00	1.50	1.59	1.70	
10	1.22	2.30	1.55	*****	*****	2.00	1.56	1.39	2.00	1.48	1.47	1.70	
11	1.20	2.28	1.75	1.56	0.76	1.66	1.58	1.39	1.70	1.40	1.28	1.98	
12	0.50	2.42	1.70	1.30	1.22	1.18	1.70	1.36	1.86	1.30	1.04	1.48	
13	0.50	2.42	1.40	1.70	1.10	2.00	1.05	1.12	2.00	1.30	0.83	1.90	
14	0.50	2.50	1.70	1.66	0.74	2.44	*****	1.16	2.00	1.20	1.10	1.60	
15	0.50	1.60	1.39	1.30	0.76	2.00	1.19	1.28	1.76	1.30	1.37	1.80	
16	0.50	1.70	1.38	1.30	0.66	2.00	1.49	*****	*****	1.30	1.20	1.80	
17	0.50	2.05	1.70	1.39	0.60	1.86	1.26	1.00	1.45	1.05	1.18	1.98	
18	0.50	1.20	1.70	0.90	1.08	1.95	1.50	1.66	1.45	0.70	1.30	1.50	
19	2.05	1.70	1.75	1.00	1.08	1.87	1.90	1.00	1.52	1.30	1.26	1.26	
20	2.10	1.80	1.90	1.30	0.80	2.00	*****	1.40	*****	1.40	1.26	1.58	
21	2.10	1.50	*****	1.50	1.04	2.00	*****	0.80	1.20	1.40	1.20	1.50	
22	2.20	1.45	1.90	1.36	0.78	2.00	1.90	1.30	1.67	0.75	1.20	2.00	
23	2.00	1.02	2.00	*****	1.30	*****	1.70	*****	1.50	0.75	1.22	2.00	
24	2.20	1.45	2.10	0.70	1.28	1.74	1.32	1.00	1.46	1.20	1.00	1.90	
25	2.00	1.80	2.00	0.60	1.50	1.67	1.04	1.70	1.10	1.30	1.00	*******	
26	2.10	1.69	*****	0.60	1.40	1.70	*****	1.70	*****	2.00	1.00	1.46	
27	2.30	1.66	1.90	0.80	1.40	2.00	1.20	1.75	1.06	2.00	1.00	1.40	
28	2.20	*****	*****	0.96	1.32	1.92	1.50	2.00	1.60	2.00	1.00	*******	
29	2.32	1.20	1.66	0.85	1.22	2.00	1.40	2.00	0.90	1.35		*******	
30	2.50	0.80	2.00	0.68	1.80	2.00	1.66	2.10	*****	1.85		1.66	
31		1.34		0.66	2.00		2.20		*****	1.50		1.89	
Max.	2.50	2.50	2.10	2.00	2.00	2.86	2.80	2.85	2.40	2.00	1.80	2.00	2.86 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.56
Station : K.56, (K.56) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 2001

Daily Max. Gage Height In Meter (MSL.) April 1, 2001 To March 31, 2002

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	*****	1.25	1.40	1.95	1.00	*****	1.95	2.00	1.70	*****	1.08	1.19	
2	1.38	1.30	1.70	1.00	1.10	*****	1.90	2.00	1.40	*****	1.40	1.22	
3	1.09	1.20	1.40	0.68	1.00	*****	1.90	2.00	1.40	1.08	1.40	1.26	
4	1.10	1.30	1.40	0.90	1.60	*****	1.90	1.90	1.40	1.00	1.40	1.40	
5	1.80	1.60	1.28	1.29	1.50	1.50	2.00	1.70	0.72	1.00	1.10	0.90	
6	2.10	1.60	1.00	1.30	1.53	1.95	2.00	2.00	*****	1.10	1.10	1.00	
7	1.46	1.25	1.20	*****	1.90	1.95	1.50	1.70	2.00	1.08	1.30	1.80	
8	1.20	1.10	1.28	*****	1.95	1.81	1.40	1.70	1.95	1.00	1.18	1.70	
9	1.60	*****	1.70	*****	2.00	2.00	1.70	1.60	2.00	1.02	1.16	1.35	
10	1.40	1.20	1.70	*****	*****	1.70	1.80	0.78	1.80	1.12	1.04	1.40	
11	1.50	1.20	1.60	*****	2.00	*****	1.80	*****	*****	1.20	1.00	1.40	
12	*****	1.20	1.40	*****	1.56	*****	1.80	1.18	*****	1.24	1.04	1.40	
13	*****	1.20	1.30	*****	1.30	*****	1.73	1.00	*****	1.10	1.20	1.00	
14	*****	1.20	1.80	*****	1.30	*****	1.90	1.30	*****	1.08	*****	1.90	
15	1.10	1.20	1.89	*****	1.95	*****	1.56	1.16	*****	1.15	*****	1.80	
16	1.02	1.00	1.80	*****	2.00	*****	2.30	1.06	*****	1.20	*****	1.70	
17	1.00	1.30	1.90	*****	1.90	*****	2.00	1.26	*****	1.10	*****	*****	
18	1.20	*****	1.45	*****	1.90	2.00	2.00	1.00	*****	1.20	*****	1.40	
19	1.60	1.40	1.34	*****	*****	2.30	2.00	1.36	*****	1.40	*****	1.50	
20	1.72	1.30	*****	*****	1.60	2.40	*****	1.28	*****	1.30	1.23	1.80	
21	1.24	1.00	*****	1.00	1.42	2.30	2.00	1.30	*****	1.40	1.26	1.90	
22	1.30	1.00	1.20	1.00	1.40	1.98	*****	0.70	*****	1.60	1.22	1.70	
23	1.20	1.09	*****	1.00	2.40	1.90	1.96	1.40	*****	1.30	1.10	1.20	
24	0.90	1.53	1.00	0.90	2.80	1.70	1.70	*****	1.20	1.55	1.14	*****	
25	0.90	1.53	1.25	0.90	2.00	2.00	1.70	1.20	1.20	1.48	1.34	1.20	
26	1.08	1.30	0.90	1.00	2.00	2.00	1.95	1.20	1.00	1.31	1.24	1.32	
27	1.10	1.40	0.90	1.10	1.20	1.90	2.00	0.80	0.92	1.60	1.30	1.20	
28	1.60	1.25	1.30	1.00	1.40	2.00	1.86	0.80	1.20	1.76	1.10	1.31	
29	1.24	1.70	1.20	1.00	0.96	1.76	*****	1.70	1.20	2.00		2.00	
30	*****	1.40	1.20	1.00	1.30	1.70	2.00	1.80	1.24	1.90		1.90	
31		1.70		1.00	1.50		2.00		*****	*****		2.00	
Max.	2.10	1.70	1.90	1.95	2.80	2.40	2.30	2.00	2.00	2.00	1.40	2.00	2.80 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.56, (K.56)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.56
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 2002

Daily Max. Gage Height In Meter (MSL.) April 1, 2002 To March 31, 2003

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.02	1.14	1.36	1.56	2.00	2.30	5.00	2.40	2.55	*****	2.05	1.52	
2	1.21	1.20	1.70	1.18	1.87	2.30	4.70	*****	2.43	*****	1.60	1.35	
3	1.30	1.20	*****	1.56	1.82	2.70	4.60	*****	2.37	*****	1.63	1.33	
4	1.20	1.30	*****	1.70	1.94	2.80	4.30	*****	2.46	*****	1.75	1.41	
5	*****	1.20	*****	1.90	2.00	3.80	4.20	*****	2.50	*****	1.81	1.45	
6	1.22	1.32	*****	1.50	1.72	4.00	3.90	*****	2.10	*****	1.90	1.48	
7	1.20	1.20	*****	1.23	1.68	4.00	*****	*****	2.50	*****	1.95	1.31	
8	*****	1.32	1.30	1.10	1.80	3.43	*****	*****	2.44	*****	1.97	1.30	
9	*****	2.00	1.30	*****	1.99	3.40	5.27	*****	2.46	*****	1.95	1.35	
10	1.52	2.00	1.40	1.52	2.00	3.80	4.40	*****	2.05	*****	2.05	1.40	
11	1.74	1.50	1.36	1.90	2.00	4.20	4.44	*****	2.20	*****	1.83	1.42	
12	*****	1.60	1.86	1.80	2.00	4.40	3.90	*****	2.15	*****	1.50	1.31	
13	*****	1.50	1.98	1.50	1.80	4.50	3.40	*****	2.05	*****	1.59	1.30	
14	*****	1.66	1.84	1.50	1.72	4.64	3.00	2.05	2.10	*****	1.63	1.25	
15	*****	1.60	1.92	1.70	2.00	4.40	2.85	2.10	1.80	*****	1.69	1.41	
16	*****	1.50	1.94	*****	2.00	3.81	2.82	2.15	1.78	*****	1.95	1.40	
17	1.20	1.42	2.00	1.60	1.99	3.30	2.90	2.10	2.00	*****	1.50	1.34	
18	1.20	*****	1.89	1.60	2.30	3.30	*****	1.85	2.23	*****	1.59	1.35	
19	1.20	1.30	*****	0.60	2.68	3.20	*****	2.25	2.50	*****	1.45	1.41	
20	1.20	1.80	2.00	*****	3.79	3.20	*****	2.30	2.55	*****	1.35	1.42	
21	1.20	*****	1.80	*****	4.00	2.40	*****	2.35	2.72	*****	1.19	1.56	
22	1.20	*****	1.36	*****	3.95	3.50	*****	2.50	2.31	*****	1.30	1.50	
23	1.50	3.18	1.30	*****	3.10	4.00	*****	2.60	2.33	*****	1.45	1.35	
24	1.70	2.78	1.40	*****	3.20	*****	*****	2.69	2.35	*****	1.60	1.50	
25	*****	2.00	1.10	*****	3.32	5.70	*****	2.75	1.84	*****	1.70	1.70	
26	1.20	1.70	1.10	1.60	3.14	6.00	*****	2.63	2.20	*****	1.85	1.76	
27	1.20	0.90	1.80	1.70	3.17	5.78	*****	2.60	2.30	*****	1.60	1.79	
28	1.30	1.10	1.80	*****	3.32	5.40	*****	2.58	2.30	*****	1.75	1.80	
29	*****	1.20	1.09	*****	3.32	5.32	2.30	2.68	1.80	*****		1.95	
30	1.20	1.18	1.30	2.00	3.30	5.30	*****	2.66	1.68	*****		2.10	
31		1.12		1.00	2.98		*****		1.65	*****		2.08	
Max.	1.74	3.18	2.00	2.00	4.00	6.00	5.27	2.75	2.72	*******	2.05	2.10	6.00 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.56
Station : K.56, (K.56) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 2003

Daily Max. Gage Height In Meter (MSL.) April 1, 2003 To March 31, 2004

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.22	1.41	2.03	1.05	1.59	1.70	2.60	*******	1.80	1.70	1.50	1.25	
2	1.06	1.50	1.87	1.53	1.60	1.30	2.60	*******	2.00	1.90	1.55	1.20	
3	0.80	1.59	1.55	1.95	1.40	1.40	2.80	*******	1.90	1.90	1.55	1.30	
4	1.05	1.65	1.51	2.07	1.30	1.20	3.00	*******	2.10	1.80	1.60	1.10	
5	1.35	1.69	1.47	1.85	1.20	1.40	3.10	*******	1.70	1.75	1.40	1.25	
6	1.60	1.68	1.26	2.16	1.19	1.80	2.95	*******	1.90	1.90	1.50	1.20	
7	1.73	1.70	1.25	2.07	1.20	0.90	3.00	*******	2.00	1.80	1.60	1.20	
8	1.76	1.65	1.15	2.02	1.20	0.85	3.10	*******	2.10	1.85	1.55	1.15	
9	1.81	1.62	1.05	1.88	1.09	0.85	3.25	*******	1.95	2.00	1.45	1.35	
10	1.85	1.74	0.94	1.71	1.17	0.80	3.10	*******	2.00	1.80	1.55	1.25	
11	1.87	1.79	0.84	1.52	1.32	1.00	2.80	*******	1.95	1.70	1.60	1.45	
12	1.90	1.70	0.79	1.49	1.17	0.95	2.75	*******	1.90	1.85	1.75	1.35	
13	2.10	1.75	0.69	1.47	1.15	1.20	2.65	1.20	1.95	1.80	1.70	1.45	
14	2.15	1.75	0.73	1.42	1.18	1.25	2.60	1.55	2.00	1.90	1.80	1.35	
15	2.10	1.80	0.70	1.70	1.15	1.30	2.80	1.50	2.00	2.10	1.95	1.30	
16	1.95	1.79	0.72	1.95	1.25	1.20	*******	0.95	1.80	1.90	1.75	1.50	
17	1.81	1.81	0.70	2.04	1.22	1.00	*******	1.10	1.75	1.95	1.65	1.60	
18	1.89	1.76	0.74	2.20	1.25	1.00	*******	1.20	1.75	1.80	1.75	1.55	
19	1.77	1.81	0.69	2.25	1.49	0.95	2.45	1.30	1.80	2.00	1.80	1.55	
20	1.70	1.80	0.85	2.18	1.79	1.20	2.55	1.40	2.00	1.90	1.70	1.40	
21	1.78	1.81	0.90	1.47	1.50	1.20	2.20	1.35	1.90	1.70	1.60	1.30	
22	1.65	1.78	0.99	1.63	1.55	1.10	1.80	1.40	1.90	1.70	1.50	1.45	
23	1.43	1.78	1.05	1.05	1.55	1.10	1.38	1.55	1.80	1.80	1.60	1.55	
24	1.34	2.05	1.25	1.25	1.58	1.85	1.45	1.70	1.85	1.75	1.35	1.80	
25	1.39	1.70	1.60	1.50	1.50	2.10	1.20	1.50	1.90	1.80	1.40	1.60	
26	1.43	1.76	1.65	1.85	1.25	2.90	1.30	1.50	2.00	1.75	1.50	1.80	
27	1.63	1.79	1.77	2.20	1.10	3.05	2.30	1.40	1.90	1.75	1.55	1.60	
28	1.32	1.80	1.72	2.50	1.60	2.95	1.90	1.40	2.10	1.90	1.60	1.60	
29	0.81	1.79	1.67	2.31	1.95	3.05	1.85	1.60	1.90	1.85	1.40	1.70	
30	0.64	1.83	1.59	2.10	2.05	2.80	2.10	1.60	1.95	1.80	1.60		
31		1.80		2.15	2.10		2.00		2.00	1.90		1.65	
Max.	2.15	2.05	2.03	2.50	2.10	3.05	3.25	1.70	2.10	2.10	1.95	1.80	3.25 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

ID Computer Center
Station : Siriluk Bridge, Muang, Ratchaburi, (K.2B)
Stream : Mae Klong
River : Mae Klong
River System : Mae Klong

WLEVEL/MAXDLY K.2B
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 1998

Daily Max. Gage Height In Meter (MSL.) April 1, 1998 To March 31, 1999

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	*******	*******	*******	*******	*******	*******	1.03	1.10	0.90	0.80	*******	1.08	
2	*******	*******	*******	*******	*******	*******	1.11	1.15	1.00	1.02	*******	0.98	
3	*******	*******	*******	*******	*******	*******	1.40	1.06	1.10	1.10	*******	0.90	
4	*******	*******	*******	*******	*******	*******	1.29	1.35	1.10	1.07	*******	0.90	
5	*******	*******	*******	*******	*******	*******	1.19	1.15	1.30	1.06	*******	0.92	
6	*******	*******	*******	*******	*******	*******	0.87	1.36	1.27	1.12	*******	0.83	
7	*******	*******	*******	*******	*******	*******	1.15	1.22	1.26	1.10	*******	0.64	
8	*******	*******	*******	*******	*******	*******	2.70	1.18	1.13	1.10	*******	0.75	
9	*******	*******	*******	*******	*******	*******	2.10	1.14	1.14	1.15	*******	0.70	
10	*******	*******	*******	*******	*******	*******	1.98	1.16	0.70	1.00	*******	0.72	
11	*******	*******	*******	*******	*******	*******	1.66	1.23	0.64	0.90	*******	0.60	
12	*******	*******	*******	*******	*******	*******	1.44	1.02	1.00	0.81	*******	0.64	
13	*******	*******	*******	*******	*******	*******	1.57	0.86	0.95	0.81	*******	0.80	
14	*******	*******	*******	*******	*******	*******	1.88	0.85	0.94	1.00	*******	0.88	
15	*******	*******	*******	*******	*******	*******	1.52	0.73	0.74	1.10	*******	0.94	
16	*******	*******	*******	*******	*******	*******	1.20	0.95	0.71	1.27	*******	1.06	
17	*******	*******	*******	*******	*******	*******	1.15	0.87	0.95	1.25	*******	1.02	
18	*******	*******	*******	*******	*******	*******	1.00	1.05	1.05	1.10	*******	0.92	
19	*******	*******	*******	*******	*******	*******	1.03	1.11	0.94	1.04	*******	0.96	
20	*******	*******	*******	*******	*******	*******	1.10	0.92	1.05	1.16	*******	0.96	
21	*******	*******	*******	*******	*******	*******	1.05	0.81	1.08	1.16	*******	0.80	
22	*******	*******	*******	*******	*******	*******	1.15	1.07	1.10	0.91	*******	0.70	
23	*******	*******	*******	*******	*******	*******	1.20	1.05	1.12	1.00	*******	0.90	
24	*******	*******	*******	*******	*******	*******	1.24	1.02	1.06	1.00	*******	1.00	
25	*******	*******	*******	*******	*******	*******	1.01	1.04	1.02	0.87	*******	0.82	
26	*******	*******	*******	*******	*******	*******	1.00	0.98	1.05	1.00	*******	0.86	
27	*******	*******	*******	*******	*******	*******	0.94	1.03	1.05	1.01	*******	0.76	
28	*******	*******	*******	*******	*******	*******	1.07	1.20	1.06	0.78	*******	0.98	
29	*******	*******	*******	*******	*******	*******	1.06	1.00	1.00	0.95		1.02	
30	*******	*******	*******	*******	*******	*******	1.00	1.00	0.90	1.05		0.84	
31		*******		*******	*******		1.05		0.80	1.10		0.82	
Max.	*******	*******	*******	*******	*******	*******	2.70	1.36	1.30	1.27	*******	1.08	2.70 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.2B
Station : Siriluk Bridge, Muang, Ratchaburi, (K.2B) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 1999

Daily Max. Gage Height In Meter (MSL.) April 1, 1999 To March 31, 2000

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.15	1.08	0.50	0.30	0.67	0.62	1.00	2.35	1.00	1.04	1.10	1.30	
2	0.98	1.50	0.25	0.30	0.60	0.70	1.24	2.29	0.91	1.02	1.20	1.50	
3	1.02	1.78	0.34	0.50	0.26	0.58	1.20	2.88	0.90	0.96	1.16	1.20	
4	0.95	1.04	0.38	0.48	0.30	0.40	1.24	3.21	0.83	1.10	1.34	1.35	
5	0.95	1.02	0.32	0.36	0.56	0.86	1.26	3.14	0.90	1.10	1.20	1.33	
6	0.94	0.90	0.32	0.30	0.70	0.60	1.34	2.80	1.12	1.28	1.85	1.30	
7	0.99	0.62	0.44	0.27	0.90	0.90	0.88	2.54	1.14	1.20	1.27	1.18	
8	0.99	0.70	0.42	0.42	1.22	0.78	1.30	2.10	1.16	1.24	1.14	1.08	
9	0.94	0.86	0.54	0.58	1.14	0.64	1.16	1.70	1.00	1.26	1.25	0.97	
10	0.96	0.78	0.70	0.64	1.16	0.66	1.08	1.58	1.28	1.26	1.30	1.18	
11	0.80	0.84	0.68	0.60	0.92	0.72	1.18	1.50	1.25	1.10	1.14	1.04	
12	0.86	1.10	0.80	0.46	0.82	0.80	1.14	1.20	1.18	1.20	1.26	0.86	
13	0.90	1.14	0.88	0.36	0.74	0.82	1.05	1.44	1.19	1.20	1.20	0.88	
14	1.04	1.24	0.76	0.48	0.44	0.70	1.36	1.38	1.04	1.14	1.18	0.88	
15	0.84	1.16	0.64	0.58	0.74	0.72	1.40	1.26	1.00	0.95	1.00	0.88	
16	0.72	0.94	0.70	0.80	0.64	0.76	1.24	1.18	1.02	1.02	1.18	1.06	
17	0.78	0.90	0.64	0.71	0.62	0.90	1.30	1.34	1.02	0.96	1.30	1.10	
18	0.74	0.92	0.60	0.50	0.66	0.74	1.24	1.26	1.12	1.08	1.36	1.14	
19	0.68	0.82	0.60	0.35	0.62	0.76	2.80	1.08	1.00	1.10	1.20	1.18	
20	0.70	0.81	0.46	0.38	0.58	0.96	1.74	1.16	1.08	1.46	1.18	1.10	
21	0.96	0.78	0.48	0.22	0.72	0.98	1.68	1.02	1.08	1.44	1.14	1.10	
22	0.98	0.88	0.58	0.24	0.91	0.88	1.50	1.10	1.10	1.28	1.00	1.10	
23	1.25	0.90	0.51	0.20	0.98	0.96	1.30	1.14	1.24	1.30	1.00	1.10	
24	1.22	0.86	0.64	0.40	0.80	0.94	1.00	1.28	1.30	1.24	1.02	1.20	
25	1.22	0.85	0.70	0.40	0.60	1.02	1.46	1.22	1.32	1.22	1.10	1.10	
26	1.20	0.84	0.44	0.36	0.52	1.02	1.64	1.44	1.12	1.35	1.24	1.20	
27	1.18	0.72	0.50	0.32	0.50	0.80	2.70	1.44	1.06	1.26	1.26	1.10	
28	1.14	0.80	0.42	0.30	0.66	1.17	2.86	1.31	1.04	1.17	0.95	0.96	
29	1.20	0.68	0.46	0.38	0.71	1.10	2.65	1.29	1.02	1.18	1.08	0.92	
30	1.05	0.60	0.46	0.40	0.80	0.90	2.58	1.30	1.05	1.10	1.04		
31	0.56		0.55	0.74		2.48		1.10	1.08	1.20			
Max.	1.25	1.78	0.88	0.80	1.22	1.17	2.86	3.21	1.32	1.46	1.85	1.50	3.21 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.2B
Station : Siriluk Bridge, Muang, Ratchaburi, (K.2B) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2000

Daily Max. Gage Height In Meter (MSL.) April 1, 2000 To March 31, 2001

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.00	1.06	0.65	1.00	0.68	0.96	1.10	1.55	1.35	1.16	1.10	1.02	
2	0.90	1.20	0.90	0.95	0.60	0.90	1.12	1.77	1.45	1.02	1.28	1.10	
3	1.00	1.10	0.85	0.92	0.72	0.91	1.30	1.50	1.52	0.88	1.22	1.10	
4	0.85	0.96	0.78	0.92	0.58	0.94	1.15	1.22	1.26	1.01	1.18	0.91	
5	0.94	1.00	0.75	0.70	0.50	0.84	1.35	1.16	1.20	1.05	1.10	0.98	
6	0.94	0.88	0.84	0.80	0.39	0.94	1.00	1.15	1.20	1.02	1.20	1.25	
7	1.10	0.94	0.80	0.72	0.47	1.10	1.18	1.14	1.06	1.05	1.20	1.20	
8	0.95	1.02	0.74	0.55	0.56	1.08	1.20	1.28	1.02	1.10	1.36	1.10	
9	1.10	1.10	0.90	0.45	0.80	1.20	1.08	1.35	1.20	1.12	1.35	1.50	
10	0.98	1.04	0.72	0.66	0.86	1.00	1.10	1.25	1.20	1.20	1.28	1.36	
11	1.00	1.04	0.90	0.56	0.88	0.96	0.82	1.05	1.40	1.18	1.00	1.40	
12	0.84	1.06	0.80	0.80	0.90	0.82	0.94	1.00	1.36	1.24	1.34	1.32	
13	1.00	1.10	0.70	1.04	0.62	0.91	0.68	1.14	1.38	1.22	1.00	1.40	
14	1.14	1.20	0.95	0.74	0.33	1.00	0.80	1.16	1.44	1.20	1.22	1.28	
15	1.10	0.90	0.70	0.55	0.36	0.85	1.00	1.34	1.52	1.32	1.42	1.28	
16	1.08	1.04	0.57	0.50	0.36	0.90	1.15	1.20	1.40	1.18	1.26	1.10	
17	0.94	1.10	0.70	0.60	0.10	1.15	1.24	1.10	1.20	1.08	1.08	1.02	
18	0.96	0.80	0.74	0.46	0.68	1.25	1.21	1.40	1.34	1.00	1.08	0.86	
19	0.96	0.84	0.55	0.48	0.78	1.15	1.36	1.30	1.24	1.16	1.16	0.95	
20	1.20	0.78	0.68	0.64	0.40	1.00	1.18	1.24	1.29	1.15	1.16	0.96	
21	1.15	0.94	0.68	0.64	0.40	1.18	1.20	1.12	1.04	1.20	1.14	1.16	
22	1.20	0.70	0.87	0.47	0.61	1.21	1.19	1.11	1.20	1.15	1.10	1.38	
23	0.92	0.74	0.80	0.30	0.28	1.51	1.30	1.15	1.15	1.08	1.06	1.30	
24	1.00	0.72	0.80	0.40	0.80	1.32	1.24	1.04	1.20	1.00	1.10	1.24	
25	0.88	0.80	0.84	0.26	1.04	1.29	1.20	1.25	1.20	1.11	0.92	1.20	
26	0.96	0.82	0.71	0.10	1.10	1.24	1.10	1.36	1.04	1.14	0.98	1.12	
27	0.91	0.80	0.70	0.58	1.00	1.20	0.96	1.30	1.00	1.20	0.92	1.14	
28	1.10	0.90	0.86	0.80	0.60	1.10	1.18	1.50	1.15	1.40	0.88	0.86	
29	1.06	0.95	0.98	0.60	0.54	*******	1.10	1.40	1.22	1.32		1.02	
30	1.26	0.75	1.00	0.48	0.60	*******	1.32	1.42	1.15	1.39		1.08	
31		0.80		0.58	0.85		1.55		1.16	1.06	0.98		
Max.	1.26	1.20	1.00	1.04	1.10	1.51	1.55	1.77	1.52	1.40	1.42	1.50	1.77 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.2B
Station : Siriluk Bridge, Muang, Ratchaburi, (K.2B) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2001

Daily Max. Gage Height In Meter (MSL.) April 1, 2001 To March 31, 2002

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	0.94	0.90	1.00	0.56	0.64	1.00	1.19	1.21	1.27	1.17	1.30	1.00	
2	1.00	1.10	1.01	0.72	0.60	1.14	1.30	1.45	1.26	1.14	1.24	1.06	
3	1.00	1.16	1.00	0.54	0.60	1.16	1.10	1.40	1.31	1.05	1.26	1.02	
4	1.15	1.20	0.90	1.74	0.66	0.80	1.22	1.36	1.26	1.04	1.19	1.12	
5	1.30	1.20	0.80	1.34	0.74	0.80	1.40	1.45	1.14	0.94	1.08	1.14	
6	1.40	1.22	0.68	1.26	0.55	1.00	1.31	1.48	1.20	1.14	1.20	1.04	
7	1.17	1.06	0.71	0.65	0.80	1.00	1.24	1.32	1.36	1.00	1.12	1.20	
8	1.04	0.80	0.70	0.66	0.80	0.86	1.24	1.40	1.34	1.07	0.96	1.24	
9	1.14	0.56	0.75	0.61	0.80	1.00	0.96	1.36	1.14	1.06	0.94	1.16	
10	1.16	0.84	0.84	0.70	0.57	0.85	1.32	1.28	1.28	0.92	1.10	1.20	
11	0.92	0.75	0.80	0.80	0.71	0.98	1.02	1.26	1.26	1.10	1.06	1.27	
12	1.05	0.70	0.70	0.72	0.55	1.02	1.20	1.08	1.14	1.20	1.25	1.20	
13	1.00	0.65	0.66	0.70	0.45	1.20	1.30	1.28	1.20	0.98	1.08	1.20	
14	0.78	0.60	0.74	0.66	0.65	1.40	1.35	1.18	1.24	1.20	0.98	1.30	
15	0.60	0.80	0.50	0.62	1.00	1.36	1.58	1.00	1.33	1.16	1.07	1.19	
16	0.87	0.70	0.58	0.50	1.00	1.20	1.52	1.16	1.18	1.07	1.03	1.14	
17	0.92	0.82	0.70	0.90	1.00	1.14	1.36	1.22	1.42	1.08	1.00	1.08	
18	1.00	0.90	0.61	1.02	0.67	1.10	1.38	1.24	1.44	1.06	1.13	1.18	
19	1.10	0.96	0.46	0.87	0.66	1.00	1.50	1.20	1.43	1.08	1.00	1.04	
20	1.15	0.94	0.42	0.56	0.88	1.26	1.32	1.04	1.45	1.06	0.96	1.00	
21	1.04	0.95	0.46	0.56	0.70	1.16	1.42	1.15	1.24	0.96	1.10	1.02	
22	1.04	0.98	0.60	0.70	0.81	1.30	1.34	1.15	1.32	1.24	0.95	1.00	
23	0.88	0.62	0.60	0.72	0.94	1.20	1.30	1.18	1.14	1.26	1.00	0.84	
24	0.93	0.62	0.50	0.60	1.07	1.08	1.42	1.19	1.10	1.28	1.18	0.91	
25	0.80	0.74	0.70	0.70	0.83	1.12	1.31	1.06	1.05	1.06	1.19	1.10	
26	0.88	0.77	0.58	0.72	0.74	1.24	1.40	1.14	1.02	1.14	1.09	1.15	
27	1.00	0.85	0.60	0.56	0.68	1.12	1.40	1.00	0.91	1.23	1.07	1.10	
28	0.96	0.92	0.50	0.42	0.86	1.36	1.30	0.98	0.90	1.45	1.00	1.08	
29	0.88	0.92	0.60	0.50	0.93	1.30	1.38	0.92	1.25	1.53		1.27	
30	0.88	0.86	0.46	0.75	1.00	1.14	1.46	1.17	1.36	1.54		1.15	
31		0.92		0.90	1.00		1.26		1.25	1.50	1.32		
Max.	1.40	1.22	1.01	1.74	1.07	1.40	1.58	1.48	1.45	1.54	1.30	1.32	1.74 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.2B
Station : Siriluk Bridge, Muang, Ratchaburi, (K.2B) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2002

Daily Max. Gage Height In Meter (MSL.) April 1, 2002 To March 31, 2003

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.10	0.94	0.80	*******	0.52	1.06	2.81	1.46	1.05	1.38	1.50	1.20	
2	1.18	1.00	0.97	*******	0.50	1.04	2.70	1.58	1.35	1.50	1.42	1.20	
3	1.02	1.04	0.78	*******	0.60	1.08	2.58	1.50	1.30	1.48	1.20	1.12	
4	0.87	0.94	0.75	*******	0.80	1.29	2.48	1.54	1.42	1.46	1.38	1.06	
5	0.80	0.93	0.74	*******	0.85	1.66	2.14	1.45	1.55	1.44	1.16	1.12	
6	1.08	0.93	0.79	*******	0.36	1.96	2.10	1.54	1.34	1.46	1.36	1.22	
7	1.08	1.00	0.75	*******	0.54	2.06	2.34	1.50	1.60	1.28	1.22	0.96	
8	1.15	0.96	0.84	*******	0.75	1.86	2.70	1.50	1.56	1.34	1.16	1.16	
9	1.08	1.25	0.85	*******	0.80	1.75	2.91	1.58	1.58	1.36	1.30	1.20	
10	1.00	1.20	0.80	*******	0.82	1.76	2.80	1.40	1.62	1.23	1.30	1.10	
11	1.08	1.12	0.74	*******	0.82	2.00	2.52	1.45	1.42	1.30	1.13	1.06	
12	1.04	1.10	0.84	*******	0.87	2.09	2.16	1.34	1.32	1.28	1.18	1.20	
13	1.10	0.98	0.94	*******	0.85	2.38	1.82	1.38	1.37	1.10	1.33	1.20	
14	1.12	0.86	0.88	*******	0.50	2.36	1.44	1.40	1.39	1.08	1.34	1.27	
15	1.08	0.80	0.96	*******	0.75	2.30	1.61	1.45	1.15	1.10	1.38	1.20	
16	0.90	0.85	1.00	*******	0.58	1.87	1.50	1.32	1.00	1.44	1.30	1.27	
17	0.87	0.90	1.02	*******	0.76	1.58	1.38	1.23	1.19	1.46	1.36	1.26	
18	0.86	0.91	0.85	*******	1.06	1.49	1.60	1.20	1.28	1.50	1.30	1.25	
19	0.90	1.08	0.86	*******	1.16	1.48	1.45	1.23	1.48	1.48	1.18	1.06	
20	0.84	1.14	0.90	*******	1.64	1.45	1.42	1.34	1.60	1.60	1.20	1.24	
21	0.90	1.24	0.85	*******	1.84	1.48	1.26	1.48	1.50	1.54	1.22	1.34	
22	1.11	1.65	0.86	*******	1.80	1.49	1.28	1.85	1.42	1.30	0.98	1.20	
23	1.08	1.64	0.64	*******	1.39	1.98	1.30	1.60	1.46	1.32	1.20	1.27	
24	1.25	1.25	0.61	*******	1.44	2.46	1.35	1.64	1.50	1.48	1.00	1.09	
25	1.23	1.10	0.68	*******	1.55	3.09	1.45	1.70	1.44	1.48	1.03	1.18	
26	1.00	1.06	0.86	*******	1.47	3.35	1.60	1.74	1.47	1.34	1.03	1.18	
27	1.08	0.84	0.58	*******	1.36	3.29	1.64	1.62	1.40	1.16	1.20	1.28	
28	0.92	0.76	0.81	*******	1.49	3.14	1.42	1.70	1.32	1.20	1.30	1.30	
29	0.94	0.82	0.69	*******	1.40	3.00	1.48	1.48	1.30	1.40		1.29	
30	0.90	0.82	0.47	*******	1.20	2.95	1.47	1.40	1.40	1.70		1.26	
31		0.78		*******	1.10		1.54		1.20	1.40	1.20		
Max.	1.25	1.65	1.02	*******	1.84	3.35	2.91	1.85	1.62	1.70	1.50	1.34	3.35 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.2B
Station : Siriluk Bridge, Muang, Ratchaburi, (K.2B) Royal Irrigation Department
Stream : Mae Klong Thailand
River : Mae Klong Hydrology Division
River System : Mae Klong

WATER YEAR - 2003

Daily Max. Gage Height In Meter (MSL.) April 1, 2003 To March 31, 2004

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.10	0.68	0.90	0.60	0.86	1.02	1.50	1.36	1.22	1.00	1.28	0.90	
2	1.05	0.92	0.74	0.60	0.87	0.90	1.52	1.32	1.30	1.00	1.10	0.97	
3	1.20	0.80	0.74	0.66	0.64	0.56	1.50	1.28	1.28	0.89	1.08	1.06	
4	1.12	0.78	0.62	0.75	0.56	0.94	1.76	1.28	1.22	1.06	1.38	1.00	
5	1.06	0.68	0.80	0.72	0.46	1.06	1.78	1.17	1.11	1.04	1.20	1.45	
6	1.05	0.70	0.80	0.80	0.50	1.10	1.60	1.12	1.06	1.10	1.35	1.38	
7	0.90	0.78	0.92	0.70	0.82	1.00	1.64	1.19	1.25	1.28	1.26	1.32	
8	0.93	0.90	0.72	0.86	1.15	0.66	1.78	1.08	1.26	1.31	1.40	1.06	
9	0.82	0.92	0.86	0.72	1.14	0.50	1.76	1.20	1.37	1.35	1.10	1.18	
10	1.00	1.02	0.90	0.74	1.15	0.50	1.65	1.20	1.39	1.40	1.18	1.04	
11	1.16	0.90	0.80	0.52	0.62	0.60	1.49	1.16	1.53	1.40	1.18	1.15	
12	1.00	1.16	1.10	0.64	0.70	0.66	1.45	1.26	1.46	1.50	1.17	1.16	
13	1.10	1.10	1.18	0.80	0.50	0.80	1.38	1.16	1.48	1.44	1.20	1.07	
14	0.90	0.90	0.90	0.80	0.60	0.60	1.30	1.22	1.29	1.40	1.20	1.00	
15	1.00	1.12	0.84	0.80	0.84	0.80	1.59	1.30	1.22	1.34	1.20	1.13	
16	1.02	1.16	0.94	0.75	0.92	0.84	1.47	1.28	1.28	1.26	1.12	1.15	
17	1.03	1.10	0.80	0.86	0.94	0.85	1.32	1.26	1.22	1.17	1.17	1.22	
18	1.02	0.90	0.86	0.78	0.76	0.78	1.30	1.18	1.21	1.16	1.29	1.20	
19	0.82	1.10	0.86	0.80	0.76	0.70	1.28	1.12	1.15	1.17	1.20	1.32	
20	1.08	0.92	0.88	0.58	0.80	1.02	1.48	1.18	1.22	1.20	1.18	1.20	
21	1.02	1.05	0.80	0.74	0.78	1.10	1.36	1.15	0.99	1.33	1.28	1.14	
22	0.96	1.10	0.74	0.26	1.00	1.10	1.30	1.13	1.07	1.39	1.07	1.16	
23	0.92	1.06	0.72	-0.10	1.00	1.08	1.26	1.39	1.18	1.50	1.07	1.08	
24	1.00	1.10	0.70	0.76	1.02	1.30	1.20	1.27	1.37	1.30	1.09	1.14	
25	0.94	0.90	0.72	0.80	0.78	1.20	1.37	1.11	1.38	1.38	1.00	1.20	
26	1.22	0.88	0.90	1.17	0.60	1.38	1.30	1.43	1.46	1.28	0.97	0.98	
27	1.18	0.76	0.74	1.14	0.50	1.52	1.70	1.36	1.29	0.78	1.00	1.00	
28	1.02	0.80	0.82	1.24	0.62	1.50	1.75	1.50	1.30	1.14	1.15	0.92	
29	1.04	0.70	0.60	1.12	0.68	1.64	1.67	1.46	1.18	1.28	1.01	0.96	
30	0.94	0.80	0.56	0.94	0.94	1.52	1.59	1.49	1.10	1.13		0.86	
31		0.74		0.88	1.06		1.38		1.07	1.20	0.87		
Max.	1.22	1.16	1.18	1.24	1.15	1.64	1.78	1.50	1.53	1.50	1.40	1.45	1.78 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.57, (K.57)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.57
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 1998

Daily Max. Gage Height In Meter (MSL.) April 1, 1998 To March 31, 1999

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	*******	*******	*******	*******	*******	*******			0.02	1.14	0.12	0.24	0.04	1.12
2	*******	*******	*******	*******	*******	*******			0.20	1.10	0.04	0.22	-0.02	1.10
3	*******	*******	*******	*******	*******	*******			0.40	1.00	0.16	0.16	0.14	1.02
4	*******	*******	*******	*******	*******	*******			0.26	1.14	0.12	0.16	0.22	1.04
5	*******	*******	*******	*******	*******	*******			0.23	1.24	0.14	0.16	0.24	1.00
6	*******	*******	*******	*******	*******	*******			0.26	1.32	0.20	0.18	0.20	1.04
7	*******	*******	*******	*******	*******	*******			0.46	1.30	0.22	0.16	0.16	0.90
8	*******	*******	*******	*******	*******	*******			0.76	1.26	0.24	0.18	0.16	0.92
9	*******	*******	*******	*******	*******	*******			0.66	1.26	0.28	0.10	0.08	0.86
10	*******	*******	*******	*******	*******	*******			0.46	1.30	0.12	-0.02	0.10	0.88
11	*******	*******	*******	*******	*******	*******			0.46	1.32	-0.02	-0.04	0.12	0.86
12	*******	*******	*******	*******	*******	*******			0.44	1.18	-0.04	-0.24	0.16	0.84
13	*******	*******	*******	*******	*******	*******			0.54	1.14	-0.02	-0.02	0.14	0.84
14	*******	*******	*******	*******	*******	*******			0.56	1.02	-0.10	0.34	0.14	1.12
15	*******	*******	*******	*******	*******	*******			0.52	0.96	-0.12	0.36	0.06	0.92
16	*******	*******	*******	*******	*******	*******			0.06	1.12	-0.16	0.36	0.16	1.16
17	*******	*******	*******	*******	*******	*******			0.04	1.10	0.04	0.38	0.10	1.20
18	*******	*******	*******	*******	*******	*******			0.02	1.12	0.20	0.16	0.16	1.18
19	*******	*******	*******	*******	*******	*******			0.16	1.08	0.06	0.20	0.14	1.16
20	*******	*******	*******	*******	*******	*******			0.10	0.86	0.12	0.24	0.06	1.10
21	*******	*******	*******	*******	*******	*******			0.20	0.98	0.16	0.26	0.04	1.12
22	*******	*******	*******	*******	*******	*******			0.26	1.06	0.18	0.16	0.04	1.00
23	*******	*******	*******	*******	*******	*******			0.24	1.22	0.24	0.10	0.06	1.14
24	*******	*******	*******	*******	*******	*******			0.22	1.14	0.26	0.14	0.08	0.92
25	*******	*******	*******	*******	*******	*******			0.18	1.24	0.20	0.20	0.10	0.94
26	*******	*******	*******	*******	*******	*******			0.12	1.26	0.14	0.16	0.06	0.82
27	*******	*******	*******	*******	*******	*******			-0.08	1.24	0.08	0.18	0.08	1.16
28	*******	*******	*******	*******	*******	*******			0.16	1.20	0.10	0.16	0.10	1.10
29	*******	*******	*******	*******	*******	*******			0.24	1.08	0.02	0.14		0.96
30	*******	*******	*******	*******	*******	*******			0.20	1.06	0.08	0.16		1.12
31		*******		*******	*******				0.16		0.20	0.24		1.06
Max.	*******	*******	*******	*******	*******	*******			0.76	1.32	0.28	0.38	0.24	1.20	1.32 M.

Zero Gage At Bottom Elevation -1.000 M. (MSL.)

RID Computer Center
Station : K.57, (K.57)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.57
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 1999

Daily Max. Gage Height In Meter (MSL.) April 1, 1999 To March 31, 2000

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	0.96	1.02	0.58	0.56	0.40	0.66	1.14	1.64	1.32	1.18	1.24	1.20	
2	0.96	1.04	0.62	0.44	0.52	0.74	1.10	1.60	1.26	1.24	1.30	1.16	
3	0.92	1.50	0.52	0.62	0.32	0.62	1.12	1.56	1.42	1.28	1.22	1.18	
4	0.90	0.96	0.46	0.74	0.36	0.70	0.98	1.54	1.40	1.32	1.20	1.06	
5	0.88	0.86	0.58	0.70	0.64	0.58	1.04	1.56	1.36	1.34	1.14	1.16	
6	0.90	0.82	0.42	0.74	0.76	0.76	1.06	1.58	1.22	1.38	1.16	1.18	
7	0.94	0.64	0.56	0.78	0.80	0.80	0.86	1.62	1.24	1.40	1.18	1.14	
8	0.88	0.78	0.34	0.76	0.82	0.96	0.98	1.64	1.22	1.32	1.14	1.10	
9	0.90	0.62	0.54	0.76	1.36	0.96	1.02	1.60	1.34	1.36	1.10	1.12	
10	0.92	0.76	0.66	0.80	1.42	1.22	1.00	1.58	1.38	1.28	1.12	1.08	
11	0.94	0.76	0.74	0.74	1.02	1.02	1.22	1.34	1.36	1.24	1.16	1.00	
12	1.06	0.98	0.82	0.52	1.10	1.06	1.20	1.40	1.24	1.32	1.14	1.04	
13	0.94	1.02	0.74	0.48	1.36	1.26	1.24	1.36	1.26	1.30	1.10	1.06	
14	0.90	1.20	0.96	0.50	1.22	1.12	1.18	1.42	1.24	1.26	1.14	1.00	
15	0.94	1.12	0.94	0.64	1.16	1.00	1.24	1.40	1.32	1.32	1.26	1.08	
16	1.08	0.86	0.86	0.70	0.84	1.18	1.16	1.34	1.24	1.34	1.28	1.10	
17	0.84	0.84	0.74	0.38	0.92	1.12	1.12	1.38	1.16	1.30	1.24	1.16	
18	0.86	1.00	0.60	0.32	0.94	1.16	1.46	1.40	1.14	1.28	1.26	1.00	
19	1.14	0.76	0.84	0.24	0.90	1.10	1.30	1.34	1.16	1.24	1.18	1.08	
20	0.84	0.74	0.58	0.12	1.04	1.16	1.44	1.28	1.20	1.28	1.14	1.14	
21	0.86	0.76	0.38	0.04	1.20	1.26	1.58	1.38	1.20	1.28	1.16	1.16	
22	0.82	1.04	0.16	0.56	1.16	1.32	1.54	1.44	1.24	1.30	1.10	1.10	
23	0.64	0.74	0.30	-0.06	1.28	1.26	1.62	1.40	1.20	1.34	1.08	1.12	
24	0.86	1.06	0.38	0.52	1.26	1.30	1.64	1.32	1.14	1.38	1.14	1.08	
25	0.78	0.74	0.78	0.10	1.12	1.26	1.70	1.24	1.16	1.32	1.20	1.08	
26	0.72	0.76	0.82	0.16	1.06	1.16	1.62	1.18	1.24	1.24	1.24	1.04	
27	0.84	0.72	0.82	0.20	1.02	1.18	1.80	1.16	1.22	1.24	1.28	1.06	
28	0.82	0.72	0.80	0.70	0.64	1.26	1.98	1.20	1.26	1.24	1.24	1.10	
29	1.00	0.64	0.82	0.76	1.00	1.24	1.82	1.26	1.24	1.22	1.32	1.08	
30	1.02	0.76	0.32	0.52	0.80	1.36	1.70	1.20	1.22	1.26		1.10	
31		0.52		0.74	0.76		1.68		1.22	1.30		1.16	
Max.	1.14	1.50	0.96	0.80	1.42	1.36	1.98	1.64	1.42	1.40	1.32	1.20	1.98 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.57, (K.57)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.57
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 2000

Daily Max. Gage Height In Meter (MSL.) April 1, 2000 To March 31, 2001

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.14	0.80	0.28	0.74	0.76	0.86	1.12	1.54	1.26	1.24	1.24	1.24	
2	1.08	0.80	0.46	0.52	0.82	0.84	1.10	1.62	1.32	1.22	1.18	1.20	
3	1.00	0.76	0.96	0.50	0.80	0.76	1.00	1.70	1.36	1.18	1.20	1.22	
4	1.02	0.80	0.76	0.56	0.70	0.68	1.00	1.60	1.40	1.18	1.22	1.28	
5	1.04	0.82	0.68	0.50	0.42	0.92	1.02	1.36	1.26	1.20	1.22	1.32	
6	1.10	1.02	0.80	0.50	0.56	0.82	0.98	1.42	1.22	1.16	1.20	1.30	
7	1.06	0.92	0.78	0.48	0.50	0.90	0.94	1.44	1.20	1.14	1.26	1.38	
8	1.00	0.90	0.64	0.68	0.48	0.96	1.00	1.40	1.18	1.10	1.26	1.42	
9	1.10	0.86	0.62	0.62	0.46	1.00	1.04	1.42	1.16	1.06	1.24	1.40	
10	1.14	0.84	0.84	0.70	0.40	1.02	1.08	1.38	1.20	1.12	1.28	1.38	
11	1.16	0.80	0.60	0.68	0.42	1.04	1.10	1.40	1.16	1.10	1.32	1.36	
12	1.16	0.78	0.64	0.54	0.40	1.16	1.12	1.42	1.14	1.02	1.28	1.36	
13	1.20	0.96	0.66	0.56	0.38	1.20	1.06	1.36	1.10	1.06	1.30	1.34	
14	1.18	0.76	0.60	0.50	0.36	1.22	1.04	1.30	1.18	1.04	1.32	1.36	
15	1.02	0.64	0.54	0.70	0.40	1.20	1.06	1.32	1.14	1.08	1.32	1.34	
16	1.14	0.68	0.50	0.54	0.38	1.18	1.10	1.28	1.10	1.00	1.36	1.32	
17	1.16	0.76	0.74	0.56	0.36	1.16	1.14	1.30	1.06	1.02	1.28	1.30	
18	1.10	0.80	0.46	0.52	0.48	1.14	1.18	1.26	1.02	1.00	1.34	1.26	
19	1.08	0.78	0.52	0.54	0.56	1.12	1.16	1.24	1.06	1.04	1.34	1.22	
20	1.06	0.84	0.48	0.50	0.52	1.10	1.20	1.26	1.04	1.08	1.36	1.16	
21	0.90	0.68	0.64	0.46	0.46	1.10	1.16	1.24	1.08	1.16	1.20	1.18	
22	1.00	0.60	0.56	0.42	0.52	1.10	1.14	1.16	1.12	1.18	1.18	1.14	
23	0.80	0.54	0.32	0.22	0.74	1.12	1.20	1.24	1.20	1.18	1.16	1.10	
24	1.02	0.62	0.64	-0.02	0.96	1.14	1.14	1.30	1.12	1.22	1.18	1.08	
25	1.00	0.60	0.28	0.04	1.10	1.16	1.16	1.38	1.18	1.24	1.18	1.10	
26	0.96	0.62	0.32	0.26	1.12	1.12	1.18	1.38	1.22	1.32	1.20	1.08	
27	0.94	0.86	0.32	0.42	0.94	1.24	1.20	1.36	1.20	1.26	1.02	1.06	
28	1.00	0.58	0.40	0.44	0.84	1.20	1.18	1.42	1.16	1.24	1.06	1.06	
29	1.12	0.54	0.44	0.58	0.64	1.22	1.26	1.34	1.14	1.30		1.02	
30	0.96	0.60	0.52	0.94	0.76	1.24	1.40	1.46	1.18	1.26		0.94	
31		0.64		1.06	0.90		1.58		1.20	1.28		1.02	
Max.	1.20	1.02	0.96	1.06	1.12	1.24	1.58	1.70	1.40	1.32	1.36	1.42	1.70 M.

Zero Gage At Bottom Elevation 0.000 M. (A.D.)

RID Computer Center WLEVEL/MAXDLY K.57
Station : K.57, (K.57) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 2001

Daily Max. Gage Height In Meter (MSL.) April 1, 2001 To March 31, 2002

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.08	0.72	0.86	0.62	0.86	1.06	1.00	1.22	0.98	0.84	1.16	1.20	
2	1.08	0.70	0.84	0.60	0.88	1.00	0.68	1.18	1.04	0.76	1.20	1.18	
3	1.10	0.62	0.80	0.58	0.80	1.12	0.64	1.20	1.00	0.64	1.22	1.14	
4	1.00	0.66	0.76	0.56	0.82	1.14	0.70	1.16	0.96	0.80	1.18	1.20	
5	1.00	0.70	0.64	0.50	0.86	1.02	0.64	1.10	1.00	1.24	1.26	1.24	
6	1.02	0.64	0.62	0.48	0.84	0.98	0.56	0.98	1.00	1.32	1.24	1.44	
7	1.12	0.62	0.42	0.46	0.88	1.08	0.54	0.94	0.92	1.16	1.14	1.40	
8	1.08	0.50	0.50	0.46	0.92	1.10	0.70	0.86	0.92	1.20	1.26	1.32	
9	1.10	0.56	0.48	0.46	0.90	1.02	0.74	0.82	0.84	1.24	1.24	1.44	
10	1.06	0.52	0.44	0.48	0.94	1.06	0.78	0.74	0.82	1.26	1.20	1.36	
11	1.08	0.48	0.40	0.50	0.96	1.16	0.74	0.78	0.87	1.18	1.20	1.30	
12	1.12	0.46	0.38	0.54	0.92	1.12	0.76	0.70	0.76	1.12	1.24	1.26	
13	1.14	0.52	0.46	0.58	0.98	1.14	0.78	0.92	0.76	1.18	1.18	1.24	
14	1.16	0.50	0.50	0.60	0.98	1.04	0.80	0.96	0.92	1.24	1.20	1.32	
15	1.12	0.60	0.46	0.60	0.94	1.08	0.74	0.84	0.96	1.32	1.16	1.26	
16	1.14	0.62	0.32	0.64	1.04	1.10	0.64	0.98	1.00	1.26	1.18	1.24	
17	1.14	0.44	0.36	0.68	1.06	1.50	0.62	0.96	1.08	1.28	1.22	1.28	
18	1.16	0.46	0.38	0.62	1.10	1.54	0.60	0.78	1.06	1.22	1.14	1.18	
19	1.12	0.60	0.32	0.70	0.96	1.32	0.76	0.74	1.08	1.24	1.16	1.22	
20	1.12	0.62	0.26	0.74	0.98	1.22	0.78	0.66	0.96	1.24	1.20	1.20	
21	1.04	0.50	0.34	0.76	0.90	1.36	1.36	0.60	0.96	1.20	1.26	1.14	
22	1.06	0.48	0.46	0.82	0.92	1.34	1.18	0.62	0.92	1.18	1.24	1.18	
23	1.10	0.58	0.32	0.80	0.96	1.32	1.10	0.60	0.88	1.00	1.28	1.16	
24	1.00	0.62	0.42	0.84	0.94	1.26	1.20	0.60	0.75	1.02	1.32	1.20	
25	0.98	0.56	0.56	0.86	1.06	1.28	0.84	0.60	0.75	1.22	1.34	1.14	
26	0.96	0.86	0.54	0.94	1.04	0.80	0.80	0.64	0.80	1.18	1.32	1.20	
27	0.94	0.82	0.60	0.96	1.00	0.84	0.86	0.60	0.80	1.26	1.32	1.16	
28	0.90	0.80	0.58	0.98	1.06	0.86	0.88	1.00	0.86	1.34	1.36	1.24	
29	0.96	0.84	0.62	1.00	0.96	0.76	0.80	1.02	1.04	1.50		1.24	
30	0.92	0.86	0.74	1.02	1.04	0.82	0.82	1.06	1.12	1.56		1.12	
31		0.90		1.04	1.02		0.84		0.80	1.42		1.04	
Max.	1.16	0.90	0.86	1.04	1.10	1.54	1.36	1.22	1.12	1.56	1.36	1.44	1.56 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center
Station : K.57, (K.57)
Stream :
River :
River System : Mae Klong

WLEVEL/MAXDLY K.57
Royal Irrigation Department
Thailand
Hydrology Division

WATER YEAR - 2002

Daily Max. Gage Height In Meter (MSL.) April 1, 2002 To March 31, 2003

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	0.92	1.10	0.60	0.74	0.54	0.86	1.54	1.38	1.50	1.20	1.46	1.34	
2	0.96	1.06	0.56	0.70	0.46	0.98	1.62	1.36	1.54	1.22	1.44	1.36	
3	1.00	1.04	0.58	0.68	0.42	1.14	1.70	1.28	1.28	1.26	1.46	1.30	
4	1.02	1.02	0.62	0.70	0.32	1.28	1.62	1.30	1.30	1.28	1.50	1.32	
5	0.94	1.00	0.64	0.72	0.96	1.32	1.72	1.60	1.24	1.22	1.52	1.36	
6	0.86	1.10	0.70	0.66	0.98	1.46	1.70	1.50	1.20	1.24	1.42	1.32	
7	0.88	0.98	0.66	0.72	0.86	1.42	1.68	1.50	1.22	1.20	1.40	1.40	
8	0.90	0.82	0.72	0.86	0.72	1.18	1.74	1.50	1.26	1.20	1.36	1.42	
9	0.92	1.00	0.64	0.76	0.52	1.00	1.78	1.50	1.20	1.34	1.34	1.36	
10	0.94	1.14	0.58	0.82	0.36	1.14	1.60	1.56	1.18	1.38	1.36	1.38	
11	0.90	1.12	0.54	0.60	0.36	1.18	1.50	1.30	1.18	1.46	1.22	1.36	
12	0.80	0.96	0.56	0.54	0.42	1.16	1.42	1.22	1.18	1.56	1.21	1.34	
13	0.92	0.86	0.64	0.56	0.50	1.12	1.32	1.40	1.16	1.50	1.26	1.38	
14	0.90	0.82	0.70	0.62	0.72	1.26	1.28	1.24	1.20	1.52	1.27	1.32	
15	0.84	0.80	0.72	0.60	0.32	1.10	1.30	1.25	1.18	1.44	1.18	1.30	
16	0.86	0.76	0.60	0.56	0.36	1.04	1.26	1.25	1.06	1.40	1.18	1.26	
17	0.92	0.82	0.62	0.54	0.68	1.14	1.40	1.00	1.18	1.42	1.20	1.28	
18	0.86	0.84	0.64	0.50	0.76	1.30	1.46	1.15	1.20	1.48	1.19	1.20	
19	0.90	0.82	0.64	0.58	1.12	1.34	1.48	1.20	1.16	1.46	1.22	1.24	
20	0.94	0.84	0.70	0.82	1.30	1.16	1.50	1.50	1.24	1.48	1.16	1.36	
21	1.00	0.80	0.66	0.98	1.52	1.22	1.36	1.54	1.26	1.48	1.20	1.34	
22	1.06	0.78	0.92	1.02	1.26	1.20	1.20	1.56	1.36	1.36	1.32	1.30	
23	1.12	0.78	0.96	0.92	0.76	1.18	1.24	1.50	1.44	1.38	1.34	1.38	
24	1.10	0.92	0.64	0.76	0.86	1.38	1.36	1.50	1.42	1.36	1.30	1.26	
25	1.00	1.08	0.80	0.70	0.72	1.62	1.24	1.70	1.36	1.40	1.26	1.24	
26	0.98	1.16	0.82	0.78	0.68	1.80	1.20	1.70	1.34	1.30	1.32	1.20	
27	1.04	0.84	0.76	0.76	0.56	1.78	1.14	1.56	1.38	1.32	1.36	1.26	
28	1.00	0.96	0.76	0.80	0.62	1.78	1.20	1.62	1.30	1.36	1.36	1.24	
29	1.10	0.86	0.82	0.82	0.64	1.74	1.18	1.54	1.28	1.46		1.26	
30	1.06	0.84	0.86	0.54	0.56	1.56	1.20	1.42	1.28	1.50		1.34	
31		0.82		0.60	0.54		0.86		1.24	1.40		1.32	
Max.	1.12	1.16	0.96	1.02	1.52	1.80	1.78	1.70	1.54	1.56	1.52	1.42	1.80 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

RID Computer Center WLEVEL/MAXDLY K.57
Station : K.57, (K.57) Royal Irrigation Department
Stream : Thailand
River : Hydrology Division
River System : Mae Klong

WATER YEAR - 2003

Daily Max. Gage Height In Meter (MSL.) April 1, 2003 To March 31, 2004

Date	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
1	1.06	0.98	0.90	0.54	0.94	0.82	1.54	1.40	1.54	1.00	1.34	0.96	
2	1.14	0.86	0.74	0.50	0.86	0.72	1.42	1.32	1.38	1.06	1.18	1.10	
3	1.24	0.82	0.76	0.62	0.88	0.90	1.34	1.40	1.36	1.04	1.20	1.12	
4	1.20	0.80	0.70	0.60	0.54	0.74	1.54	1.30	1.32	0.90	1.36	1.22	
5	1.22	0.74	0.68	0.46	0.78	1.04	1.56	1.18	1.24	1.20	1.42	1.34	
6	1.06	0.72	0.54	0.38	0.16	1.18	1.66	1.08	0.92	1.30	1.46	1.42	
7	1.18	0.76	0.56	0.38	0.76	1.20	1.56	1.14	1.32	1.40	1.34	1.40	
8	1.18	0.70	0.60	0.30	1.04	0.96	1.62	1.18	1.30	1.46	1.32	1.38	
9	1.20	0.74	0.80	0.42	1.16	0.90	1.60	1.16	1.50	1.36	1.12	1.38	
10	1.22	0.60	0.86	0.82	1.22	0.82	1.58	1.10	1.56	1.42	1.22	1.14	
11	1.18	0.62	0.86	1.10	0.76	0.72	1.48	1.30	1.58	1.32	1.20	1.26	
12	1.24	0.60	0.98	0.94	0.76	0.64	1.38	1.32	1.52	1.26	1.22	1.26	
13	1.20	0.50	1.18	0.80	0.66	0.68	1.38	1.26	1.52	1.46	1.14	1.18	
14	1.26	0.90	1.02	0.60	0.74	0.70	1.46	1.32	1.46	1.44	1.22	1.12	
15	1.28	1.08	1.06	0.70	0.92	0.74	1.50	1.38	1.26	1.38	1.02	1.22	
16	1.32	1.16	1.14	0.76	0.76	0.62	1.30	1.26	1.30	1.28	1.32	1.36	
17	1.20	0.98	1.00	0.70	0.74	0.76	1.26	1.36	1.26	1.26	1.36	1.34	
18	1.18	1.00	0.90	0.96	0.74	0.86	1.32	1.28	1.30	1.22	1.36	1.20	
19	1.10	1.20	0.70	0.64	0.84	0.84	1.40	1.26	1.18	1.30	1.40	1.28	
20	1.12	1.00	0.74	0.44	0.62	1.12	1.52	1.12	1.30	1.38	1.34	1.22	
21	0.62	0.92	0.80	0.46	0.80	1.22	1.40	1.16	1.18	1.42	1.32	1.20	
22	0.64	0.90	0.70	0.30	1.02	1.26	1.18	1.14	1.20	1.54	1.22	1.22	
23	0.78	0.80	0.86	0.26	1.06	1.18	1.38	1.28	1.32	1.58	1.16	1.18	
24	0.70	0.76	0.68	0.68	1.10	1.40	1.46	1.38	1.56	1.36	1.14	1.20	
25	0.74	0.74	0.72	0.96	1.00	1.26	1.18	1.22	1.40	1.34	1.08	1.12	
26	0.78	0.80	0.86	1.26	0.98	1.30	1.34	1.52	1.42	1.34	1.00	1.16	
27	0.74	0.74	0.98	1.32	0.66	1.40	1.60	1.50	1.48	1.10	1.10	1.00	
28	0.76	0.74	1.06	1.24	0.60	1.16	1.72	1.62	1.36	1.20	1.12	1.04	
29	0.84	0.88	0.82	0.86	0.50	1.40	1.48	1.56	1.26	1.32	1.02	1.02	
30	0.94	0.62	0.72	0.98	0.58	1.54	1.62	1.52	1.16	1.20		1.04	
31		0.60		0.82	0.60		1.36		1.16	1.20	1.08		
Max.	1.32	1.20	1.18	1.32	1.22	1.54	1.72	1.62	1.58	1.58	1.46	1.42	1.72 M.

Zero Gage At Bottom Elevation 0.000 M. (MSL.)

BIOGRAPHY

NAME	Miss Waleerat Rangsimapirat
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