CHAPTER 1

INTRODUCTION

1.1 OBJECTIVE OF PMP ESTIMATES

The objective of a probable maximum precipitation (PMP) estimate is to calculate the probable maximum flood (PMF) used in the design of a given project at a particular geographical location in a given watershed, and to further provide information that could assist in designing the size (dam height and reservoir storage capacity) of the given project and dimension of the flood-carrying structures (spillway and flood carrying tunnel) of the project.

1.2 DEFINITIONS OF PMP AND PMF

1.2.1 Definition of PMP

PMP is the theoretical maximum precipitation for a given duration under modern meteorological conditions. Such a precipitation is likely to happen over a design watershed, or a storm area of a given size, at a certain time of year. Under disadvantageous conditions, PMP could be converted into PMF – the theoretical maximum flood. This is necessary information for the design of a given project in the targeted watershed.

1.2.2 Definition of PMF

PMF is the theoretical maximum flood that poses extremely serious threats to the flood control of a given project in a design watershed. Such a flood could plausibly occur in a locality at a particular time of year under current meteorological conditions.

1.3 CLOSE COMBINATION OF HYDROLOGY AND METEOROLOGY

PMP/PMF estimation falls within the field of hydrometeorology. It is a method of hydrometeorology used to estimate the design flood, which combines hydrology and meteorology. The work of PMP/PMF estimation requires close cooperation between hydrologists and meteorologists. Any issues arising in PMP/PMF estimation should not be studied from a purely hydrological or purely meteorological point of view. The concepts and theories of both hydrology and meteorology should be considered. Only in this way can the PMP/PMF estimates be optimized and reflect a balance between safety and cost-efficiency in project design. The studies should also cover all factors that affect PMF, including meteorology, hydrology, geology and topography. Nevertheless, separate analysis of meteorological factors is possible.

The manual contains advances based on the methods and technologies introduced in the literature in recent years and new experience of current practices. Physical models are not usable as they produce low-accuracy estimates of precipitation. The use of numerical weather models for PMP estimation is currently a topic of research (Cotton and others, 2003).

1.4 PMP/PMF ESTIMATION

1.4.1 Basic knowledge

Storms, and their associated floods, have physical upper limits, which are referred to as PMP and PMF. It should be noted that due to the physical complexity of the phenomena and limitations in data and the meteorological and hydrological sciences, only approximations are currently available for the upper limits of storms and their associated floods.

1.4.2 Approaches to and methods of PMP estimation

1.4.2.1 Approaches

PMP is primarily considered to be the precipitation resulting from a storm induced by the optimal dynamic factor (usually the precipitation efficiency) and the maximum moisture factor simultaneously. There are two general approaches to estimating PMP: one based on storm area (area surrounded by isohyets) and the other based on the specific watershed location (watershed area).

The approach based on storm area (the indirect approach) focuses on the estimation of a group of PMPs with various durations and areas in a wide region (a zone with meteorologically homogeneous