Table 6.3. Catchment areas in the Chambal watershed

No.	*River (or tributary)*	*Catchment area (km^2)*
1	Main Chambal	46 073
2	Banas	48 577
3	Kali Sindh	25 741
4	Parvati	14 122
5	Kunar	4 507
6	Kunwari	7 610

sub-basin were calculated. The rules of classification defined by IMD were followed to designate the rainfall threshold for each duration. Storms whose rainfall exceeded the threshold were extracted for isohyetal analyses. Ultimately, 24 storms (with a daily rainfall at the storm centre of between 225 mm and 396 mm) were selected for analysis from among the 95 in the Chambal watershed. These 24 storms were used to conduct 1-day isohyetal analyses. Similarly, 2- and 3-day isohyetal analyses were conducted using 17 and 10 storms, respectively.

The three storms for which the DAD enveloping curves were drawn occurred on 27–29 June 1945, 22–23 July 1971 and 22–24 July 1986. They were all caused by the trough movement from the Bay of Bengal.

6.2.4.3.4 *Estimating PMP*

The following steps are applied in estimating PMP:

(a) Drawing the DAD curve:
- (i) a. The DAD curve is drawn for each typical storm;
  - b. The DAD curves for the three extraordinary storms in 1945, 1971 and 1986 are drawn.
- (ii) As a result, the typical storms that controlled the DAD enveloping curves were:
  - a. 1-day duration: DAD enveloping curve was 29 June 1945;
  - b. 2-day duration: DAD enveloping curves were 28–29 June 1945 and 22–23 July 1971;
  - c. 3-day duration: DAD enveloping curves were 27–29 June 1945 and 22–24 July 1986.
- (iii) Rainfall on the DAD enveloping curve is called the standard project storm (SPS). Table 6.5 lists the SPS by standard area size for the Chambal watershed.

(b) Calculating the storm maximization factor and adjustment factor by region:
- (i) The moisture maximization factor (MMF) is calculated by

  $$MMF = (W_2)_{h1}/(W_1)_{h1}$$

  where h_1 is the mean watershed elevation of the region where the typical storm occurs; $(W_1)_{h1}$ is the precipitable water for the part of the catchment beyond the elevation h_1 to which the representative dew point for the typical storm (or the storm region) d_1 corresponds; d_2 occurs at the same location and month as d_1.

  Table 6.6 shows the MMF of the three typical storms for drawing the DAD enveloping curves.

- (ii) The location adjustment factor (LAF) is calculated by

  $$LAF = (W_3)_{h1}/(W_2)_{h1}$$

  where $(W_3)_{h1}$ is the precipitable water for the part of the catchment beyond the elevation h_1 to which the maximum dew point for the storm transposed region d_3 corresponds. When $d_3 > d_1$ then LAF $\neq$ 1.

- (iii) The barrier adjustment factor (BAF) is calculated using

  $$BAF = (W_3)_{h2}/(W_3)_1,$$

  where h_2 is the mean elevation of the transposed region; $(W_3)_{h2}$ and $(W_3)_{h1}$ are the precipitable water for the parts of the catchment beyond the elevations h_2 and h_1, respectively, to which the maximum dew point for the transposed region d_3 corresponds. When $h_2 > h_1$ then BAF < 1; when $h_2 = h_1$ then BAF = 1. Storm transposition is not recommended if the elevation difference between the transposed region and the storm occurrence region Δh is greater than 1 000 m.

Table 6.4. Sub-basin location in the Chambal watershed

Sub-basin no.	*Location*
404	Up Chambal River to Kotah dam site
405	From Kotah Dam to the intersection of the Chambal and Banas rivers
406	Banas River
407	From the intersection of the Chambal and Banas rivers to the Yamuna River