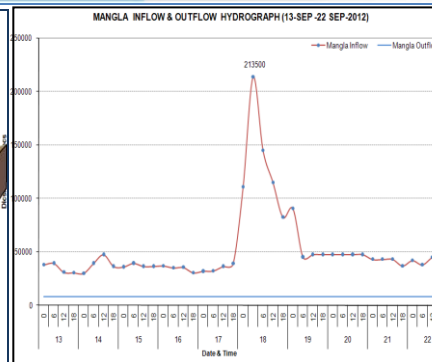
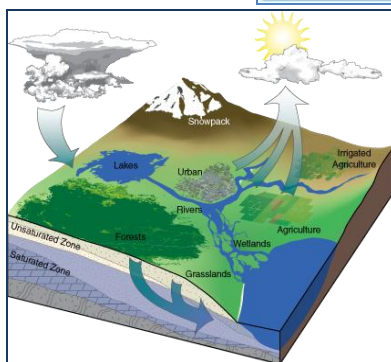
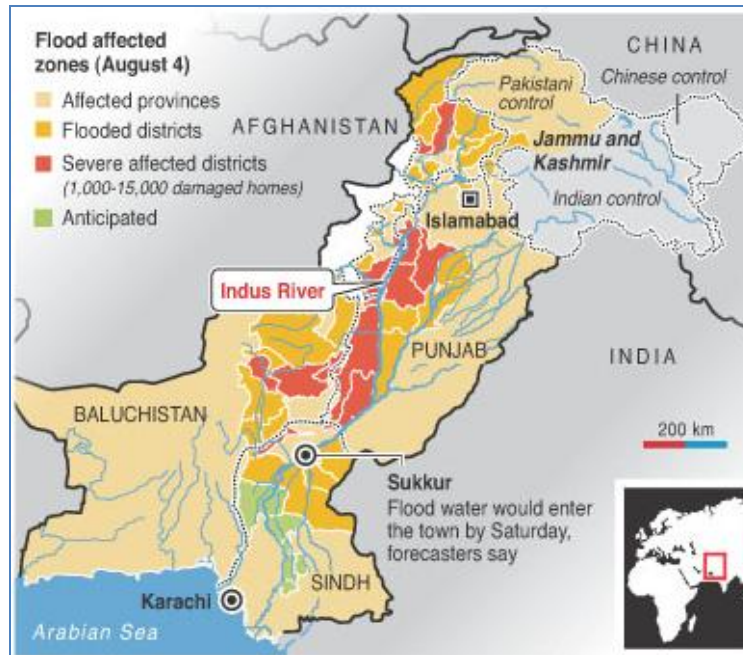


# Pakistan Meteorological Department

## *Flood Report 2012*



***Flood Forecasting Division***  
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## Preface

Floods and flash floods are the deadliest of natural disasters. Floods bring misery to those who live in the flood prone areas and not only cause loss of precious life but also cause a great disruption to daily normal life. Its effects can be reduced by analyzing the prevailing atmospheric conditions on micro scale, future possible variability in it and then possible accurate forecast .The timely dissemination of the flood information to the concerned authorities, media and public contributes a lot in minimizing the losses due to floods. The floods depend upon the current base flow of river sites, intensity and duration of rainfall & topography .These parameters are monitored by weather radars, weather satellites, Hydro meteorological models, telemetric network & by the network of meteorological observatories and timely reception of hydrological data of different river sites. The Flood Forecasting Division Lahore (FFD), since its establishment is serving the nation by issuing flood forecasts during each flood season (15<sup>th</sup> June -15<sup>th</sup> October). Similarly FFD monitored flood season 2012 carefully through its Hydro meteorological bulletins, Warnings / Advisories, and then informing different Government agencies, press and electronic media, in order to minimize mass destruction. The compilation of flood report after each flood season is a regular feature observed by FFD Lahore. Flood report for the year 2012 has been prepared under the able guidance and kind instructions of Director General, Meteorological Services and Chief Meteorologist FFD. It contains all the details pertaining to flood forecasting like monsoon lows tracks, rainfall during wet spells, flood peaks, monthly and seasonal Isohyetal maps, normal isopercental maps, flood limits and flood evaluation report .

Chief Meteorologist  
Flood Forecasting Division  
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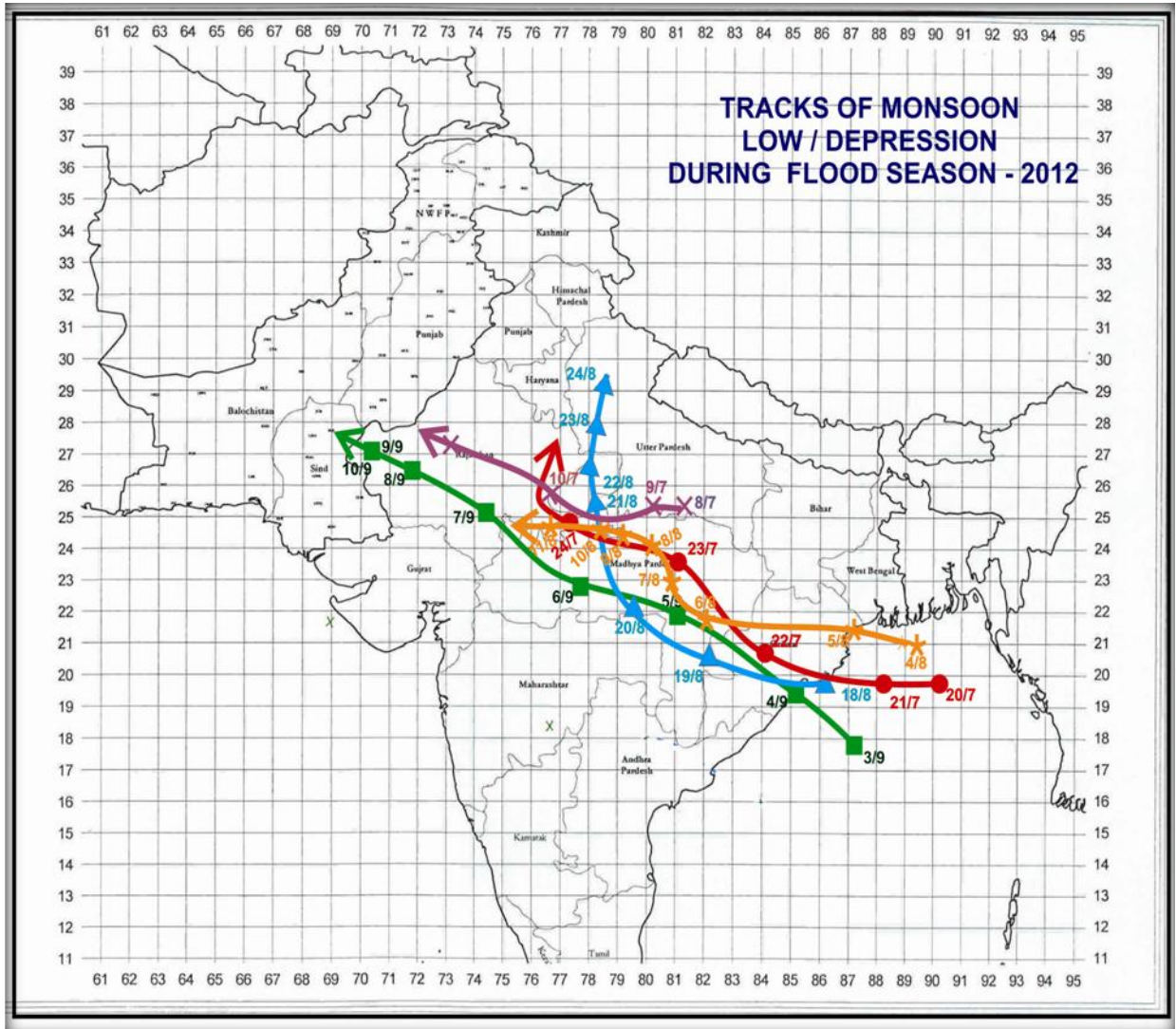
# **Hydrometeorological Report 2012**

## 1 Highlights

- Monsoon remained very active over south Punjab, North Sindh and Northeast Balochistan this year and very heavy rain fell over the areas. Most parts of the upper catchments of all the major rivers received normal rainfall.
- A total number of five monsoon lows originated from the Bay of Bengal. However, two were able to reach in the vicinity of Pakistan.
- The seasonal precipitation (July 2012 to September 2012) Isopercental pattern is the indicative of significantly above normal rainfall in south Punjab , North Sindh and some parts of northeast Balochistan. Northern parts of the country received near normal rainfall, whereas Western Balochistan remained almost dry during the period.
- Nine rain bearing spells occurred during the monsoon season, 2012.
- The supply of Hydro-Meteorological data from WAPDA, Punjab and Sindh Irrigation departments , Pakistan Commissioner for Indus Water (PCIW) & Drainage Authorities remained satisfactory.
- The concerned federal and provincial authorities along with press and electronic media were also daily informed about the prevailing weather/flood conditions through fax & Internet as well.
- 24 Significant Flood Forecasts /warnings were issued by FFD during Monsoon season 2012, whenever the weather/flood situation demanded.
- Overall accuracy of forecast issued by FFD during the season 2012 has been calculated as 98.1%.

## 2 Tracks of Lows during Monsoon Season 2012:

During the monsoon season 2012 (15<sup>th</sup> June to 15<sup>th</sup> October) five monsoon lows developed over Bay of Bengal. The path followed by each low is shown in figure below.



**Figure 1:** Tracks of Monsoon Lows / depressions during Flood Season-2012

## 3 Significant Hydrometeorological Events during the month of June, 2012:

Only one rainfall spell occurred during the period.

### 3.1 Meteorological Events:

No Monsoon low developed over Bay of Bengal during the month of June 2012. The rainfall which occurred over Pakistan during June, 2012 was due to the accentuation of seasonal low over Balochistan, passing of westerly wave in the North of the country and influx of weak monsoon current from Arabian Sea.

### 3.1.1 Wet Spell of June 2012 (from 26-06-2012 to 29-06-2012):

The only wet spell of June 2012 which lasted for four days was mainly caused by the interaction of western disturbance and the moist current from the Arabian Sea. Rainfall distribution during the spell is given below;

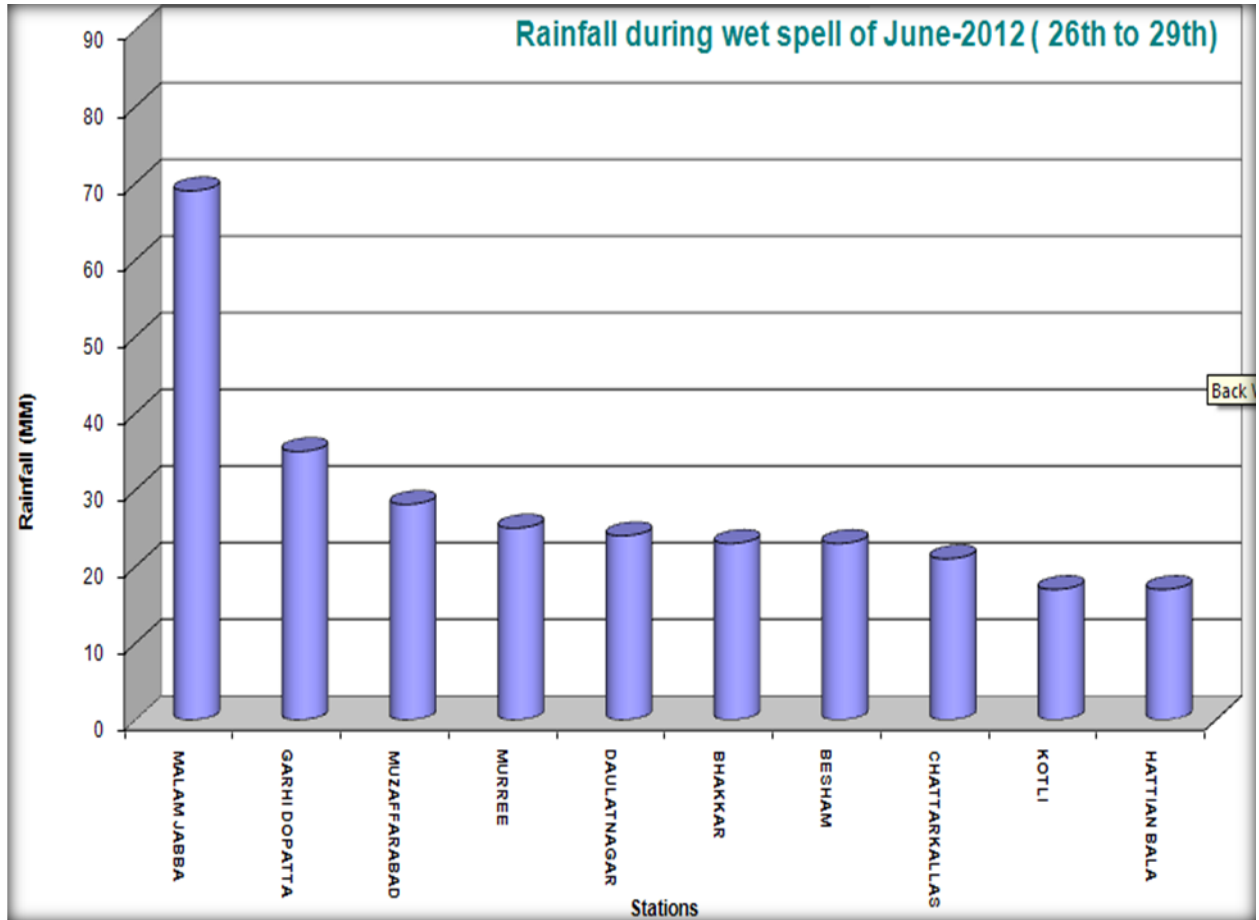


Figure 2: Wet spell of June-2012 (26 June-29 June)

### 3.1.2 Rivers Position during June 2012:

All the rivers, hill torrents and Nullahs maintained their normal flows during the period.

## 4 Significant Hydrometeorological Events during the month of July 2012:

Three rainfall spells occurred during the month of July-2012.

### 4.1 Meteorological Events:

First spell occurred from 11<sup>th</sup> to 15<sup>th</sup> July 2012. It was mainly due to a trough of westerly wave passing over the Northern parts of the country and moist current from Arabian Sea which was penetrating into sub mountain areas of Punjab and Kashmir. The second spell of

July was observed during 25<sup>th</sup> to 27<sup>th</sup> July 2012 was caused due to the interaction of westerly wave passing over the Northern parts of the country and the moist influx from Arabian sea. Final spell of the Month of July was observed from 30<sup>th</sup> to 31<sup>st</sup> July 2012. It was also caused due to interaction of westerly wave and moist current from Arabian sea. Scattered to widespread rains with moderate falls at isolated places occurred over North Punjab, Khyber Pakhtunkhwa, and Kashmir. Rainfall also occurred over Northeast Balochistan during this spell.

#### 4.1.1 First Wet Spell of July 2012 (11-07-2012 to 15-07-2012):

First spell of July 2012 which was 2<sup>nd</sup> of the flood season 2012 lasted for 5 days. It was mainly due to the passage of westerly wave, accentuation of seasonal low and incursion of moist current from Arabian Sea. The significant rain during the spell is shown below;

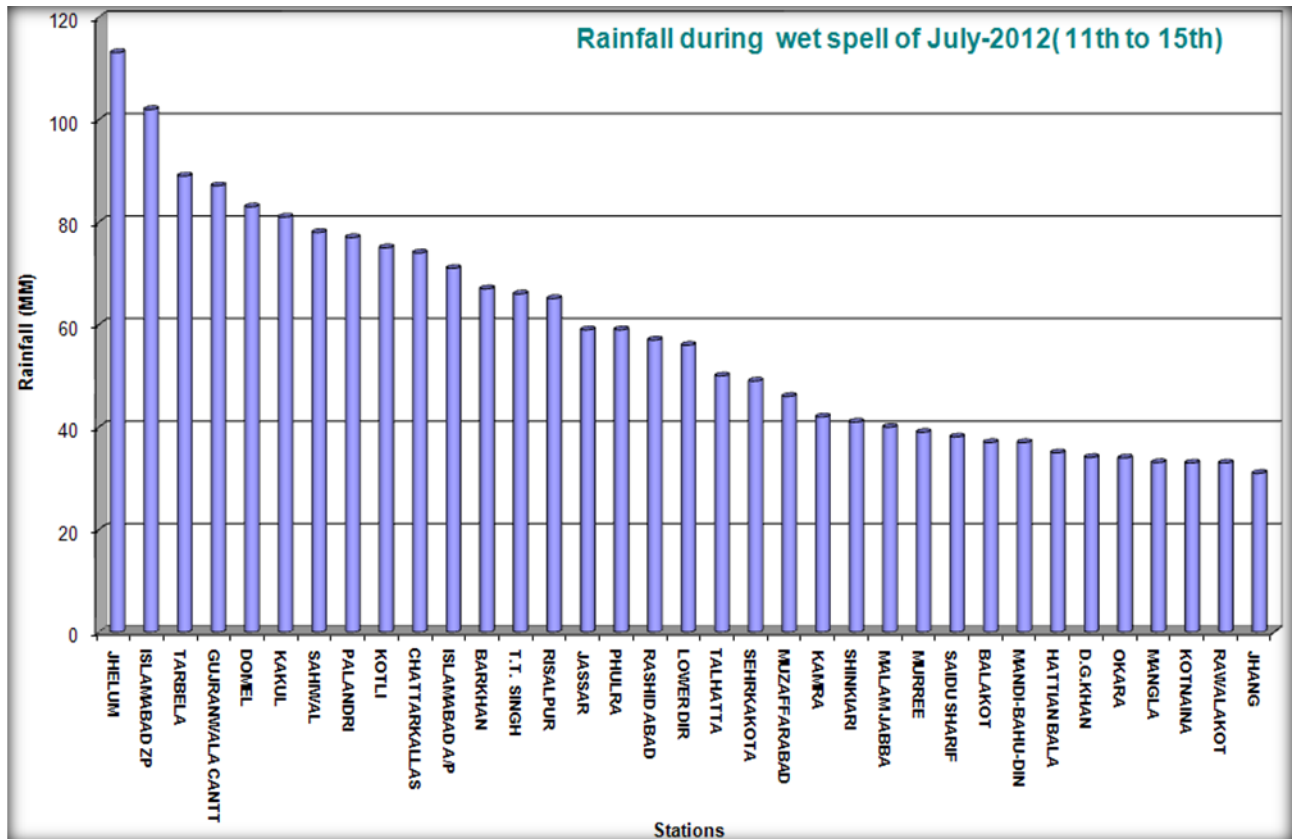


Figure 3: Wet spell of July (11<sup>th</sup> July – 15<sup>th</sup> July)

#### 4.1.2 Rivers Position Due to the Spell:

River Kabul at Nowshera remained in state of Medium flood level during the period while river Indus at Kalabagh and Chashma attained Low flood level during the period.

#### 4.1.3 Second Wet Spell of July 2012 (25-07-2012 to 27-07-2012):

This spell lasted for 3 days. The rainfall of moderate intensity was recorded in Khyber Pakhtunkhwa, Punjab and Kashmir as shown below;

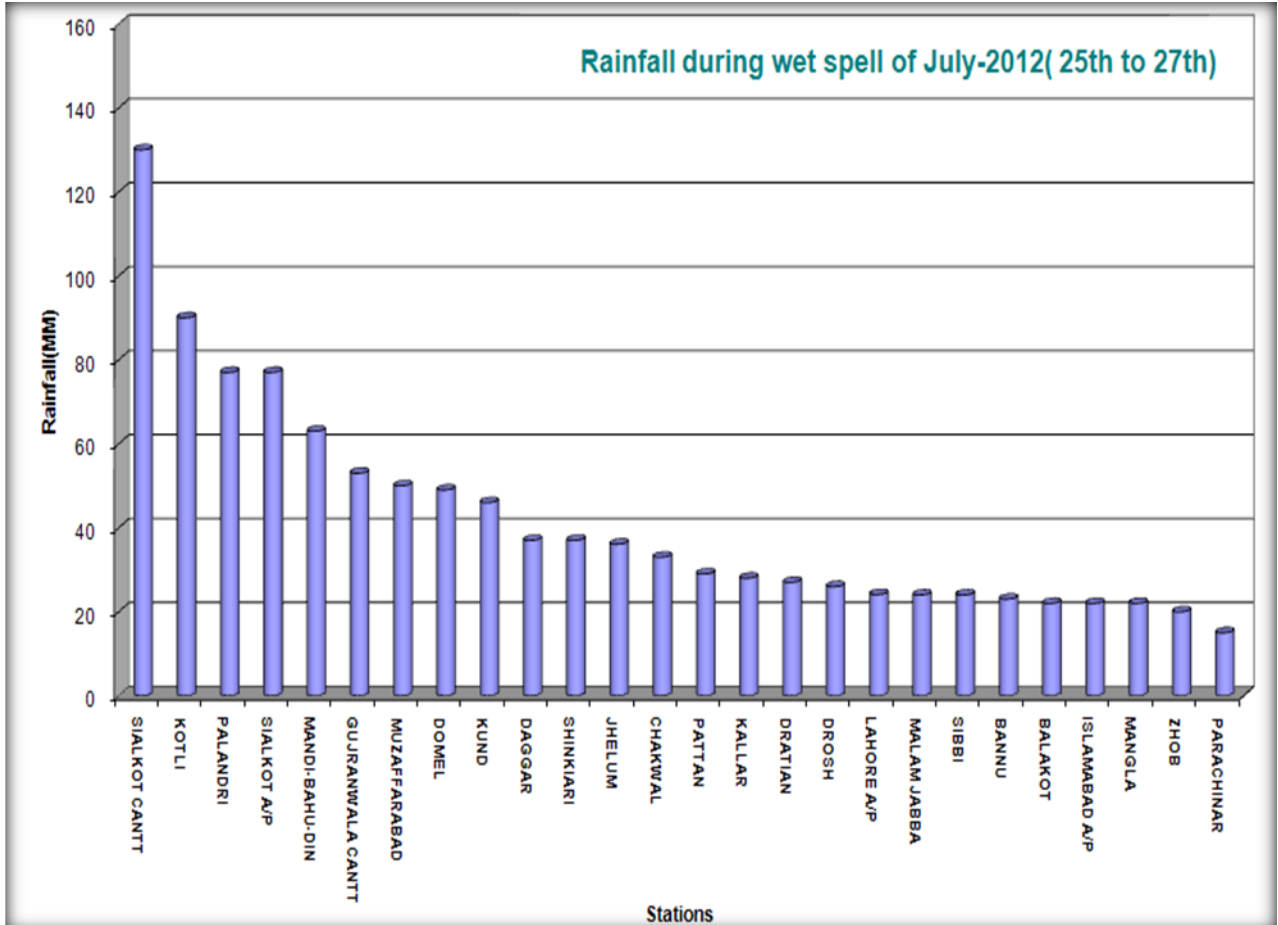


Figure 4: Wet spell of July-2012(25-27 July)

#### 4.1.4 Rivers Position Due to the Spell:

River Kabul at Nowshera remained in state of low flood level during the period while all the other rivers remained below low flood level (Downstream).

#### 4.1.5 Third Wet Spell of July 2012 (30-07-2012 to 31-07-2012):

This spell lasted for 2 days. The rainfall of moderate intensity was recorded over northeast Punjab and Kashmir as shown below;

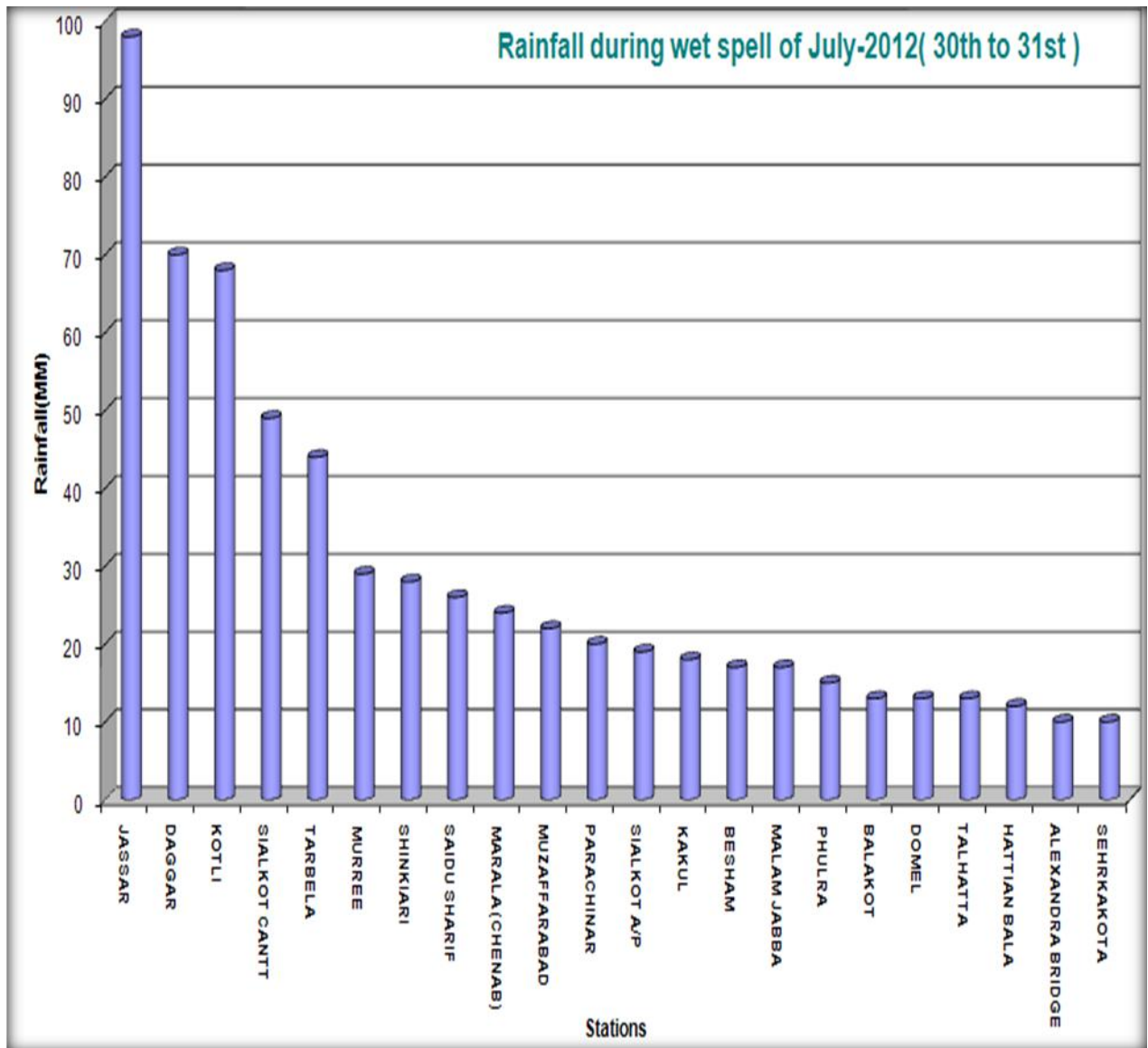


Figure 5: Wet spell of July-2012(30-31 July)

#### 4.1.6 Rivers Position Due to 3<sup>rd</sup> Spell:

No significant flood situation observed during the spell.

#### 4.1.7 Rainfall Pattern for the Month of July 2012:

Isohyetal map of July 2012 indicates that the two regions of maximum rainfall (More than 200 mm) lay one over Kashmir and other over northeast Punjab.

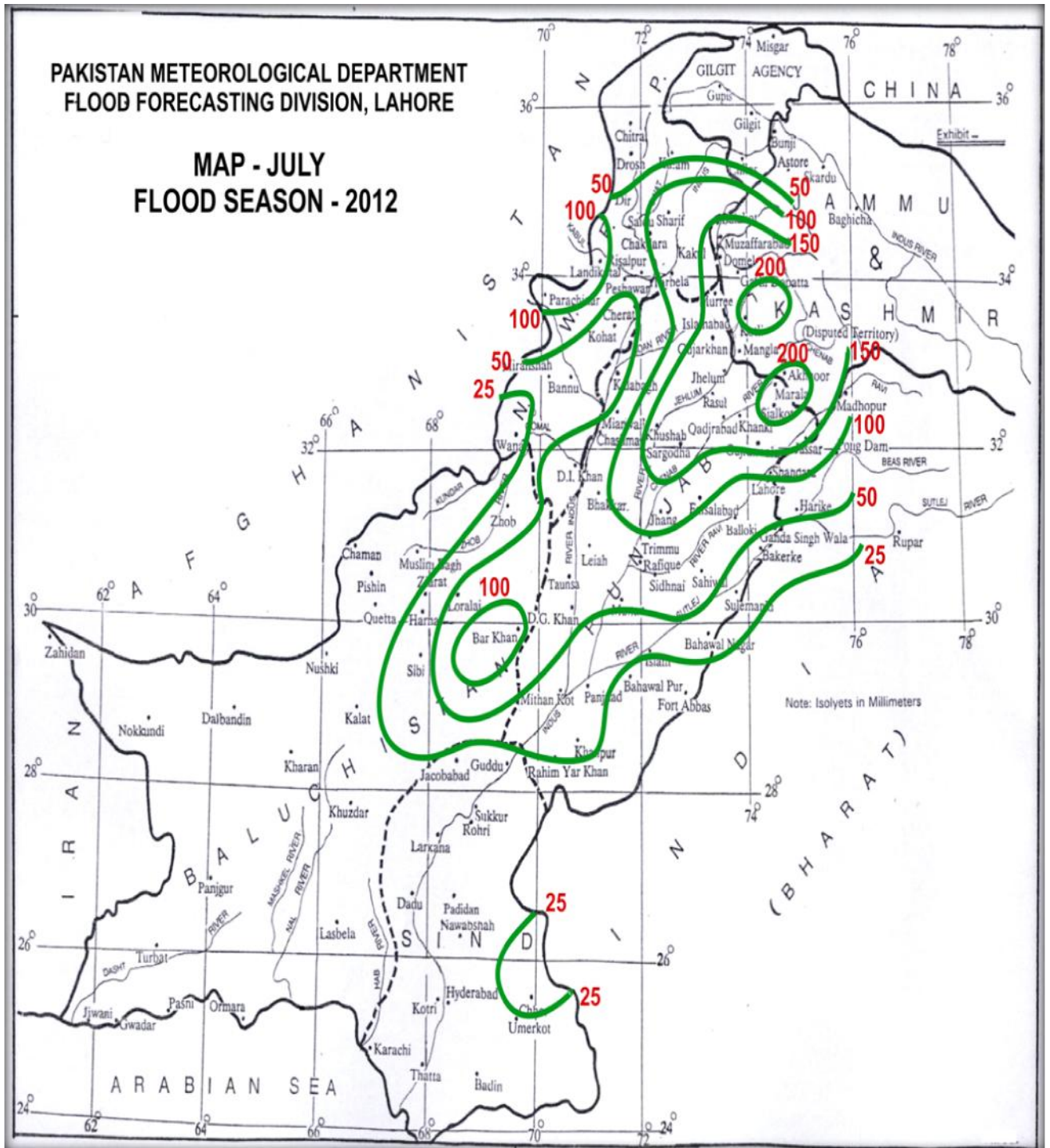


Figure 6: (Isohyetal Map of July 2012)

**4.1.8 Rivers Position during the month:**

Date	Rivers	Station	Up stream (cusecs discharge)	Flood level
05-7-12	Chenab	Marala	105252	Low
07-7-12	Indus	Tarbela	262000	Low
08-7-12	Kabul	Nowshera	100700	Medium
18-07-12	Indus	Kalabagh	285327	Low
08-07-12	Indus	Chashma	298347	Low
14-07-12	Indus	Chashma	295727	Low
12-7-12	Kabul	Nowshera	82500	Medium
14-7-12	Indus	Kalabagh	267827	Low

**5 Significant Hydrometeorological Events during the month of August 2012:****5.1 Meteorological Events:**

Three heavy and heavy to very heavy rainy spells occurred during the month of August. First spell occurred from 4<sup>th</sup> to 6<sup>th</sup> August 2012. This spell was caused by the trough of westerly wave accentuation of seasonal low and moist current from the Arabian Sea. Second wet spell of the August observed from 20<sup>th</sup> to 23<sup>rd</sup> August 2012. This spell was also caused by the moving trough of westerly wave accentuation of seasonal low and moist current from the Arabian Sea. Third and final spell occurred from 25<sup>th</sup> to 28<sup>th</sup> August 2012. This spell caused also by the passage of westerly wave and accentuation of seasonal low. During August two monsoon lows developed over the Bay of Bengal and none of them reached in the vicinity of the country.

**5.1.1 First Wet Spell of August (04-08-2012 to 06-08-2012):**

The rainfall during the first spell of August which was 5<sup>th</sup> of the season occurred during 4<sup>th</sup> to 6<sup>th</sup> August 2012. Moderate to heavy Rainfall was observed in this spell over Kashmir, north and northeast Punjab. Rainfall during the spell is shown in figure 7,

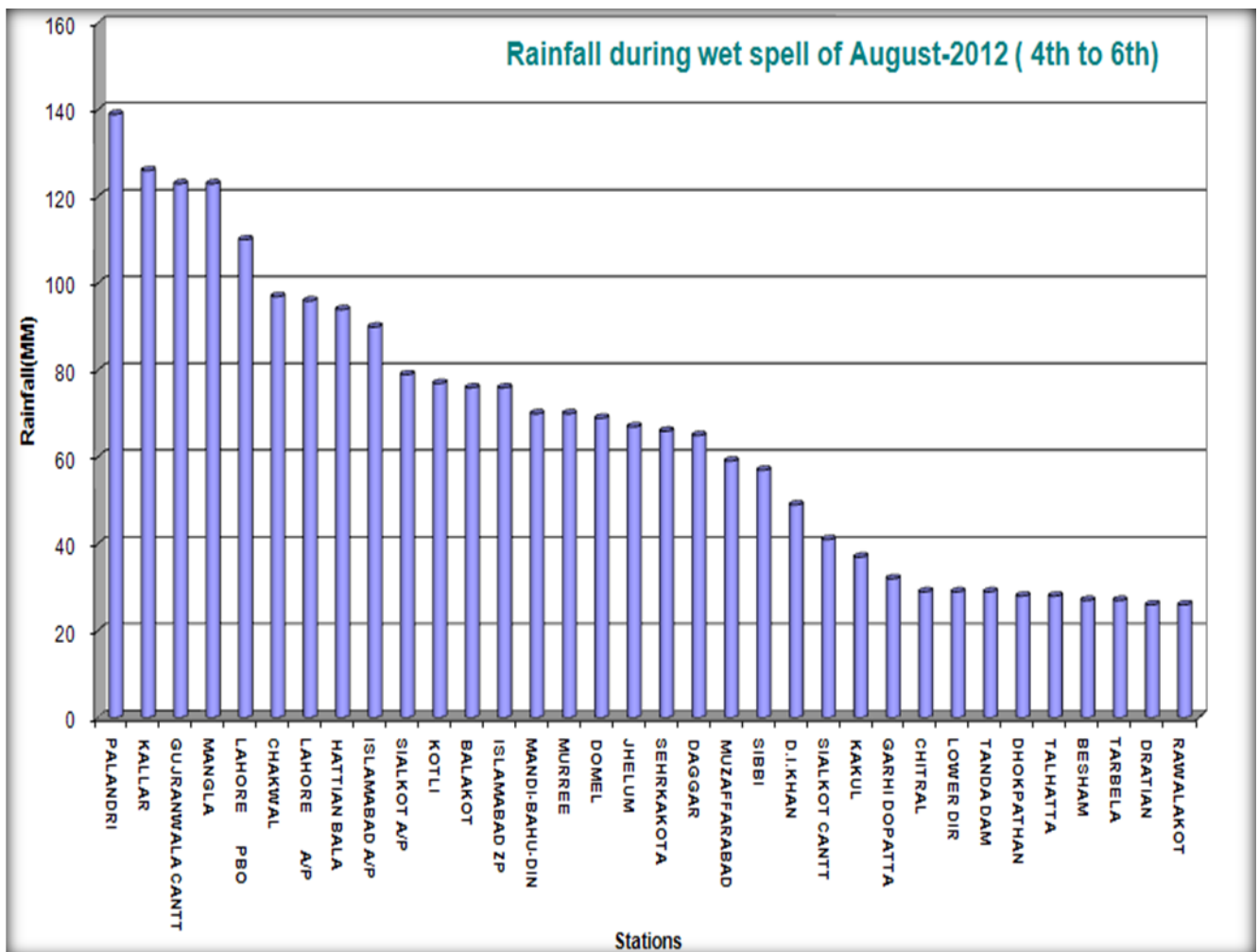


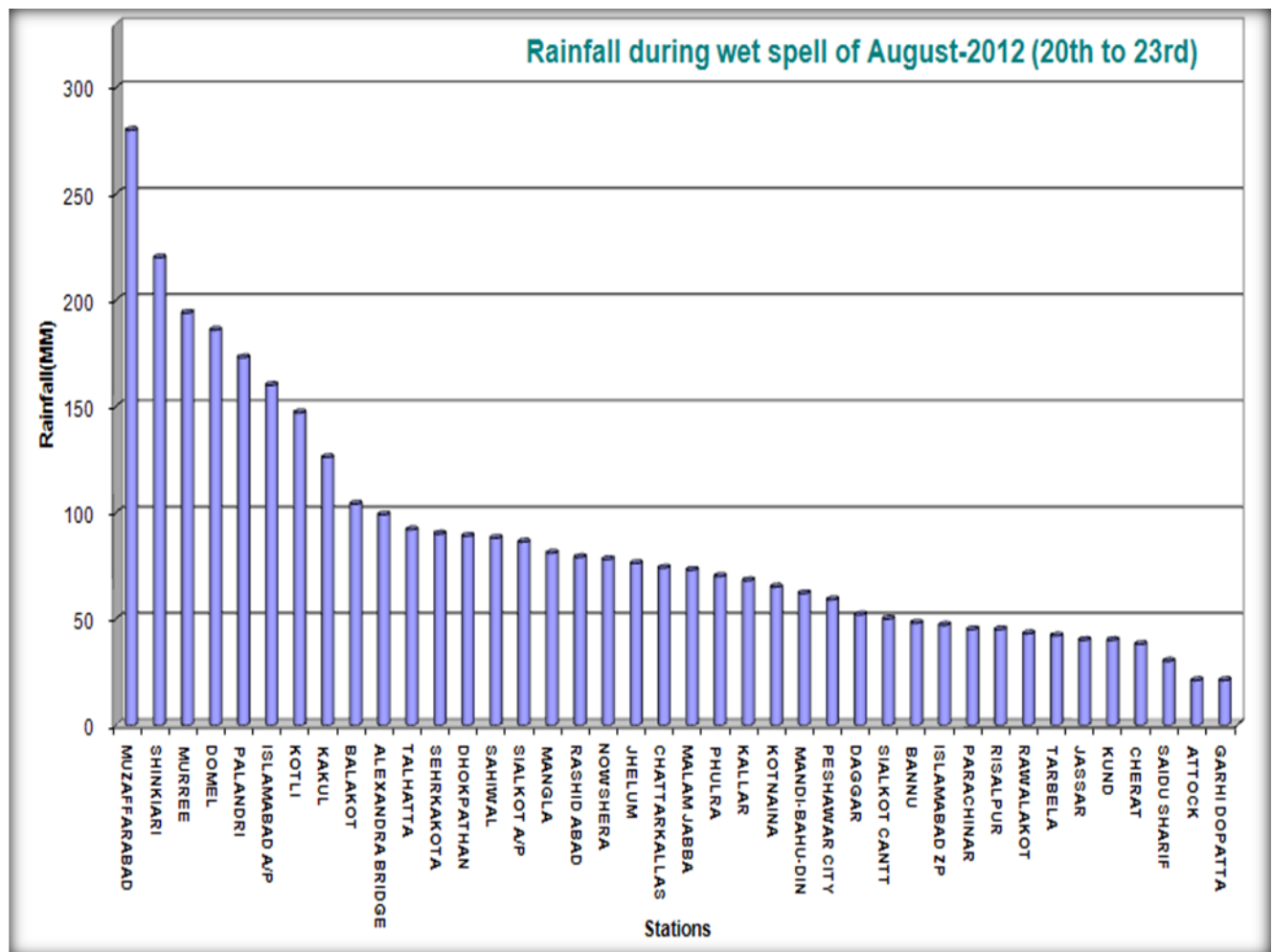
Figure 7: Wet spell of August-2012 (04 Aug-6 Aug)

### 5.1.2 Rivers Position during the Spell:

Due to this spell river Chenab at Marala (upstream) attained a High flood situation, while medium flood situation was observed in river Chenab at Khanki and Qadirabad. Low flood peaks (Upstream) were also recorded in rivers Jhelum at Mangla, Kabul at Nowshera, Indus at Tarbela, Kalabagh & Chashma.

### 5.1.3 Second Wet Spell of August (20-08-2012 to 23-08-2012):

Heavy to very heavy rainfall over Kashmir and moderate to heavy rainfall over north Punjab recorded is shown in the figure 8.



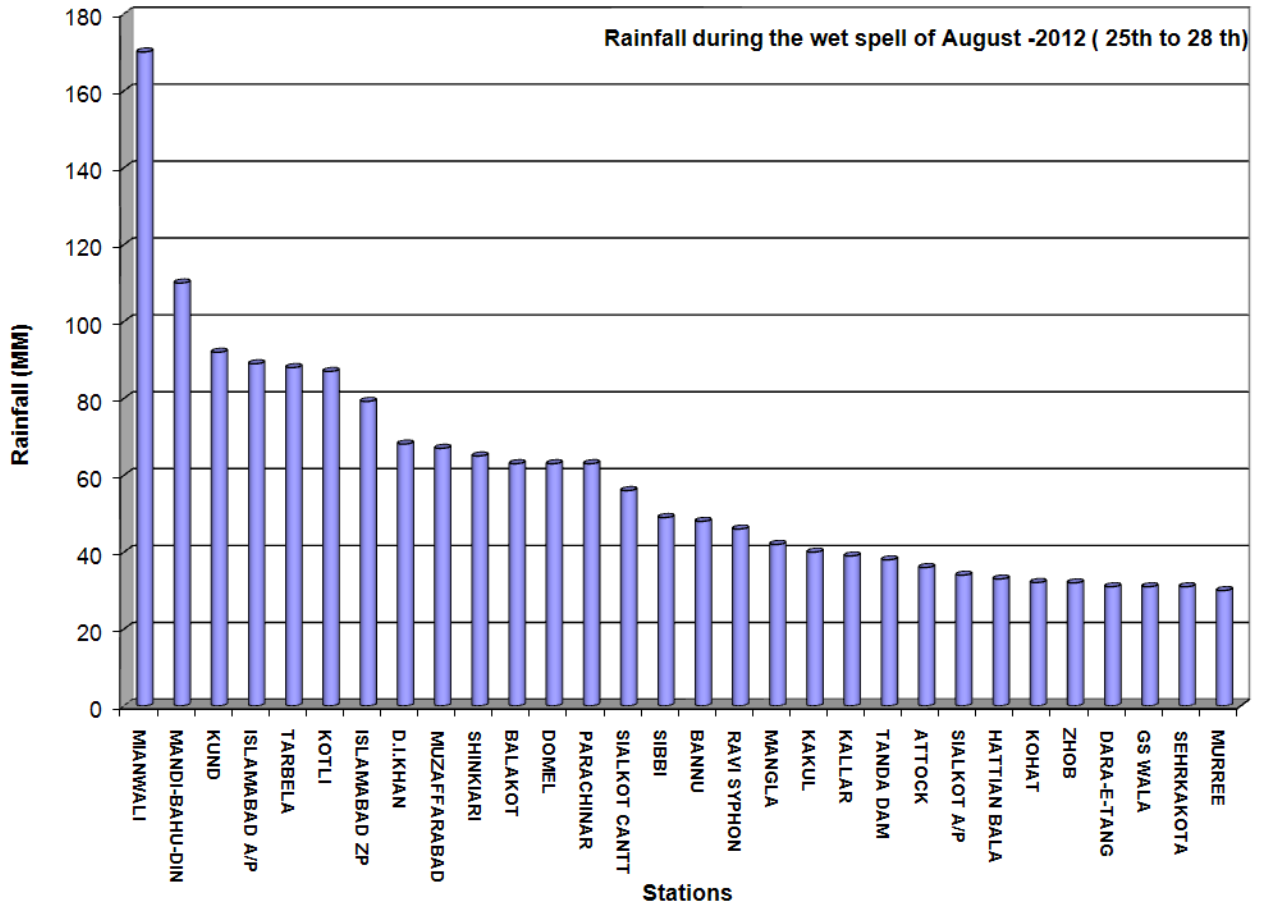
**Figure 8:** Wet spell of August-2012(20 Aug-23 Aug)

#### 5.1.4 Rivers Position During the Spell:

Due to this spell, low flood situation upstream as well as downstream reported over river Chenab at Marala, Khanki & Qadirabad. River Ravi at Shahdara and only upstream at River Ravi at Balloki and river Indus at Tarbela and Kalabagh also reported low flood situation.

#### 5.1.5 Third Wet Spell of August (25-08-2012 to 28-08-2012):

This spell was due to the interaction of westerly wave over northern parts of the country and accentuation of seasonal low along with penetration of monsoon currents from Arabian sea and Bay of Bengal. During this spell light to moderate rainfall was recorded over North Punjab, Khyber Pakhtunkhwa and Kashmir as shown in the figure 9 ;



**Figure 9:** Wet spell of August-2012(25 Aug-28 Aug)

### 5.1.6 Rivers Position during the Spell:

Low flood (upstream as well as downstream) was observed in river Kabul at Nowshera river Chenab at Marala, Khanki and Qadirabad only at upstream in River Ravi at Balloki. All the other rivers remained in their normal state.

### 5.1.7 Rainfall Pattern for the month of August, 2012:

The monthly Isohyetal pattern during the month of August indicates normal monsoon activity over most parts of the country. Rainfall maxima exceeding 400 mm in the month of August 2012 was encompassed around Murree Islamabad and Muzaffarabad.

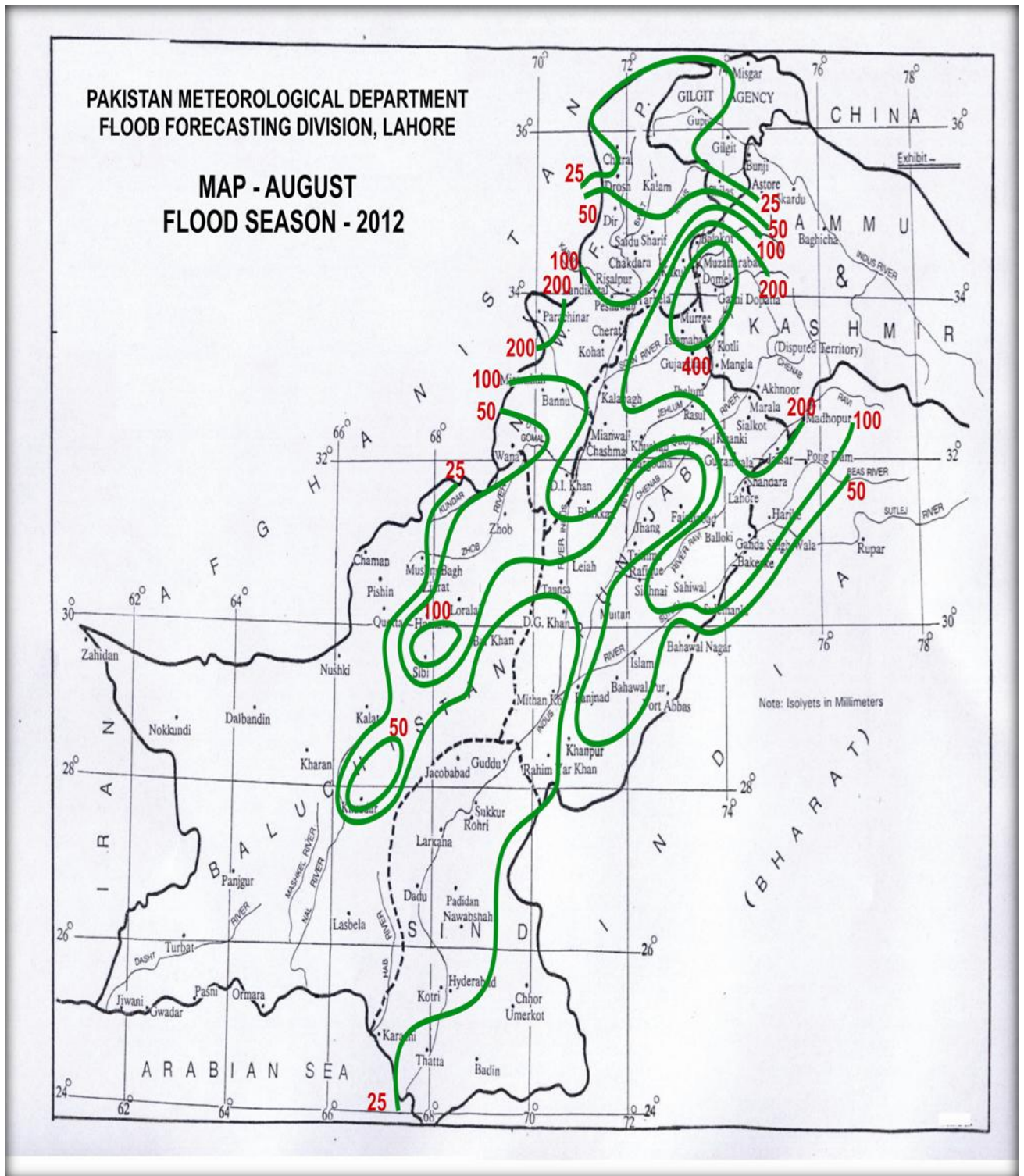


Figure 10: Isohyetal Map of August, 2012

**5.1.8 Rivers Position during the Month:**

Date	Station	Up Stream (Cusecs)	Flood Level
26-6-12	BALLOKI	58647	LOW
1-8-12	MARALA	154182	LOW
2-8-12	KHANKI	120034	LOW
2-8-12	QADIRABAD	120687	LOW
3-8-12	MARALA	111404	LOW
3-8-12	TARBELA	295000	LOW
4-8-12	MANGLA	80000	LOW
4-8-12	MARALA	183240	MEDIUM
4-8-12	KHANKI	194813	MEDIUM
4-8-12	TARBELA	29500	LOW
5-8-12	QADIRABAD	194789	MEDIUM
5-8-12	CHASHMA	260964	LOW
5-8-12	NOWSHERA	59800	LOW
5-8-12	KABUL	254431	LOW
6-8-12	CHASHMA	293778	LOW
21-8-12	MANGLA	84000	LOW
21-8-12	MARALA	125066	LOW
22-8-12	SHAHDARA	40780	LOW
22-8-12	MARALA	143360	LOW
23-8-12	BALLOKI	60764	LOW
23-8-12	KHANKI	135780	LOW
23-8-12	QADIRABAD	132573	LOW
23-8-12	TARBELA	266000	LOW
23-8-12	KALABAGH	254435	LOW
24-8-12	CHASHMA	254767	LOW
25-8-12	MARALA	143646	LOW
25-8-12	NOWSHERA	49300	LOW
26-8-12	KHANKI	135473	LOW
26-8-12	QADIRABAD	135779	LOW

**6 Significant Hydrometeorological Events during the Month of Sep, 2012:**

Only one monsoon low developed during the month of September over Bay of Bengal at the beginning of the month and after moving west northwest wards reached Rajasthan India and entered into Southern Punjab Pakistan areas.

### 6.1 First Wet Spell (06-09-2012 to 11-09-2012):

First rainy spell of September occurred during 6<sup>th</sup> to 11<sup>th</sup> September 2012 . During this spell torrential rain of more than 400 mm was recorded over Jacobabad in Sindh. Heavy rain of more than 200 mm was recorded over Rohri , Sukkar, and Larkana in Sindh and over Rahimyar Khan and its surrounding in south Punjab. Northern part of Sindh and southern Punjab faced a Calamity like situation disrupting the civic life. Moderate rains were also observed over other parts of south Punjab and Kashmir.

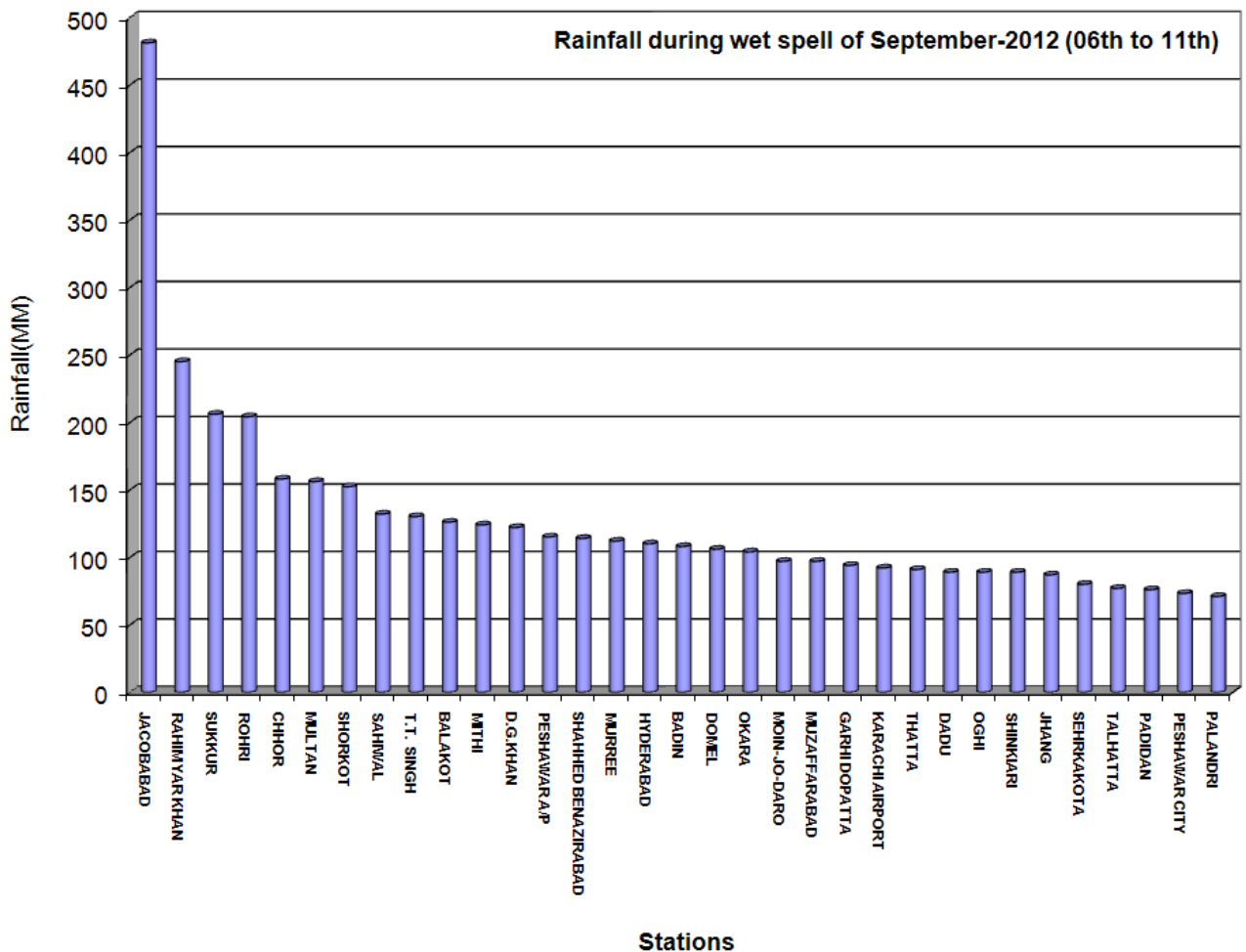


Figure 11: Wet spell of September (06 Sep-11 Sep)

### 6.2 Rivers Position during the Spell:

As rainy system affected mainly lower parts of the country therefore no significant change in any river, nullahs and hill torrents were observed.

### 6.3 Second Wet Spell (17-09-2012 to 18-09-2012) :

This spell was due to the passage of westerly wave and strong moist current from bay of Bengal & Arabian sea. During the spell heavy rainfall reported from Kashmir as shown below,

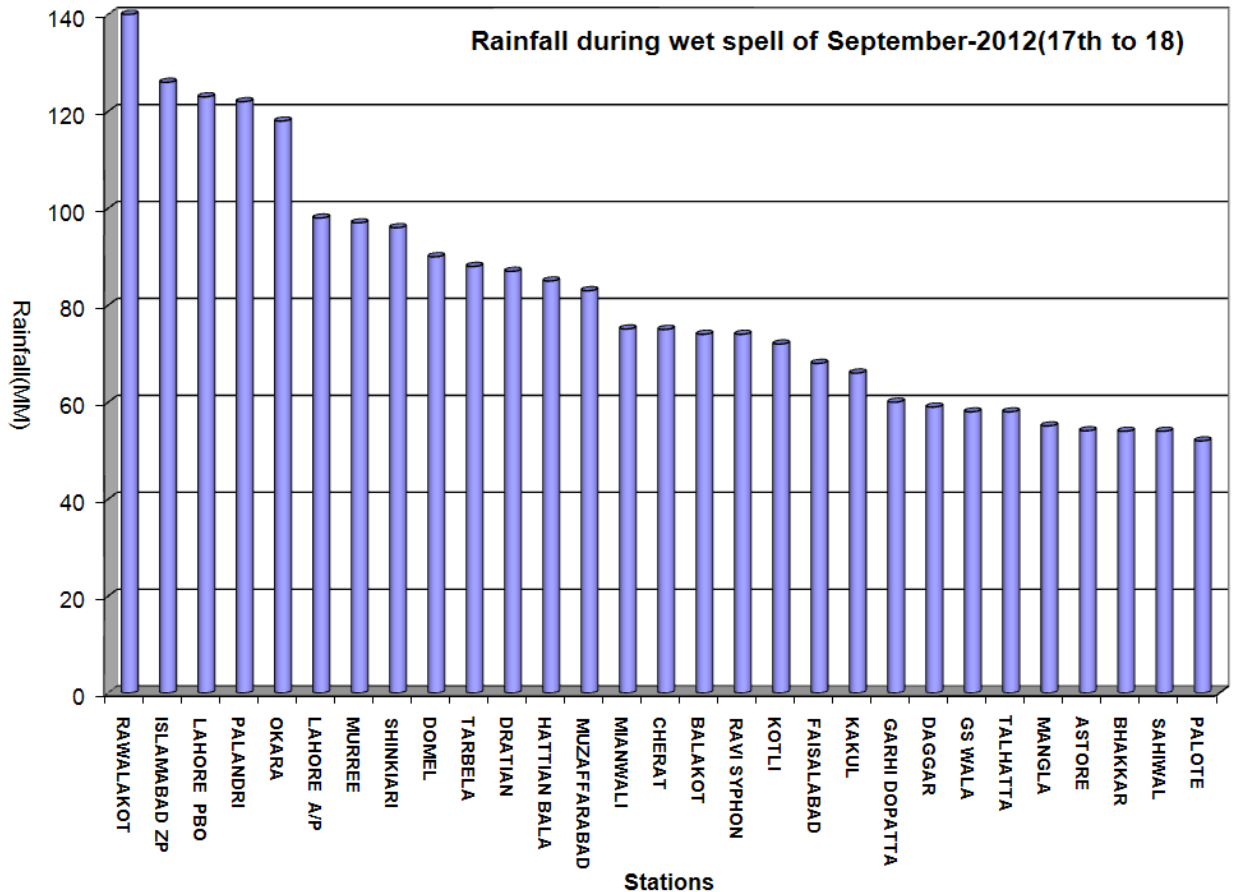


Figure 12: Wet spell of September (17<sup>th</sup> Sep -18<sup>th</sup> Sep)

### 6.4 Rivers Position during Spell:

Due to this spell a high flood peak was recorded at Mangla(upstream) in river Jhelum and low flood peaks in river Chenab at Marala , Khanki and Qadirabad (upstream as well as downstream).

### 6.5 Rainfall Pattern for the Month of September 2012:

A rainfall maximum of more than 400 mm was located around North Sindh over Jacobabad during the month of September 2012 as shown in figure-13. A lesser maximum of more than 200 mm was located around northern Punjab over Islamabad and Murree.

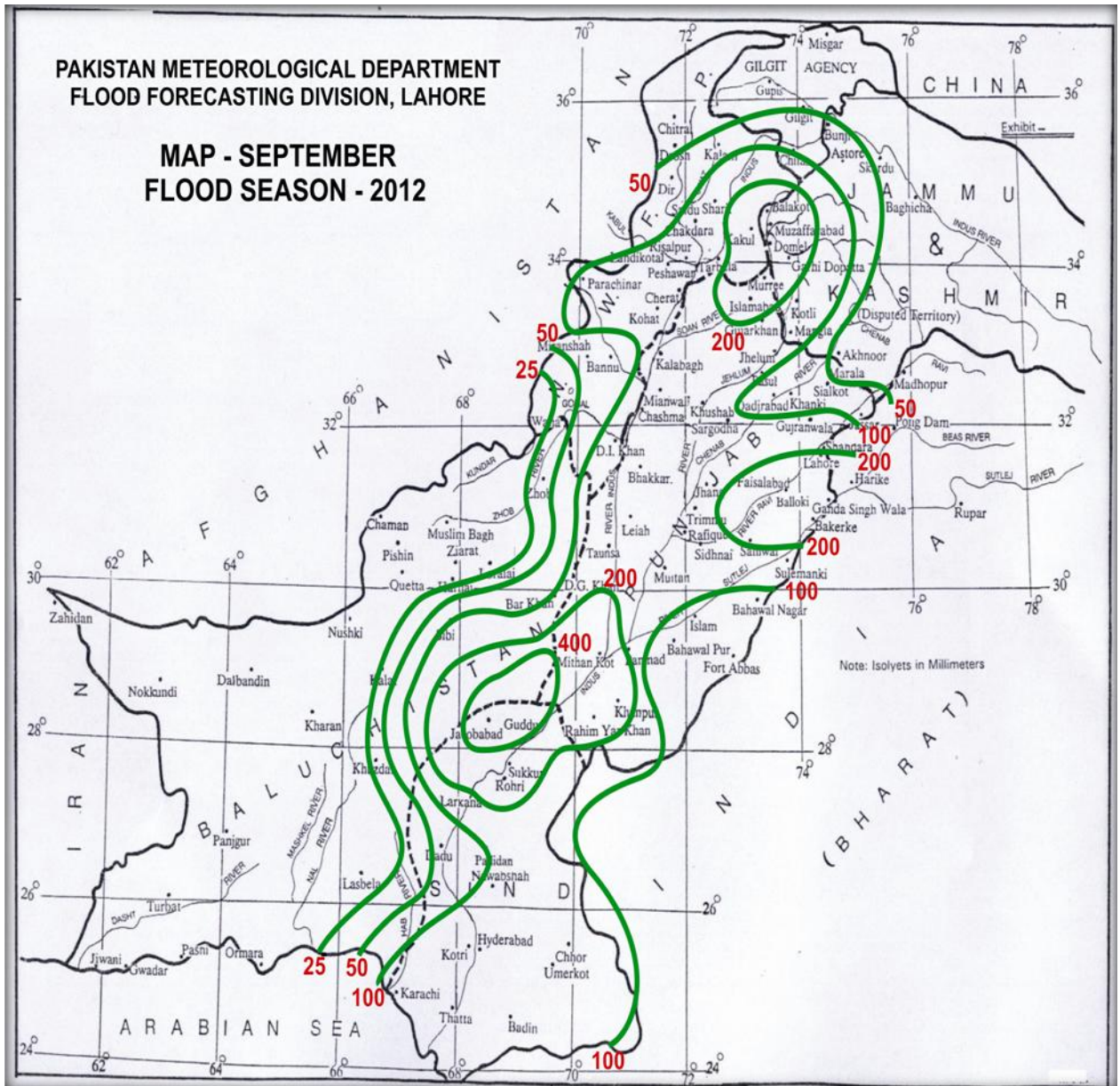


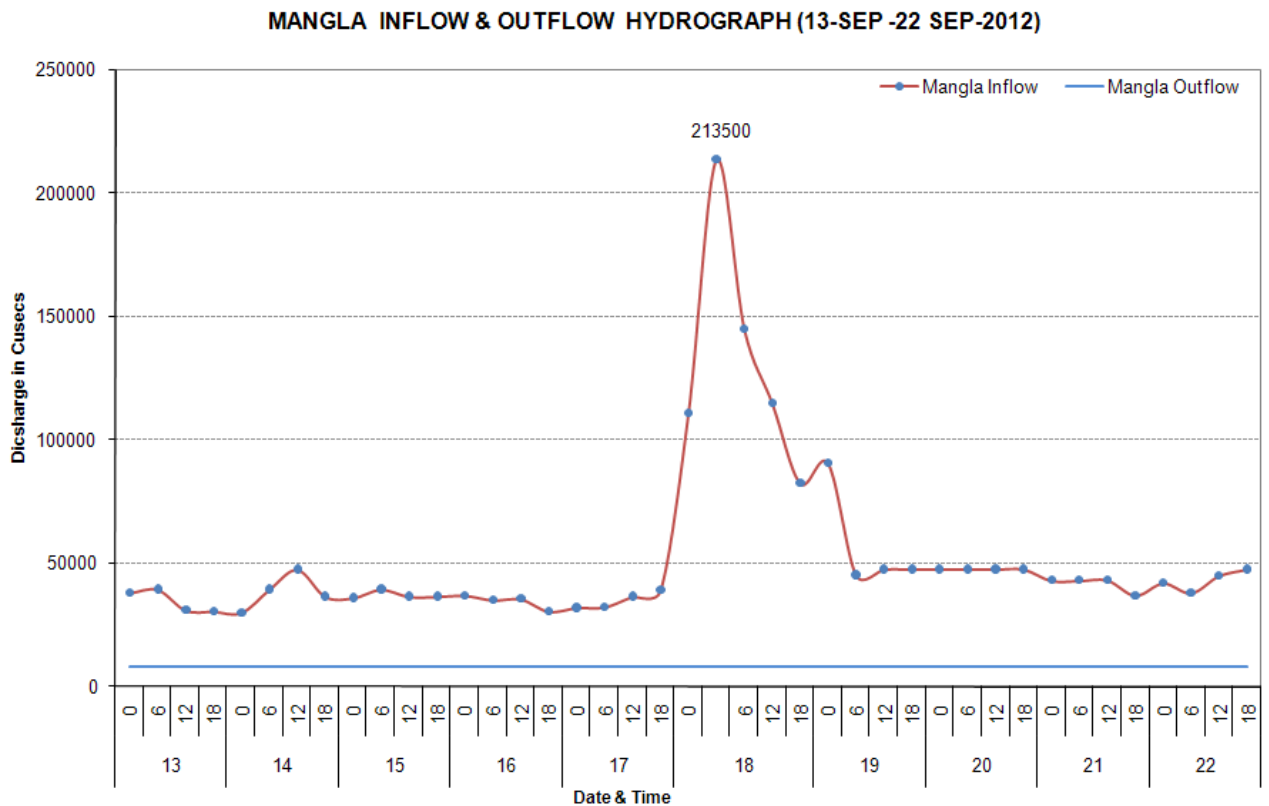
Figure 13: Isohyetal Map of September 2012

6.6 Rivers Position during the Month:

Date	Station	UP STREAM (Cusecs)	Flood Level
08-9-12	Balloki	49498	Low
18-9-12	Mangla	213500	H
18-9-12	Marala	142406	Low
19-9-12	Khanki	131101	Low
19-9-12	Qadirabad	129923	Low
20-9-12	Balloki	47581	Low

## 6.7 Significant Flood at Mangla:

Most significant peak of Flood Season-2012 at Mangla was the result of strong westerly wave over Northern parts of Pakistan & Kashmir. Under the presence of strong westerly wave the seasonal low accentuated, resulting influx of moist current from Bay of Bengal & Arabian sea, which caused the heavy rainfall over the upper catchments of River Jhelum & North Punjab. Hydrograph during the peak in River Jhelum at Mangla is shown in figure 14.



**Figure 14:** Hydrograph (13<sup>th</sup> September to 22<sup>nd</sup> September-2012)

## 7 Seasonal Rainfall Pattern July to September 2012:

Seasonal rainfall pattern during the season is shown in figure below. Region of maximum precipitation (more than 800 mm) is located over Murree and Islamabad in North Punjab, another region of Maximum precipitation more than 400 mm located over Jacobabad. West Balochistan remained almost dry during the season.

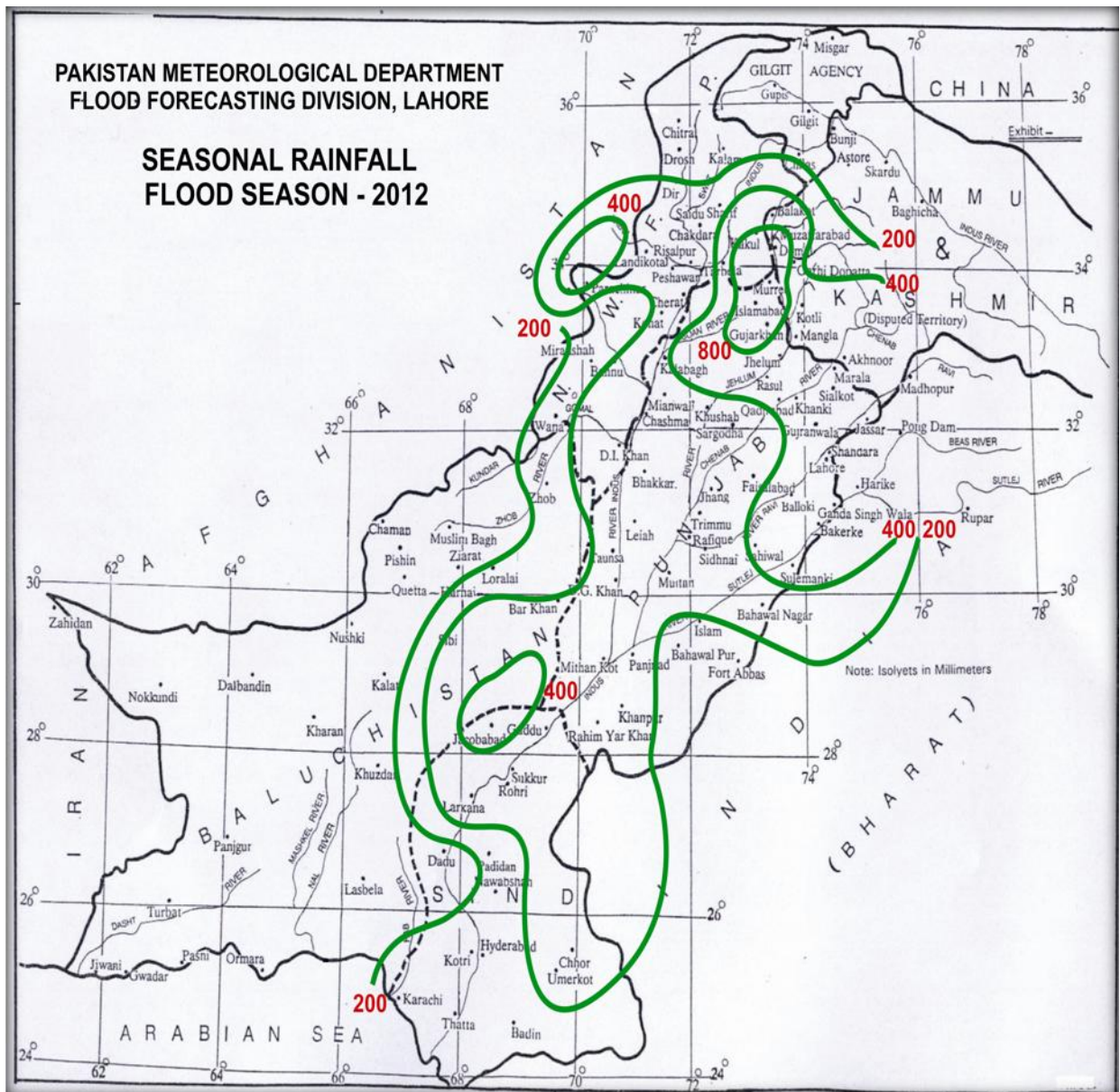


Figure 15: Seasonal Isohyetal Map(July-September-2012)

## 8 Seasonal Isopercental Map of Precipitation from July-September 2012:

The seasonal precipitation isopercental map indicates that South Punjab and northern Sindh received above normal rainfall. South Punjab near Khanpur received more than 600% rain. Northern Sindh received 400% above normal which resulted into local urban flooding in area. Catchments of all the major rivers remained almost in normal rainfall conditions. Western Balochistan remained almost dry during the monsoon season 2012.

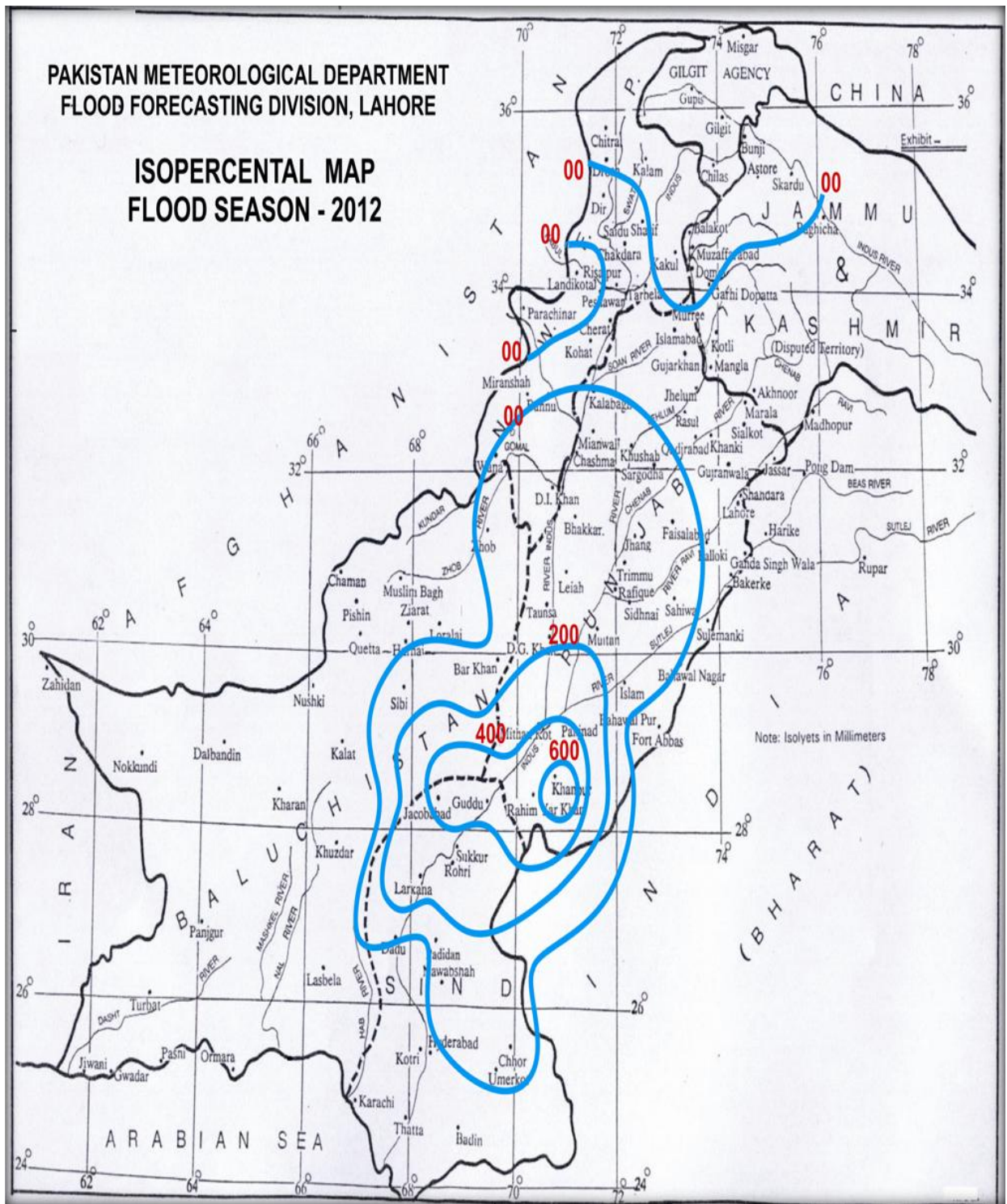


Figure 16: Seasonal Isopercental Map( July-September-2012)

## 9 Flood Forecast evaluation Report:

The Flood Forecast evaluation report for 2012 for each category of flood is given below;

DATE	Stations	Forecast (Thousands of Cusecs)	Actual Discharge	Per. Accuracy (%)
5/7/2012	MARALA	100-R-150	105252	100
6/7/2012	KHANKI	50-80	70711	100
6/7/2012	TARBELA	260-275	262000	100
8/7/2012	KABUL	900-100	100700	99
18/7/2012	KALABAGH	250-265	285327	93
8/7/2012	CHASHMA	290-R-340	298347	100
14/7/2012	CHASHMA	260-290	295727	98
22/8/2012	SHAH DRA	40-50	40780	100
23/8/2012	BALOKI	55-70	60764	100
4/8/2012	MANGLA	70-140	80000	100
21/8/2012	MANGLA	70-120	84000	100
1/8/2012	MARALA	120-R-190	154182	100
3/8/2012	MARALA	80-120	111404	100
4/8/2012	MARALA	160-R-220	205914	100
21/8/2012	MARALA	90-R-140	125066	100
22/8/2012	MARALA	100-R-180	143360	100
25/8/2012	MARALA	170-R-220	143646	85
2/8/2012	KHANKI	80-R-150	120034	100
4/8/2012	KHANKI	140-R-200	194813	100
23/8/2012	KHANKI	60-R-160	135780	100
26/8/2012	KHANKI	90-R-180	135473	100
2/8/2012	QADIRABAD	120-F-70	120687	100
5/8/2012	QADIRABAD	70-R-170	194789	87
23/8/2012	QADIRABAD	115-R-140-F-80	132573	100
26/8/2012	QADIRABAD	135-F-80	135779	100
3/8/2012	TARBELA	280-310	295000	100
23/8/2012	TARBELA	265-280	266000	100
23/8/2012	KALABAGH	220-260	254435	100
5/8/2012	CHASHMA	220-260	260964	100
6/8/2012	CHASHMA	260-300	293778	100
24/8/2012	CHASHMA	220-260	254767	100
8/9/2012	BALOKI	40-50	49498	100
20/9/2012	BALOKI	40-55	47581	100
18/9/2012	MANGLA	100-150	213500	100
18/9/2012	MARALA	100-R-180	142406	70
19/9/2012	KHANKI	60-140	131101	100
19/9/2012	QADIRABAD	60-R-130	129923	100

R: Rising F: falling

The overall accuracy of the forecast issued by FFD Lahore during the flood season 2012 has been calculated which shows a good 98.1% against all odds.

### 10 Flood limits (in lacs of cusecs):

RIVER	SITE	DESIGN CAPACITY	LOW	MED	HIGH	VERY HIGH	EXCEPTIONALLY HIGH
KABUL	NOWSHERA	-	0.45	0.47	1.0	2.0	4.0
	WARSAK	15.0	0.30	0.45	1.0	2.0	4.0
INDUS	TARBELA	15.0	2.5	3.75	5.0	6.5	8.0
	ATTOCK	-	2.5	3.75	5.0	6.5	8.0
	KALABAGH	9.5	2.5	3.75	5.0	6.5	8.0
	CHASHMA	9.5	2.5	3.75	5.0	6.5	8.0
	TAUNSA	10.0	2.5	3.75	5.0	6.5	8.0
	GUDDU	12.0	2.0	3.5	5.0	7.0	9.0
	SUKKUR	9.0	2.0	3.5	5.0	7.0	9.0
JHELUM	KOTRI	8.5	2.0	3.0	4.5	6.5	8.0
	KOHALA	-	1.0	1.5	2.0	3.0	4.0
	MANGLA	10.6	0.75	1.1	1.5	2.25	3.0
CHENAB	RASUL	8.5	0.75	1.1	1.5	2.25	3.0
	MARALA	11.0	1.0	1.5	2.0	4.0	6.0
	KHANKI	8.0	1.0	1.5	2.0	4.0	6.0
	QADIRABAD	8.07	1.0	1.5	2.0	4.0	6.0
RAVI	TRIMMU	6.45	1.5	2.0	3.0	4.5	6.0
	PANJNAD	7.0	1.5	2.0	3.0	4.5	6.0
	JASSAR	2.75	0.5	0.75	1.0	1.5	2.0
	RAVI SYPHON	4.5	0.4	0.65	0.9	1.35	1.8
	SHAHDARA	2.5	0.4	0.65	0.9	1.35	1.8
SUTLEJ	BALLOKI	2.25	0.4	0.65	0.9	1.35	1.8
	SIDHNAI	1.5	0.3	0.46	0.6	0.9	1.3
	SULEMANKI	3.25	0.5	0.8	1.2	1.75	2.25
	ISLAM	3.0	0.5	0.8	1.2	1.75	2.25

## 11 Detail of damages and losses-2012

Districts	Village Affected	Persons Affected	Area Affected (Acres)	Crop Affected (Acres)	Houses Damages		Persons died	Persons Injured	Cattle Head Perished	Relief Camps Estb	Persons in relief Camps
					Partially	Fully					
R. Y. Khan	1150	93211	488562	76953	10039	1947	20	9	552	*	*
Rajapur	218	177240	643462	346981	3320	5550	15	241	339	15	2914
DG Khan	103	616623	357698	48250	2934	1541	*	*	*	25	2150
Mianwali	3	*	*	1461	2	3	*	*	*	*	*
Hafizabad	1	90	*	*	31	*	*	*	*	*	*
Khanawal	1	96	775	353	*	12	*	*	*	*	*
Sahiwal	1	*	*	*	9	1	4	2	6	*	*
Bahawalnagar	21	26	*	*	38	*	6	7	*	*	*
Chiniot	6	7	*	*	66	10	6	6	*	*	*
TT Singh	6	*	*	*	*	*	5	7	1	*	*
Layyah	2	52	*	*	*	52	1	*	*	*	*
Muzaffargarh	*	*	*	*	1	*	3	*	*	*	*
Total	1512	877345	1490827	473998	16440	9116	60	272	898	40	5064