GOVERNMENT OF PAKISTAN
MINISTRY OF WATER AND POWER

ANNUAL FLOOD REPORT 2010

Pictures of 2010-Floods

OFFICE OF THE CHIEF ENGINEERING ADVISER & CHAIRMAN, FEDERAL FLOOD COMMISSION ISLAMABAD

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EXECUTIVE SUMMARY

Till 1976, the Provincial Governments were responsible for the planning and execution of flood protection works. Heavy losses sustained to the economy during disastrous floods of 1973 and 1976 were discussed at an Inter-Provincial Conference in 1977 and subsequently in January 1977, it was decided by the Federal Government to establish Federal Flood Commission (FFC) at the federal level in order to ensure comprehensive integrated flood management on country wide basis. Since its establishment, FFC has so far prepared and executed three National Flood Protection Plans covering periods from 1978-1988 (NFPP-I), 1988-1998 (NFPP-II) and 1998-2008 (NFPP-III). NFPP-IV (2008-2018) is under approval by Planning Commission, while flood protection works are being undertaken through Normal/Emergent Flood Programme (GOP funded) on yearly basis to meet urgent need of the Provinces and Federal Line Agencies. Until now, a total investment of Rs 26.138 billion (this includes 1988-Flood Damages Restoration Project and 1992-94 Flood Damages Restoration Project costing Rs 1.80 billion and 6.50 billion respectively) has been made for construction of flood protection infrastructure and flood forecasting & warning system. Presently, the provinces & federal line agencies are maintaining 1410 No. of Spurs and 6803 Km long flood embankments in various parts of the country.

Generally, floods are caused by the heavy concentrated rainfall during the monsoon season, which are sometimes augmented by snowmelt flows in rivers. Occasionally destructive floods are also caused due to Monsoon currents originating in the Bay of Bengal and resultant depressions which often result in heavy downpour in the Himalayan foothills additionally affected by the weather systems from the Arabian Sea (Seasonal Low) and from the Mediterranean Sea (Westerly Wave).

Pakistan has suffered a cumulative financial loss of US$ 30 billion during the past 60 years. During the period from 1950 to 2009, there was a total financial loss of US$ 20 billion, some 8,887 people lost their lives, 109,822 villages were reportedly damaged/ destroyed and an overall area of 407,132 Sq.km was affected. In comparison, 2010-Floods alone resulted into a cumulative financial loss of US$ 10 billion, life loss of about 2,000 people, 17,553 villages were reportedly damaged/ destroyed and a total area of 160,000 Sq.km was affected.

Federal Flood Commission is responsible for integrated planning for flood control at the national level and arrange financial resources for the implementation of flood management projects on country wide basis. Under Normal/Emergent Flood Program, all the four provinces and Federal Line Agencies (Gilgit-Baltistan, FATA, and AJ&K) submit their flood related schemes which are technically scrutinized and submitted to Ministry of Water & Power for approval of DDWP/ CDWP. Flood Communication Cell of Federal Flood Commission remains in operation on round-the-clock basis for the entire flood season (July-October) and Flood Situation Report is issued on daily basis to all concerned.

2010-Floods:

The monsoon of the Year 2010 brought with it the worst flooding in past 80 years in the region. Heavy monsoon rains in the KP , Sindh, lower Punjab and Balochistan regions made the rivers surge and overflow which comprehensively devastated areas from Gilgit-Baltistan to the last structure across River Indus i.e. Kotri (Sindh). During 2010 flood season, flows in western rivers were very high and some of the discharge levels recorded were comparable to those observed during the floods of 1956, 1976, and 1992. ADB has estimated the cost of flood damages to irrigation, drainage & flood protection infrastructure as Rs 23.60 billion and their reconstruction/ rehabilitation cost is around Rs 83.00 billion, which includes remodeling cost of some structures for building back safer.

Way Forward:

For the forthcoming flood season 2011, FFC has advised provinces and federal agencies to mobilize all resources to repair/restore the damaged infrastructure, streamline the procedures and update the SOPs of dams and barrages in order to ensure safety of all the structures and manage any future floods in a much better state of preparedness.

Acknowledgement

The preparation and distribution of Annual Flood Report of Federal Flood Commission commenced from 1998 with a view to compile essential information on yearly basis for documentation of the yearly flood events, flood flow data, lessons learnt from these yearly events, and for exploring the needs for future protective measures.

The 2010 Annual Flood Report contains inter-alia, information about historical floods in Pakistan, flood management works, functions of FFC & other related provincial and federal level organizations, flood warning dissemination system and flood preparedness activities carried out during flood season. The report specifically focuses on unprecedented floods of 2010 which caused extensive damages to the Irrigation, Drainage & Flood Protection Structures, besides other private as well as public sector infrastructure in the country.

Services of following officers are greatly acknowledged who contributed in a dedicated manner for the preparation of 2010-Annual Flood Report of Federal Flood Commission:

Name	**Designation**	**Role**
Mr. Alamgir Khan	Chief Engineer (Floods)	Supervisory
Mr. Ather Hameed	Principal River Engineer	Contributory
Mr. Ashok Kumar	Superintending Engineering (Floods)	Contributory
Mr. Nasir Ibrar	Deputy Engineering Advisor (Civil)	Contributory
Mr. Zafar Iqbal	Senior Engineer (Floods)	Contributory
Mr. Muhammad Mazhar Iqbal	Assistant Engineer (Floods)	Contributory
Mr. Muhammad Amin	Assistant Engineer (Floods)	Contributory

1. FLOODS IN PAKISTAN

Since its creation, Pakistan has faced severe floods in 1950, 1956, 1957, 1973, 1976, 1978, 1988, 1992 and now in 2010 record flood peak discharges. Floods of various magnitudes occurred between 1922 and 2010. These floods affected the basins of the rivers in Punjab and Sindh. In Khyber Pakhtunkhwa (KPK), Balochistan, FATA, G-B, AJK and some areas of Punjab also, damages are caused mainly due to flash floods in secondary and tertiary rivers including from hill torrents.

In upper to mid reaches of Indus Basin, generally main tributaries like Jhelum & Chenab are mostly the cause of flooding. River floods particularly hit Punjab and Sindh while hill torrents tend to affect the hilly areas of KPK, Balochistan, Gilgit-Baltistan, FATA, AJK and some areas of southern Punjab i.e. D.G.Khan, Rajanpur. Districts of Charsadda, Mardan, Nowshera, Peshawar and Swat in KPK are exposed to risks from flooding in the Rivers Kabul, Panjkora & Swat/Khiali. In recent years, vulnerabilities of large cities to flooding have increased. Cities like Karachi, Lahore and Rawalpindi have experienced flooding due to improper drainage system to cope with heavy rains.

1.1. Indus Basin River System

Five main rivers, namely, the Indus, Jhelum, Chenab, Ravi and Sutlej flow through the country's plains. The Indus (including the Kabul, Swat and Panjkora tributaries) Jhelum and Chenab are known as the **western rivers**, and the Ravi, Beas, and Sutlej known as the **eastern rivers**. Supplemented by a number of secondary rivers and streams, these rivers supply water to the entire Indus Basin Irrigation System. The rivers have their origin in the higher altitudes and derive their flows mainly from snowmelt and monsoon rains. The catchment area of Indus is most unique in the sense that it contains seven (7) of the world's highest-ranking peaks, after Mount Everest. These include K-2 (28,253 ft), Nanga Parbat (26,660 ft), Rakaposhi (25,552 ft) etc. Likewise, barring the polar areas, seven (7) glaciers situated in the Indus catchment, namely Siachin, Hispar, Biafo, Batura, Baltoro, Barpu and Hopper are amongst the largest in the world.

The Irrigation System of Pakistan is the largest integrated irrigation network in the world, serving 42 million acres of contiguous cultivated land. The system is fed by the waters of the Indus River and its tributaries. The salient features of the Irrigation Network are summarized in the following Table-1:

Table 1: Salient Features of Irrigation Network of Pakistan

Structure	No.
Major Storage Reservoirs	3
Barrages	19
Inter-River Link Canals	12
Independent Irrigation Canal Commands	45
Large Dams of height 15 meter and above	143

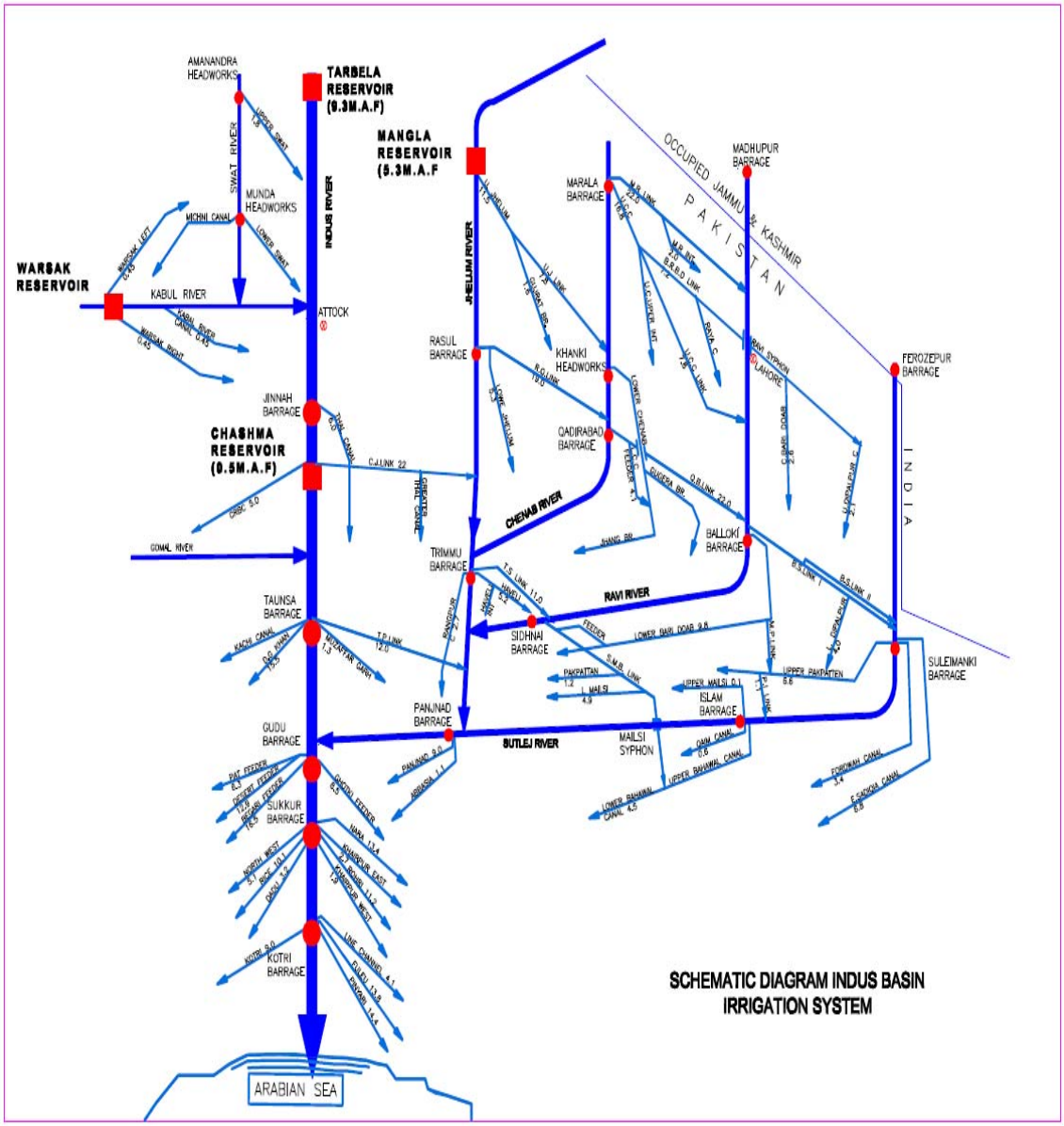


Figure 1: Schematic Diagram of Indus basin Irrigation System

The major storage reservoirs include Tarbela (existing Live Storage Capacity = 6.625 MAF against original 9.70 MAF), Chashma (existing Live Storage Capacity = 0.263 MAF against original 0.70 MAF) on River Indus and Mangla (existing Live Storage Capacity = 4.542 MAF against original 5.30 MAF) on River Jhelum. The total length of main canals/ distributaries and minors is 64,000 KM. Watercourses comprise another 1,621,000 Kilometers.

Diversion of river waters into off taking canals is made through barrages, which are gated diversion weirs. The main canals in turn deliver water to branch canals, distributaries and minors. The watercourses get their share of water through outlets in the irrigation channels. Distribution of water from a watercourse is effected through a time-schedule called “warabandi”.

Average annual surface water availability is 142 MAF whereas the annual canal withdrawal is 104 MAF. Water availability at farm gate is 106 MAF comprising 62 MAF of surface water and 44 MAF of groundwater. Supplemented by an annual groundwater withdrawal of some 44 MAF, the average depth of water available at the farm gate is 3.07 feet per acre. Approximately 3 million individual farms with an average size of about 12 acres benefit from this system. Indus River System Authority (IRSA), created in consequence of 1991 Water Accord between the provinces, makes the inter-provincial water allocations.

1.2 Causes of Floods in Pakistan

The major cause of floods in Pakistan is heavy concentrated rainfall in the river catchments, which sometimes augmented by snowmelt flows, generally result into floods in rivers during the monsoon season. Occasionally, Monsoon currents originating in the Bay of Bengal and resultant depressions often result in heavy downpour in the Himalayan foothills additionally affected by the weather systems from the Arabian Sea (Seasonal Low) and from the Mediterranean Sea (Westerly Wave) cause destructive floods in either or all of the main rivers of the Indus System. However, in some cases exceptionally high floods have occasionally been caused by the formation of temporary natural dams due to land sliding or glacial movement and their subsequent collapse. There are large seasonal variations in almost all the river discharges, which further aggravate the river course and morphology.

The major rivers cause flood losses by inundation of areas along their banks, by damaging irrigation and communication facilities across or adjacent to the rivers, and by erosion of land along the riverbanks. In the upper part of the Indus Basin System, floodwater spilling over the riverbanks generally returns to the river. However, in the lower part of Indus River (Sindh Province), which is primarily flowing at a higher elevation than adjoining lands, the spill flows do not return to the river. This phenomenon largely extends the period of inundation resulting in even greater damages. Although flood protection by embankments have been provided along almost the entire length in the Sindh Province and at many locations in the upper areas, the bund breaches can still occur. Such breaches often cause greater damage than would have occurred without the bunds because of their unexpected nature and intensification of land use following the provision of flood protection.

The inadequate existing discharge capacity of some of the important structures (Barrages and Rail or Road Bridges) on Rivers Indus, Chenab and Ravi are another major reason of flooding. The exceptionally high floods thus result in afflux on the upstream side, which sometimes results in breaches in the flood embankments. Some times, the flood embankments have to be deliberately breached at pre-selected locations to save the main barrage structures and other vital settlements and installations in the vicinity. The encroachment of village abadies in riverine areas has also increased the quantum of flood damages and losses to humans and livestock. As there is no proper regulatory frame work in the country regarding the settlement in riverine areas, most of the poor people

have constructed their shelters along the vulnerable river banks and become victims to devastating floods. Some people are making the most of these areas for business purpose through promoting agriculture and cattle Ghats/dairies. All such activities are extending beyond the safe limits of riverine areas to achieve more economic benefits but in fact these activities are posing a great threat to unprecedented and unruly flood; the losses due to which may be in hundred multiples of such small scale economic profit. The river catchments and flood plains are to be kept as prohibited area for the riverine community especially during the flood season.

In recent years, vulnerabilities of large cities to flooding have increased. Cities like Karachi, Lahore and Rawalpindi have experienced flooding due to improper storm water drainage system to cope with heavy rains.

1.3 Impact of Global Warming

Global Warming is emerging as a major drive of disasters, with frequent and intense floods and storms, increasing forced displacement as an extremely likely consequence. The world weather crisis that is causing floods in Pakistan, wildfires in Russia and landslides in China is evidence that global warming predictions are correct. According to climate change experts, all these disasters happened more or less simultaneously as the result of a global climate pattern, yet each was reported as a separate event and interpreted as though there was no connection.

According to the experts from World Climate Research Programme and the World Meteorological Organization (WMO), the climate change is a major contributing factor in this "unprecedented sequence of extreme weather in Pakistan" in months of July and August 2010. Scientists from Intergovernmental Panel on Climate Change (IPCC) warn that man-caused climate changes can contribute to those disasters happening more frequently. In 2007 report, a UN scientific body of the IPCC concluded that "it is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent." IPCC also warns; "*the floods of the kind that hit Pakistan may become more frequent and more intense in the future in the same region and other parts of the world*". Earlier, WMO made a similarly qualified assessment that the weather related cataclysms of July and August (2010) fit patterns predicted by climate scientists. They also stated; "*While a longer time range is required to establish whether an individual event is attributable to climate change, the sequence of current events matches IPCC projections of more frequent and more intense extreme weather events due to global warming*".

In the case of Pakistan, an enormous portion of the country's farmland has been destroyed, along with much of its infrastructure, and this has taken place in an area that is so poor that people have little to fall back on. The water has flowed south from northwestern Pakistan, where seasonal monsoon rains lasted for a month without stopping.

Pakistan is among the countries, which will be hit hardest by effects of climate change even though it contributes only a fraction to global warming. The severe droughts in 1999 and 2000 are the main examples that caused sharp declines in water tables and dried up wetlands, severely degrading ecosystems. Precipitation has decreased 10 to 15 percent in the costal belt and hyper-arid plains over the last 40 years while there is an increase in summer and winter rains in northern Pakistan.

1.4 Historical Flood Events

Eighteen major floods in 60 years (almost one major flood event every 3 years) are one of the main challenges to economic development. Overall, more than 10,000 people lost their lives and the country suffered a cumulative financial loss of US$ 30 billion. Some 127,375 villages were reportedly damaged/ destroyed and a total area of 567,132 Sq.km was affected due to the eighteen major flood events. Among these extreme flood events, 2010 flood was the most destructive flood in Pakistan, which significantly added to these figures (Table-2).

Table 2: Historical Flood Damages in Pakistan

Year	Direct losses (US$ million)		Lost lives (No)	Affected villages (No)	Flooded area (Sq-km)
	@ 1US$= PKR 40	@ 1US$=PKR 86			
1950	227	488.05	2190	10000	17920
1955	176	378.4	679	6945	20480
1956	148	318.2	160	11609	74406
1957	140	301	83	4498	16003
1959	109	234.35	88	3902	10424
1973	2,388	5134.2	474	9719	41472
1975	318	683.7	126	8628	34931
1976	1,621	3485.15	425	18390	81920
1977	157	337.55	848	2185	4657
1978	1,036	2227.4	393	9199	30597
1981	139	298.85	82	2071	4191
1983	63	135.45	39	643	1882
1984	35	75.25	42	251	1093
1988	399	857.85	508	100	6144
1992	1,400	3010	1008	13208	38758
1994	392	842.8	431	1622	5568
1995	175	376.25	591	6852	16686
2010	-	10000	1985	17553	160000
Total	**8923**	**29184.45**	**10152**	**127375**	**567132**

The existing flood management strategy includes flow regulation by two reservoirs and barrages, flood forecasting, early warning, evacuation, protection of critical infrastructure, and urban and rural areas by flood embankments and spurs etc along the rivers. The Provincial Irrigation Departments (PIDs) maintain about 6,803 km of flood protection embankments and over 1400 main spurs along the rivers. Province-wise break up of existing flood protection infrastructure is as under:

Table 3: Existing Flood Protection Facilities in Pakistan

Name of Province	*Embankments (KM)*	*Spurs (No)*
Punjab	3,332	496
Sindh	2,422	46
Khyber Pakhtunkhwa	352	186
Balochistan	697	682
Total	**6,803**	**1,410**

1.5 Integrated Approach in Flood Management

In the past, floods were considered as a hydrological reality; only structural and non-structural measures were adopted to deal with this phenomenon, but now well-being of the people of the flood prone areas, their economic growth; and social urgency for alleviating poverty prevailing in these floods affected areas, are over riding concerns.

Enough hard work is required to address these concerns from both national and regional perspectives. The regional approach is of particular significance as activities undertaken in one region may affect, positively or negatively, the extent of floods in the other regions, particularly the downstream ones.

To make full use of the experiences gained from flood management activities in the regional countries there is pressing need for exchange of views and experiences, data and information sharing, and working together to develop approaches and methods to address pertinent flood management issues, nationally and regionally, in an open and trusting atmosphere.

2. FEDERAL FLOOD COMMISSION

2.1 Historic Background:

After creation of Pakistan in August 1947, a Central Engineering Authority was established to manage the issues of water, power and allied engineering matters at national level. It was re-designated as Chief Engineering Advisor's Office after the establishment of Water & Power Development Authority (WAPDA) in 1959.

Till 1976, the Provincial Governments were responsible for the planning and execution of flood protection works. Disastrous floods of 1973 and 1976 took heavy toll of life and property and it was felt that the existing flood protection facilities and planning were inadequate to provide effective protective measures for the country. Heavy losses to the economy were discussed at the Inter-Provincial Conference in 1977 and consequently, in January 1977, it was decided to establish Federal Flood Commission (FFC) for integrated flood management on country wide-basis.

2.2 Functions of FFC:

The functions under the charter of duties for FFC, as given in para-2 of Resolution, dated 4th January, 1977, are as under:

i. Preparation of National Flood Protection Plans (NFPPs);
ii. Approval of flood control schemes prepared by Provincial Governments and concerned federal agencies;
iii. Review of flood damages to flood protection infrastructure and review of plans for restoration and reconstruction works;
iv. Measures for improvements in Flood Forecasting and Warning System;
v. Standardization of designs and specifications for Flood Protection Works;
vi. Evaluation and monitoring relating to progress of implementation of the National Flood Protection Plans (NFPPs);
vii. Preparation of a research program for Flood Control and Protection; and
viii. Recommendations regarding principles of regulation of reservoirs for flood control.

The provincial governments and federal agencies undertake the implementation of the National Flood Protection Plans (NFPPs). The Federal Government, however, provides the resources for meeting the capital costs of projects under NFPPs.

2.3 Achievements of FFC:

Since its establishment in 1977, FFC has so far executed three 10-Years National Flood Protection Plans covering periods from 1978-1988 (NFPP-I), 1988-1998 (NFPP-II) and 1998-2008 (NFPP-III).

Brief details of projects executed under the three 10-Years Plans are given as under:

National Flood Protection Plan-I (1978-88):

Normal/ Emergent Flood Program:

• Cost actually spent (Need Based)	Rs 1,630 million
• No. of Flood Protection schemes completed in four provinces, AJ&K, FATA and NA (now G-B)	350
• Funding agency	100% by GOP

Under NFPP-I, emphasis was mainly given on the implementation of structural flood protection measures. Pakistan Meteorological Department (PMD) and WAPDA carried out localized improvements in existing telemetry and flood forecasting system.

National Flood Protection Plan-II (1988-98):

Normal/ Emergent Flood Program:

- Cost (Need Based)	Rs 2,541 million
- No. of Schemes completed	170
- Funding Agency	100% by GOP

Flood Protection Sector Project-I:

- Approved cost	Rs 4,860 million
- No. of schemes completed	257
- Foreign funding (80% ADB, 20% GOP)	US $ 131.07 million

Prime Minister's River Management Programme 1994-1996

- Project Cost	Rs. 613.384 million
- No. of schemes (in Sindh & Punjab)	10
- Funding Agency	100% by GOP

Under NFPP-II, following improvements were undertaken in the non-structural management side

- Procurement & installation of 1st phase of Meteoroburst Telecommunication System including one Master Station and 24 remote site stations.
- Installation of 10-CM Quantitative Precipitation Measurement (QPM) Weather Radar for Flood Forecasting Division (FFD) Lahore.
- Pre-feasibilities studies for four barrages for increasing their design discharge capacity to carry increased flood flows in view of 1992 floods.
- Preparation of Flood Plain Maps of Indus River (3-reaches).
- Establishment of National Flood Forecasting Bureau (NFFB) now FFD, Lahore.

National Flood Protection Plan – III (1998-2008):

Normal/Emergent Flood Program:

-	Cost actually spent	Rs 3,415 million
-	No. of Flood Protection Schemes in four Provinces, AJ&K, FATA, ICT and NA (Now G-B)	362
-	Funding Agency	100% by GOP

Second Flood Protection Sector Project:

-	Cost actually spent	Rs 4,165 million
-	No. of Flood Protection Schemes	101
-	Funding Agency	80% by ADB, 20% by GOP
-	Flood Forecasting & Warning System	Rs 432.123 million

Flood Forecasting & Warning System for Lai Nullah Basin in Islamabad–Rawalpindi:

-	Approved Cost		Rs 360 million
-	Cost actually spent		Rs 348 million
-	Funding	-Japanese Grand –in-Aid	Rs 337 million
		-GOP share	Rs 11.00 million

- Facilities provided include:

  - Two No. Telemetry rainfall gauging stations at Golra, Islamabad and Bokra, Islamabad
  - Two No. water level gauging stations at Kattarian Bridge, Rawalpindi and Gawal Mandi Bridge, Rawalpindi.
  - Master control station in PMD, Islamabad.
  - Two monitoring stations at FFC and TMA/Rescue-1122-Rawalpindi respectively.
  - Executive Warning Control room in Rawalpindi Fire Brigade , and
  - Nine (9) No. warning posts at various locations.

Apart from above, non-structural interventions undertaken on country wide basis include;

- Procurement & installation of 24 No. HF-Radio Sets, also some coverage to Kabul River & Swat River.
- Procurement & installation of 20 additional remote stations under existing Meteoroburst Telecommunication System (Phase-II)
- Upgradation of 10-CM Quantitative Precipitation Measurement Weather Radar installed in the premises of FFD, Lahore.
- Upgradation of 5.36-CM Sialkot Weather Radar into 10-CM Quantitative Precipitation Measurement Weather Radar.
- Procurement & installation of new 10-CM Quantitative Precipitation Measurement Weather Radar at Mangla.
- Development of initial/1st version of Computer Based Early Warning System through NESPAK, PMD & Delft Hydraulics, Flood Early Warning System (FEWS).

- Expansion of Flood Plain Mapping activity covering remaining reaches of River Indus, alongwith rivers Jhelum, Chenab, Ravi, Sutlej etc.
- Bathymetric Survey and flow managements in the Indus River and its major tributaries (i.e. Sutlej, Ravi, Chenab and Jhelum) for improvements in the discharge rating curves and to collect data for FEWS Model & Flood Plain Mapping Activity.

National Flood Protection Plan -IV (2008-2018):

Keeping in view the level of investments made under the three 10-Year Plans (NFPP I–III), and the needs of the executing agencies, the National Flood Protection Plan –IV was prepared for flood management works estimated at Rs 30 billion. The Plan was submitted to Ministry of Water and Power in November 2006, for approval of the Competent Authority. However, the Plan has not yet been approved by the Planning Commission.

Presently, flood protection works are being undertaken through Normal/Emergent Flood Programme which is funded by the Federal Government on annual basis in order to meet the urgent needs of the Provinces and Federal Agencies.

Summary of Federal Investment on Flood Protection Works (1978- JUNE 2010)

(Rs in million)

Flood Plans/ Programs	Location	Expenditure
NFPP-I (1978-88)	All over the country	1729
NFPP-II (1988-98) • Emergent Flood Protection Schemes	All over the country	805
• First Flood Protection Sector Project (FPSP-I)	Four Provinces (Punjab, Sindh, KP, Balochistan)	4860
1988-Flood Damage Restoration Project	Four Provinces (Punjab, Sindh, KP, Balochistan)	1874
1992-Flood Damage Restoration Project	All over the country	6659
1994-96 Prime Minister's River Management Programme	Province of Punjab & Sindh	613
NFPP-III (1998-2008) (i) Normal/Emergent Flood Programme	All over the country	4192
(ii) Second Flood Protection Sector Project FPSP-II (1998-2007)	Four Provinces (Punjab, Sindh, KP, Balochistan)	4165
Japanese Grant (Lai Nullah Flood Forecasting & Warning System)	District Rawalpindi (Punjab Province)	348
2008-10 Emergent Flood Works	All over the country	893
	Sub Total	26138
	G. Total	**26138**

Existing Flood Protection Facilities

Name of Province	***Embankments (KM)***	***Spurs (No)***
Punjab	3,332.09	496
Sindh	2,422	46
Khyber-Pakhtunkhwa	352.24	186
Balochistan	696.85	682
Total	**6,803.18**	**1,410**

3. FLOOD MANAGEMENT MECHANISM

3.1 Organizations involved and responsibilities

Flood management is a multifunctional process involving a number of organizations. The Government Organizations which play major role in the flood management are the Provincial Irrigation Departments (PIDs), WAPDA, Provincial Relief Organizations, Pak Army, PCIW, Emergency Relief Cell (ERC) of the Cabinet Division, Federal Flood Commission (FFC), Flood Forecasting Division (FFD) and National Disaster Management Authority (NDMA)/ Provincial Disaster Management Authorities (PDMAs) and the District Administration. Functions of these organizations are briefly described hereinafter.

3.1.1 Provincial Irrigation Departments:

The Provincial Irrigation Departments (PIDs) play a front line role in flood management and mitigation. Major flood related functions include:

i. Operation of Barrages and measurement of discharges at specific sites (Barrages) on rivers, canals and nullahs;
ii. Planning, design, construction and maintenance of flood protection and River training works;
iii. Running of data communication network to provide the river flow data to FFD, Lahore;
iv. Supervision of operation of the Flood Warning Centre (on behalf of Relief Commissioner, D.G, respective provincial Disaster Management Authorities) to ensure timely dissemination of the flood forecasts/warnings;
v. Director (Floods), PIDs, in his capacity as member FFD maintains close coordination with Chief Meteorologist FFD, Lahore for the issuance of flood forecasts/warnings;
vi. Preparation & implementation of the flood fighting plans for monsoon period every year.

3.1.2 WAPDA

WAPDA is actively involved in the flood forecasting process as it provides river flows and rainfall data collected through telemetric system/gauge sites in the catchments of Indus and Jhelum rivers. The system is supplemented by meteor-burst communication system. WAPDA supports another hydrometric data measurement and transmission system through its Surface Water Hydrology Project.

WAPDA's telemetric network is directly linked to FFD, Lahore. WAPDA provides hydrometric flood data, as well as data from Tarbela,, Chashma and Mangla and dams.

Coordination between FFD and WAPDA has considerably improved after the 1992-flood disaster. Daily meeting in the office of General Manager (Planning & Design) is held during flood season and suitable advice is given to Tarbela and Mangla Dam Flood Management Committees.

3.1.3 Provincial Relief Organizations/ Provincial Disaster Management Authorities:

Ultimate aim of flood warnings is to reduce the potential loss to the life and property of the community living in the flood liable areas. Provincial Relief Organizations (now Provincial Disaster Management Authorities) are responsible for disaster preparedness, emergency response, and post disaster activities pertaining to all disasters including floods. Relief functions at the district and tehsil level are now performed through the District Disaster Management Authorities, who coordinate with the other departments to execute the disaster management functions at the district level.

3.1.4 Pak Army:

Pak Army's Corps of Engineers under the command and control of Engineer-in-Chief (E-N-C) is charged with the responsibility to provide necessary help to the civil authorities to carry out the rescue and relief operations during and after the floods. It is the responsibility of the Provincial Governments to provide all the support equipment (boats, life jackets, vehicles, tents etc) to the Army for such operations.

Pakistan Army's flood related functions encompass all the three phases of flood operations from the pre-flood to post flood phases including the important flood phase. Pre-flood phase is the flood preparatory phase during which the adequacy and the serviceability of the flood fighting equipment is ensured. Pre-flood meeting are held at the E-IN-C to coordinate activities with other organizations/agencies in providing the required support to the Pak Army. Pre-flood inspections of the flood protection structures are also carried out by the respective commander corps of engineers for their respective areas to ensure that the structures (bunds, barrages, spurs etc.) are in satisfactory state of maintenance. Deficiencies, if any, are brought to the notice of the Relief Commissioner and PIDs. Availability of sufficient stock of explosives is ensured to activate the breaching sections, whenever required.

An officer of the 4 Corps Engineers is placed on duty in the Flood Warning Centre, Lahore, to keep a close watch on the flood situation. All flood forecasts and warnings are communicated to the CC Engineers 4 Corps in time to be transmitted to the D.G. Engineers and all other CC Corps of the Engineers. In the event of floods, units of the Army move out to their respective areas of responsibility and carry out the relief and rescue operations in coordination with the respective civil administration. A post flood meeting is held under the chairmanship of E-IN-C to discuss the performance of all the flood related agencies with the view to bring about the necessary improvement in future.

3.1.5 Pakistan Commissioner for Indus Waters (P.C.I.W)

Pakistan has a unique flood-forecasting problem in the sense that greater part of the flood generating upper catchments of Rivers Sutlej, Ravi, Jhelum and Chenab lie across the border in India/held Kashmir. A number of water storage reservoirs exist over the rivers across the border with the result that the free flow conditions are destroyed making the operation of the rainfall/runoff model extremely difficult. The situation underlines the need for the acquisition of river flow data from across the border in respect of important sites over the rivers in India/held Kashmir. Consequently, an agreement had been signed between the two countries in 1989 through their respective Commissioners for Indus Waters, which includes provision to share river discharges data with India such river flow and rain data as is considered important for flood forecasting in Pakistan. A number of river flow stations are specified for this purpose.

The Pakistan Commissioner for Indus Waters receives the data normally once in a day. The data is then passed on to the Chief Meteorologist, FFD, Lahore. Frequency of data reception is increased to six hourly and even to hourly in case of severe flood situation. Pakistan Commissioner for Indus Waters is thus responsible to provide to the Chief Meteorologist, FFD, Lahore, the much-needed data obtained from India for use in the flood forecasting models to ensure accurate forecasts for Rivers Sutlej, Ravi, Jhelum & Chenab. Pakistan Commissioner for Indus Waters is the only forum through which any clarification or further information can be obtained from India with regard to flood data or the flood control structures in India.

3.1.6 Emergency Relief Cell (ERC), Cabinet Division

Emergency Relief Cell (ERC) exists under the Cabinet Division and is controlled by the Cabinet Secretary. The Cell is headed by the Director General. Main functions of the Emergency Relief Cell include:

- Planning and assessment of relief requirements for major disasters;
- Stock piling of basic need items during emergency such as dry ration, tents, blankets etc;
- Establishing emergency fund upon declaration of any part of the country as calamity affected; and
- Maintaining contact with UNDP and other international aid giving agencies

3.1.7 FFC and its Role in Flood Management/Mitigation

Since its establishment in 1977, FFC has prepared integrated flood management plans for the whole country on modern lines. The Plan being implemented by FFC encompasses both structural as well as the non-structural measures. Non-structural measures mainly pertain to establishment of a modern flood forecasting & warning system to provide timely and reliable weather/flood information to the concerned flood

management organizations and the public in general. One big step towards this end is installation of 10 CM QPM Doppler Weather Radar one each at FFD, Lahore and Mangla besides up-gradation of weather radar at Sialkot to afford the acquisition of the much needed rainfall data from cross the border over Rivers Sutlej, Beas, Ravi, Chenab and Jhelum catchments through the process of remote sensing. The other important step is the development of improved flood forecasting models i.e. FEWS for FFD, Lahore. Improvement in the measurement and transmission of the hydrometric data based upon the meteor-burst a physically based model accounting for the hydro dynamical changes in the flood wave. The model calls for the survey of the channel geometry to determine the channel parameters at suitable intervals of the channel length. It has, therefore, built-in discharge/elevation relationship, which should readily yield the flood levels at any point along the channels. This is of great advantage in the area of flood warning since it allows the estimation of the areas of inundation along the channel. In turn Flood inundation maps have been prepared to facilitate the identification of the villages and other public & private property and installation are likely to be inundated as against those considered safe, for a specific level of flood to be determined on the basis of running the Hydrodynamic model. The existing Flood Telemetry and Meteorburst communication systems of WAPDA have also been considerably improved and expanded.

A large number of flood protection works, i.e. 6803 km of embankments and 1410 spurs have so far been executed through Provincial Irrigation Departments and Federal Line Agencies through financial and technical support provided by GOP and foreign donor agencies.

3.1.8 Flood Forecasting Division (FFD), Lahore

FFD, Lahore, of the Pakistan Meteorological Department plays a pivotal role in the flood forecasting & warning process. Hydro meteorological data from the various national and international sources is received in this Division, which is then processed to produce flood forecasts and warnings to be disseminated outwards to various national organizations. Major responsibilities required to be fulfilled by the Division before, during and after the flood season are summarized as under:

i. Ensure serviceability of the meteorological equipment including various weather radars, Tele-printer Network, FAX, APT, RTT and MDD Equipment.
ii. Ensure availability of the following items in sufficient quantity to last for the whole of the flood season:
    - Surface and upper air meteorological charts;
    - Isohytal maps;
    - Various forecast forms;
    - Data tabulation sheets; and
    - Stationery etc.
iii. Regularly update the calibration of radars and flood forecasting models;

iv. Ensure availability of sufficient staff strength to maintain round-the-clock roster of duties for the meteorological and hydrological work;
v. Liaison with PTCL's Coordination Officer to provide 24 hours maintenance services for the tele-printers, internet and the office and residential telephones of all the flood related functionaries; and
vi. Conduct a familiarization training of the senior cadre and junior cadre Govt. functionaries involved in the process of flood mitigation.

3.1.9 National Disaster Management Authority (NDMA)

Government of Pakistan had embarked upon establishing appropriate policy to minimize risks and vulnerabilities and passed NDMA ordinance 2006. National Disaster Management Authority (NDMA) has been established to serve as the focal point and coordinating body to facilitate implementation of disaster risk management strategies. This necessitates NDMA to directly interact/ communicate with all stakeholders, including Ministries, Divisions, and Departments in relaxation to normal communication channel.

NDMA is an expedient to provide for an effective national disaster management system and for matters connected therewith and incidental thereto. As per National Disaster management Authority Act-2010, the functions of NDMA would be as under:

a. Act as implementing, coordinating and monitoring body for disaster management;
b. Prepare the National Plan to be approved by the National Disaster Management Commission;
c. Implement, coordinate and monitor the implementation of the national policy;
d. Lay down guidelines for preparing Disaster Management Plans by different ministries or departments and the provincial authorities;
e. Provide necessary technical assistance to the provincial government and provincial authorities for preparing their Disaster Management Plans in accordance with the guidelines laid down by the National Disaster Management Commission;
f. Coordinate response in the event of any threatening disaster situation or disaster;
g. Lay down guidelines for or give directions to the concerned ministries or provincial governments and provincial authorities regarding measures to be taken by them to response to any threatening disaster situation or disaster;
h. For any specific purpose or for general assistance requisition the services of any person and such person shall be co-opted as member and exercise such power as conferred upon him by the authority inn writing;
i. Promote general education and awareness in relation to disaster management; and
j. Perform such other functions as the National Disaster Management Commission may require to perform.

3.2 Pre-Flood Meetings:

A number of pre-flood meetings are held annually by concerned flood management organizations, namely, Pak Army, NDMA, and Ministry of Water & Power/FFC and to review and discuss the flood preparedness and protection plans with all the major stakeholders. The following pre-flood meetings were held in 2010:

i. Pak Army Pre-Flood Season Coordination Conference was held on June 10 2010, at Engineers Directorate, GHQ, which was attended by FFC, NDMA and Commanders of concerned Army formations. Flood preparedness plans were reviewed;
ii. 4th Pre-Monsoon Coordination Meeting of NDMA was held on June 28, 2010 to assess preparedness, response and recovery capacity of Federal and Provincial Departments.
iii. 45th Pre-Flood Annual Meeting of FFC was held on July 8, 2010, under chairmanship of Federal Minister for Water & Power to review state of preparedness of Federal and Provincial Agencies/Departments.

3.3 Flood Communication Cell:

During flood season, each year, Flood Communication Cell of Federal Flood Commission remains in operation on round-the-clock basis for the entire flood season (July 01 to September 30) and Daily Flood Situation Report is issued to all concerned.

The main objective of the Flood Communication Cell is to obtain information from the Flood Forecasting Division (FFD), Lahore, and other Flood Warning Centers set up in the Provincial Headquarters. Also data relating to river discharges at Rim stations and other important control points and information with regard to rainfall at important stations is received through PCIW. In addition to the special duty staff (for round-the-clock collection of data), one officer remains available during all working days as well as on Sundays and National Holidays for collection of necessary information regarding rain/flood damages and flood-damaged bunds/ breaches.

Chairman FFC also sends reports to the President and the Prime Minister Secretariat as and when the situation demands. A Daily Flood Situation Report on Weather & River Discharges as received from FFD, Lahore is prepared and issued to important Government officials on daily basis during the flood season every year containing the following:

i. Actual river flow position of major rivers in a tabular form;
ii. Prevailing weather system situation;
iii. Concise forecast relating to the movement of various weather systems and river flow condition for the next 24 hours including likely inundation /flooding of nullahs etc.

iv. Damage details in the event of flood emergency in a certain area. In case of exceptionally High Floods/unprecedented emergency situation, special collection on situation is issued on daily basis.

3.4 Flood Warning Dissemination System:

Every year flood season starts from July 1st and ends on September 30. However, all the flood forecasting & warning related agencies and data collection departments start functioning from 15th June every year and continue their rainfall and river flow data collection and flood forecasting activities up to mid October. During this period effective interaction and communication between various flood related provincial as well as federal departments/agencies is maintained on round-the-clock basis in order to counter any eventuality due to rain/flood.

The earlier weaknesses in the flood warning dissemination system called for the following remedial actions: -

a. Police communication system (for the reception of flood data and the dissemination of flood forecasts/warnings) be replaced with some advanced automatic data communication system. However, until such a system becomes available the police operators posted on flood duties be given some training to enable detection of simple data errors and also to understand the urgency and importance of timely communication of data and flood forecast.

b. Dissemination of the flood/warning at least to the important recipients be done by the Flood Forecasting Centre to ensure timely dissemination under the overall supervision of the Chief Meteorologist, FFD, Lahore.

c. Some mechanism to ensure proper coordination between the various departments/agencies involved in the flood mitigation process be established. This may be done by an authority having the full legal jurisdiction over all the concerned agencies.

The problems and the possible remedies were frequently discussed in flood meetings at Provincial and Federal Government levels. As a result of such efforts the earlier flood warning dissemination system underwent gradual changes as reflected in the system currently in vogue. Salient features of current flood warning dissemination system are as follows:

i. Pre-flood familiarization training has been started since the last few years to acquaint the newly inducted people of Irrigation and WAPDA with the commonly used hydromet terms.

ii. Flood Forecasting and Warning Centre, Lahore, has been re-designated as the Flood Forecasting Division (FFD).

iii. FFD has taken in hand the dissemination of the flood forecasts/warnings to considerably large number of recipients directly or indirectly concerned with the flood mitigation process, over and above the dissemination being done by the FWC.

iv. Press briefings have been started in the office of Chief Meteorologist FFD as a regular feature to ensure correct and authentic flood and weather information to the public. Such briefings are arranged through the representative of the Punjab Information Department on duty at the FWC, only when the flood situation is or is likely to become serious enough to call for such briefings.

Considerable improvement has been made in the dissemination system since the time that it was initially started. Most of the discrepancies stated above have been removed. A much better coordination now exists with WAPDA as regular meetings or verbal advice is given by Chief Meteorologist, FFD, Lahore to G.M (Planning & Coordination) WAPDA.

The existing dissemination process has been reviewed and lists of the recipients of flood information have been streamlined. Basically there are two types of flood information required to be provided for use by the appropriate recipients: i) the flood forecasts and ii) the flood data. Whereas the flood forecasts are disseminated by FFD as well as the FWC, the flood data is disseminated by the FWC only.

4. FLOODS 2010

The monsoon of the Year 2010 brought with it the worst flooding in past 80 years in Pakistan. The unprecedented floods began in July 2010 following heavy monsoon rains in the KP , Sindh, lower Punjab and Balochistan regions. These rains over a large area made the rivers surge and overflow. According to the Met Department, within a short period of three to four days, heavy rains fell in the catchment areas of Indus and its tributary rivers causing heavy floods in River Indus. This comprehensively devastated areas from Gilgit-Baltistan to Kotri Sindh.

In the last week of July, unprecedented rains fell in the catchment areas of Kabul and Swat rivers. Heavy rainfall of more than 200 millimeters (7.9 inches) was recorded during the four day wet spell of July 27 to July 30, 2010 in the provinces of KP and Punjab (Table 4). The above average rainfall in the months of July and August 2010 are described as the worst in the last 80 years.

Table 4: Recorded Rainfalls During the Four Day Wet Spell of July 27 to July 30, 2010

City	Rainfall (mm)	Rainfall (inch)	Province
Risalpur	*468.0	18.4	Khyber Pakhtunkhwa
Cherat	*384.0	15.1	Khyber Pakhtunkhwa
Saidu Sharif	*338.0	13.3	Khyber Pakhtunkhwa
Peshawar	*226.1	8.9	Khyber Pakhtunkhwa
Lower Dir	297.0	11.7	Khyber Pakhtunkhwa
Kohat	127.3	5.0	Khyber Pakhtunkhwa
Balakot	208.7	8.2	Khyber Pakhtunkhwa
Upper Dir	309.0	12.1	Khyber Pakhtunkhwa
Dera Ismail Khan	83.3	3.3	Khyber Pakhtunkhwa
Garhi Dopatta	346	13.6	Azad Kashmir
Rawalakot	297	11.7	Azad Kashmir
Muzaffarabad	292	11.5	Azad Kashmir
Pattan	242	9.5	Azad Kashmir
Islamabad	394	15.5	Capital Territory
Murree	373	14.6	Punjab
Kamra	308	12.1	Punjab
Lahore	288	11.3	Punjab
Mianwali	*271	10.6	Punjab
Jhelum	269	10.6	Punjab
Sialkot	255	10.0	Punjab
Gujranwala	222	8.7	Punjab
Rawalpindi	219	8.6	Punjab

* Indicates new record

The 2010 floods started on July 22, 2010, after a few hours of heavy rainfall in Balochistan which caused breaching at Lehri Flood Protection Bund and flood water outburst 43 Km upstream of Sibi inundating more than 20 villages along its banks. The second spell of flooding took place by unprecedented rains across the KP before releasing to southern Punjab and Sindh. During 2010 flood season, flows in western rivers were very high and some of the discharge levels recorded are comparable to those recorded during the floods of 1956, 1976, and 1992.

A comparison of Historic Maximum Flood Peaks Vs 2010 Flood Maximum Flood Peaks is given in Table-5 and retention of flood peaks at Tarbela and Mangla reservoirs on July 30, 2010 is presented in Table 6. Figure-3 shows 2010 Flood Peaks of Indus river system.

Table-5: Historic Maximum vs 2010 Maximum Peak Discharges of Major Rivers of Pakistan

River	Barrages/ Head-works/ Bridges	Designed Capacity	Historic Maximum Peak (cusecs)		Maximum-2010 Peak (cusecs)	
			Flood	Date	Flood	Date
Indus	Tarbela	15,00,000	5,10,000	31-7-89	8,33,000	30-7-10
	Kalabagh	9,50,000	9,50,000	14-7-42	9,37,453	30-7-10
	Chashma	**9,50,000**	7,86,600	3-8-76	**10,36,673**	01-8-10
	Taunsa	11,00,000	7,88,646	22-7-58	9,59,991	02-8-10
	Guddu	12,00,000	11,99,672	15-8-76	11,48,738**	8&9-8-10
	Sukkur	15,00,000*	11,66,574	15-8-76	11,31,000#	9&11-8-10
	Kotri	**8,75,000**	9,81,000	14-8-56	**9,64,900**	27-8-10
Jhelum	Mangla	10,60,000	9,33,000	10-9-92	3,44,400	30-7-10
	Rasul	8,50,000	9,32,000	10-9-92	2,63,800	30-7-10
Kabul	Warsak	5,40,000	1,50,680	8-7-78	1,52,710	30-7-10
	Nowshera	-	-	-	2,49,100^	10-8-10
Chenab	Marala	11,00,000	11,00,000	26-8-57	3,14,378	06-8-10
	Qadirabad	8,07,000	9,48,530	11-9-92	3,29,483	07-8-10
	Trimmu	6,45,000	9,43,225	8-7-59	3,28,926	11-8-10
	Panjnad	7,00,000	8,02,516	17-8-73	3,10,000	13-8-10
Ravi	Balloki	2,25,000	3,89,845	28-9-88	69,900	23-8-10
	Sidhnai	1,50,000	3,30,210	2-10-88	27,600	28-7-10
Sutlej	Sulemanki	3,25,000	5,97,000	8-10-55	58,300	03-9-10

* Existing design capacity as reported by PID, Sindh is 9,00,000 cusecs.
** Does not include flood flows passed through breach of LMB of Guddu Barrage.
# Does not include flood flows passed through Tori Bund reach u/s Sukkur Barrage.
^ The gauges were submerged at this discharge, it is estimated that a flood more than 4,50,000 cusecs passed through this point.

Table 6: Retention of Flood Peaks at Reservoirs – July 30, 2010

Reservoir	Peak Inflow (cusecs)	Peak Outflow (cusecs)	Water Retained (cusecs)
Tarbela	833,000	604,000	229,000
Mangla	344,400	225,496	118,904
		Total	347,904

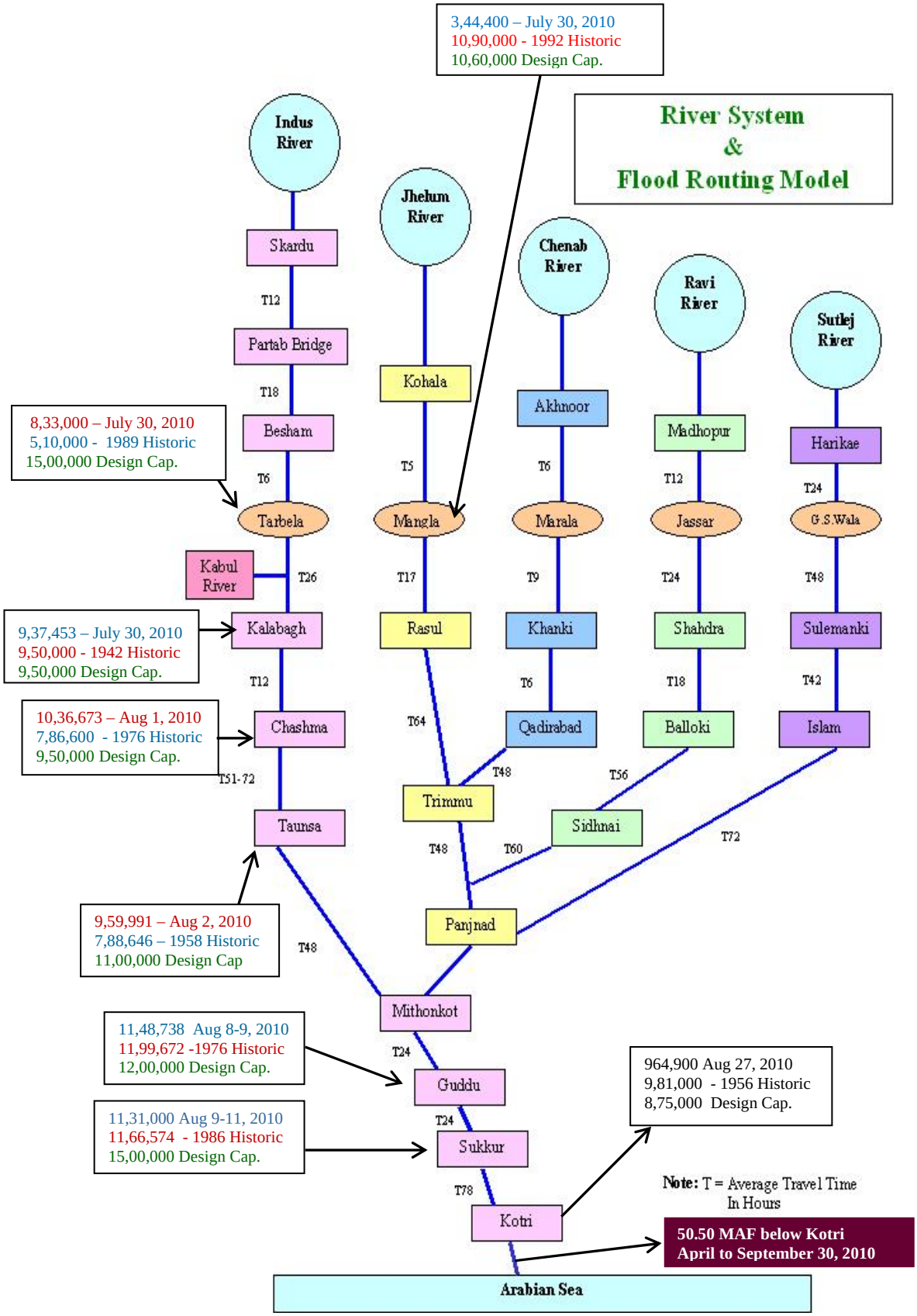


Figure-2: 2010: Flood Peaks (in Cusecs) vs Historic Peaks of Indus River System

The D.G. Khan & Rajanpur hill torrents also experienced high flash floods in the last week of July and first week of August 2010. Maximum discharges from hill torrents outlets in D.G. Khan & Rajanpur area are given in Table 7.

Table 7: Maximum Discharges of Hill Torrents during flood season (2010)
D.G. Khan – Rajanpur Area

Sr. No.	Date	Hill Torrents	Max Discharge (Cusecs)
1	22-7-2010	KAHA	80,000
2	22-7-2010	CHACHAR	35,000
3	05-8-2010	SANGHAR	76,500
4	05-8-2010	VIDOR	97,000
5	05-8-2010	SORI LUND	51,640
6	08-8-2010	VEHOWA	1,10,500
7	08-8-2010	KAURA	67,200
8	08-8-2010	MITHAWAN	61,900
	08-8-2010	***Cumulative Potential:***	***2,39,600***

4.1 Official Seasonal Monsoon Rainfall Forecast

Pakistan Meteorological Department predicted Normal monsoon rains during the period from July to September 2010. On 21 June, the Pakistan Meteorological Department cautioned that urban and flash flooding could occur from July to September in the northern parts of the country. The official prediction of seasonal monsoon rainfall by Pakistan Meteorological Department, issued in this context, is reproduced hereunder:

> *"Meteorological data suggests that on all Pakistan basis the monsoon rains during Jul-Sep (2010) in most parts of the country are likely to be normal (+10%), which means that the over all availability of water in the country from monsoon rains would be sufficient.*
>
> *Due to high sea-land temperature contrast, the development of some mid-tropospheric circulations are likely in north Arabian Sea that may cause heavy rainfall events over southern areas of Pakistan (Sindh) during Jul-Sep.*
>
> ***Due to the interactions of westerly-easterly waves, few very heavy rainfall events would also occur over north Pakistan that may cause urban/flash flooding during Jul-Sep.***
>
> *This is seasonal forecast with confidence level of 80% and meant for the planning purpose only. The normal area-weighted rainfall for July to September of Pakistan is 137.5 mm."*

4.2 Flooding Pattern during Flood Season 2010

The 2010-floods were of unprecedented magnitude mainly triggered by the Indus and its tributaries having affected all the four provinces of the country. These floods mainly affected the vast basin areas of rivers in KPK, Punjab and Sindh including northern and north eastern parts of Balochistan. In KPK, Balochistan and some areas of Punjab were also affected by flash floods mainly from hill torrents. According to the Pakistan Meteorological Department, within a short period of three to four days, heavy rains fell in the catchment areas of Indus and its tributaries causing heavy flooding. This comprehensively devastated areas from Gilgit-Baltistan to Kotri Sindh.

4.2.1 Khyber Pakhtunkhwa

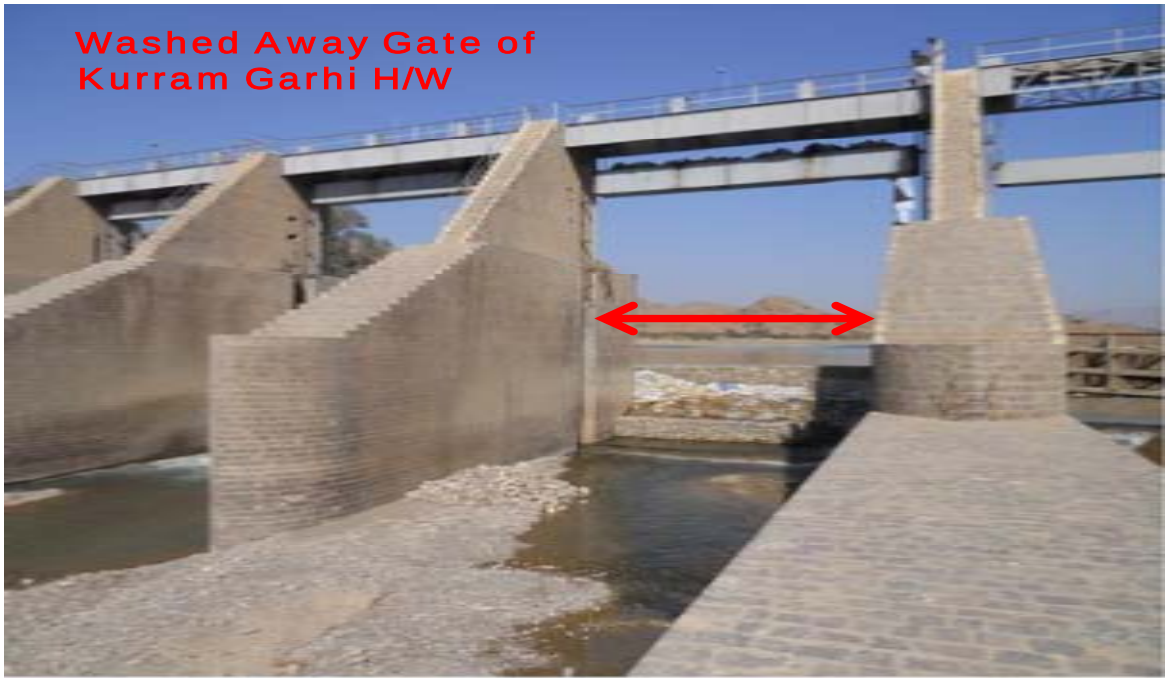
Khyber Pakhtunkhwa (KPK) was severely affected. The unprecedented monsoon rains from July 27 to July 30, 2010, followed by historic floods caused major losses to life, crops, houses, infrastructure, i.e. roads bridges, railway tracks, power installations, small dams, etc which were severely damaged due to flashy flood flow of secondary (Kabul, Swat & Panjkora) and tertiary rivers including local nullahs.

More than 200 mm (7.88 inches) of rain fell within a period of 24-hour over a number of places of KPK. A record-breaking 274 mm (10.7 inches) rain fell in Peshawar during 24 hours surpassing the previous 187 mm (7.36 inches) of rain recorded in April 2009.

Rivers Swat and Kabul experienced record floods in excessive of 400,000 cusecs crossing previous historic recorded flows of 1929 (250,000 cusecs) that caused inundation of Charsada, Nowshehra and adjoining areas. Exceptionally high floods were also recorded in Panjkora River, Budni/ other nullahs, as well as flash floods in D.I. Khan hill torrents. Areas badly affected include Districts Swat, Shangla, Upper and Lower Dir, Malakand, Mansehra, Charsadda, Mardan, Peshawar, Nowshera, Kohat, Karak, Bannu, Lakki Marwat, D.I. Khan and Tank.

MUNDA HEADWORK AFTER FLOOD

Devastation was so massive that 278 bridges were damaged/ washed away, besides severe damages to 6,511 Kms of roads, Amandra, Munda and Kurram Garhi Headworks, 605 transformers and 5 Grid stations, small dams, irrigation infrastructure and the other private as well as public infrastructure. Disastrous flooding in 544 villages of 24 districts in KP severely damaged 257,294 houses 1,790 watercourses, 121,500 hectares of cropped area and affected a population of 3.8 million resulting into life loss of 1,156 persons with 1,198 injured.



PICTURE SHOWING DAMAGES AT RIVER BANK BAHRAIN (SWAT)

4.2.2 Punjab

Heavy rainfall in Northern parts of the country raised water level in main rivers and seasonal nullahs causing heavy floods in River Indus. Later with the contribution of River Swat and Kabul to Indus led to unprecedented floods in areas of Punjab province i.e. “Jinnah Barrage to Taunsa Barrage Reach”.

River Indus experienced exceptionally high floods between July 30 & August 02, 2010, in Jinnah Barrage–Taunsa Barrage reach. At Jinnah Barrage due to high flood of 9,37,453 cusecs recorded on July 30, 2010, four (4) predetermined breaching sections were operated in Right Marginal Bund of Jinnah Barrage resulting in inundation of low lying areas and under construction Jinnah Hydropower Project. Chashma Barrage recorded historic peak flow of 10,36,673 cusecs (higher than design capacity) on August 1, 2010. Flooding occurred in river plains in Districts Mianwali, Bhakhar, and Layyah.

Indus at Taunsa Barrage received flood peak of 9,60,000 cusecs on August 2, 2010, crossing historic peak of 7,88,646 cusecs recorded in 1958. Due to immense pressure, Left Marginal Bund (LMB) of Barrage breached at RD 32-38 on August 2, 2010, inundating a number of abadies/villages, agricultural land located on left side of Indus River in District Muzaffargarh. Flood flows passing through breached section of Left Marginal Bund (LMB) overtopped Taunsa-Punjnad Link at RD 10 and hit Muzaffargarh Canal breaching it at several locations between RD: 13-14.

Consequently, abadies of Kot Addu town, Shaikh Omar, Sinawa, Thatta Gurmani, Gujrat, Mahmood Kot, Ghazi Ghat and adjoining cropped areas located between right side of Muzaffargarh Canal and left bank of River Indus in Muzaffargarh District were inundated. A cut was induced at Gattu Flood Bund downstream Ghazighat Bridge to

divert flood flows back into River Indus through breached section and escape channel at RD: 246 of Muzaffargarh Canal. Power installations/generation were badly affected at Kot Addu Power House, AES Lalpir, AES PakGen, as well as oil supplies from PARCO and PSO Depot.

Exceptionally high flash floods were also recorded in D.G. Khan & Rajanpur hill torrents. Heavy rains on Suleman Range Mountains and in the plains of Dera Ghazi Khan and Rajanpur resulted in high floods in hill torrents on the western side of the districts which also raised flood flows level in the Indus. Floodwater entered dozens of settlements adjoining the riverine area of Rajanpur district. The irrigation department warned people in Vahowa that high flood was expected in the Vahowa hill torrent because of a breach in a dam in Balochistan. Flood in Vidor hill torrent inundated hundreds of acres of land in the suburbs of Dera Ghazi Khan, Choti Zarin and Khanpur Munjwala. Comparative discharges of 2,39,600 cusecs of water from hill torrents outlets in D.G. Khan Rajanpur area added into River Indus on August 8, 2010.

Catastrophic flooding in 1778 villages of 11 districts in Punjab province damaged 375,773 houses, 746,900 hectares of cropped area, 2,598 watercourses and 2,819 km of road infrastructure. 2010 floods in Punjab affacted a population of 8.2 million resulting into life loss of 110 persons with 262 injured.

4.2.3 Sindh

The Exceptionally High Flood flows in Indus River entered the upper Sindh at Guddu Barrage on 5th August, 2010. First wave of Exceptionally High Flood peak of 11,49,000

cusecs passed through Guddu Barrage on August 8-9, 2010, and flood peak of 11,31,000 cusecs passed through Sukkur Barrage on August 9-11, 2010. Due to immense pressure, 16 mile long Left Marginal Bund (LMB) of Guddu Barrage breached at five (5) locations (1 in Sindh and 4 in Punjab). Areas of Bhong, Somiani, Kot Sabzal, Sajanpur, Indus Highway and adjoining areas were inundated. The flood water in Rainee Canal was measured to be 9645 cusecs almost double the design discharge resulting in breached on the left bank of the canal (13 Nos).

Due to heavy pressure of flood water, Tori Bund (1st line of defence) located on right bank of Indus river 30 km D/S of Guddu Barrage, breached at mile 0/2 on August 06, 2010, inundating vast area. Six (6) breaches also occurred in Beghari Sindh (B.S) Feeder on August 08, 2010. Flood water, which entered the western districts of Sindh after breaching Tori Bund, hit three Tehsils of district Dadu i.e. Mehar, Khairpur Nathan Shah and Johi.

PEAK FLOOD CONDITIONS TORI BUND COMPLEX

Resultantly, flood water entered Ghouspur, Kandhkot and Dari towns further spreading towards Thul town, Shahdad Kot and Usta Muhammad and adjoining parts of Balochistan damaging houses, cropped area and irrigation infrastructures e.g. Saifullah Magsi Branch etc. Due to exceptionally high flood flows in Indus River, Old Ghora Ghat Bund from mile 0/0 to 0/2 (1st line of defence) and Haibat Loop Bund (2nd line of defence) at mile 12/3 on right bank, D/S of Guddu Barrage were also breached. The Tori bund flood water after inundating the surrounding areas of Jacobabad city entered in Balochistan.

BREACH OCCURED @ RD 101 KHIRTHAR CANAL

Furthermore, second wave of Exceptionally High Flood again passed through Guddu and Sukkur barrages between August 14-17, and situation remained critical. A breach developed M.S Bund (Mile 18/2) on the eastern bank of the Indus River in Thatta district on August, 26, 2010. Thatta city was evacuated as the Indus breaches its western bank in the south.

Exceptionally High Flood Flow of 965,000 cusecs was recorded at Kotri Barrage on August 27, 2010. Inundation and riverine flooding of low lying areas of Districts Hyderabad, Thatta, Badin, especially Sajawal, Mirpur Bathoro, Mirpur Sakro, Jhang Shahi, Jamshoro, Matiari, Makaro, Keti Bunder, Shah Bunder took place. Whole Katcha area upstream and downstream Kotri Barrage were inundated. Flood water passing through the breach in M.S. Bund (mile 18/2) inundated area upto Sajawal Town and spread over Jati & Chohar Jamali and adjoining areas of District Thatta.

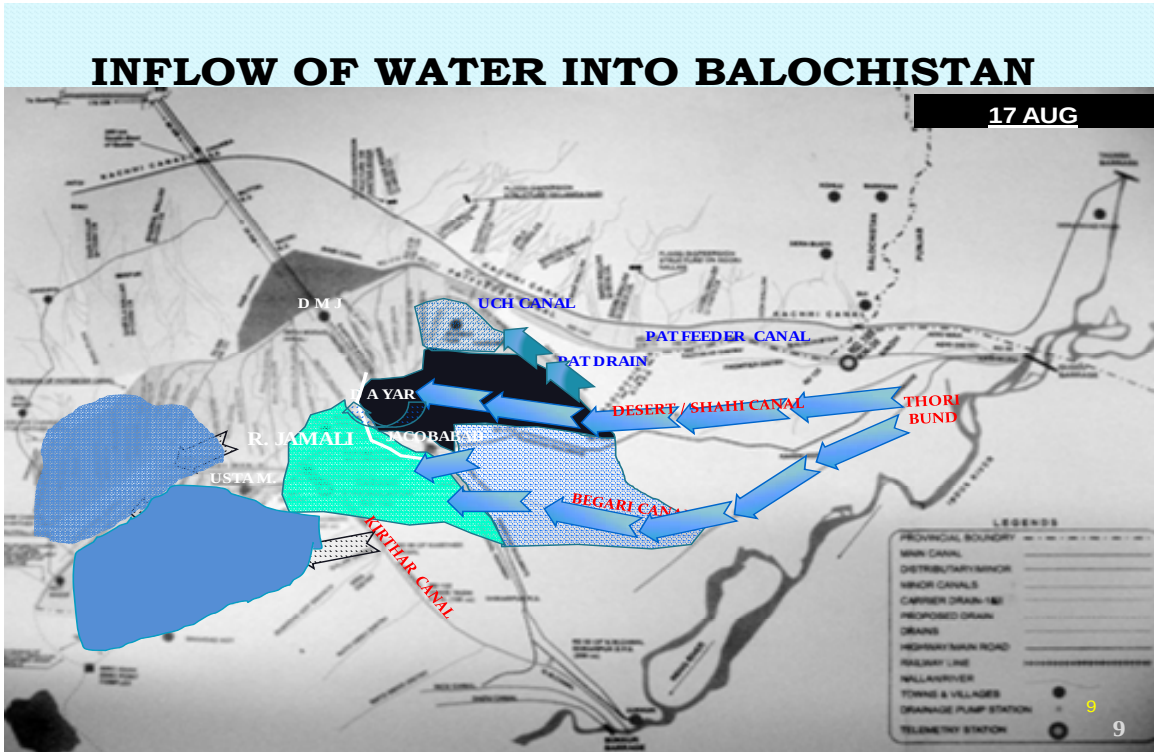
Manchar Lake overtopped on September 16, 2010 at RD: 92-97, flooded vast area of District Jamshoro. Eight relief cuts were made in Manchar Lake and a breach in the Main Nara Valley (MNV) drain could not be plugged, resulting in flood waters to flow towards the last embankment of Bhan Saeedabad at Indus link canal. As a result, the vast area was flooded. This brought the total number of villages inundated to 200. Sehwan airport, the railway track, Pak-Arab refinery station, Indus highway, different telecommunication towers and the main line of optical fiber were inundated as well, completely paralyzing the telecommunications system in the area.

The destructive flooding in 11,988 villages of 17 districts in Sindh province extensively damaged 879,978 houses, 1,043,500 hectares of cropped area, 6,990 water-courses and 8,467 km of road infrastructure. Besides, a population of 7.185 million was badly affected causing 411 deaths with 1,235 injured.

4.2.4 Balochistan

North-eastern parts of Balochistan were affected by July 2010 rains/ thunderstorms which resulted in flash floods from hill torrents. Major affected areas include districts Zhob, Kohlu, Sibi, Barkhan, Kachhi, Nasirabad, Jafferabad, Musakhel, Shirani, Harnai and Killa Saifullah. The rains breached Lehri dam in Sibi and affected about 20 villages. In the first week of August 2010, due to breach in Tori Bund in Sindh, flood water entered into Jaffarabad and Nasirabad districts and in some parts of Jhal Magsi district. Areas of Rojhan Jamali, Usta Muhammad and several other villages were also inundated.

Floods affected 12 districts severely affected a population of 0.7 million; 54 people were reported dead and 104 injured besides 79,720 houses damaged. Crops on 132,500 hectares had been completely destroyed and 47 No. water-cources & 2,077 km of road infrastructure were ruined by the 2010 floods. Flood water also crossed over Indus Highway, due to which Road between Shikarpur - Jacobabad, Jacobabad – Sibbi and Shikarpur to Kandhkot was closed for several weeks for all type of traffic.



4.2.5 FATA

Damages occurred to irrigation infrastructure and other private as well as public property of FATA. According to DNA report jointly prepared by ADB and World Bank, disastrous flash flooding in FATA damaged 5,419 houses, 7,220 hectares of cropped area and 1,257 km of road infrastructure.

4.2.6 Gilgit-Baltistan

In Gilgit rains starting from July 28, 2010 had disastrous effects in Gilgit-Baltistan (G-B) as Karakuram Highway (KKH) got blocked at various sections and land link of the country with G-B got suspended. Thunderstorm resulted in floods which caused widespread damages to road, bridges, power houses, water channels, etc. Rivers and nullahs inundated low-lying areas affecting 100,000 persons in 347 villages. About 183 deaths were reported, 3,157 houses damaged and at least 7,900 hectares of cropped area was destroyed. 2010 flooding in 7 districts in G-B damaged 960 watercourses and 382 km of road infrastructure.

4.2.7 Azad Jammu & Kashmir

Heavy rains and floods devastated major parts of Azad Jammu & Kashmir resulting in 71 deaths, 87 injured and affected a population of about 200,000 persons. Some 6,843 houses and 33,100 hectare of cropped area were badly affected. Damages also occurred to public infrastructure, e.g. roads, bridges, power installations, water channels, etc. Catastrophic flash flooding in AJK damaged 657 watercourses and 3,575 km of road infrastructure.

4.3 Overall Assessment of 2010-Monsoon Season

2010-Monsoon Season can be termed a heavy wet monsoon season. Meteorological Department recorded above-average rainfall in the months of July and August 2010 and described as the worst in the last 80 years. Number of rivers experienced Exceptionally High Flood situations. As may be seen from Table-5 maximum discharge experienced by River Indus was at Guddu i.e. 11,49,738 cusecs (August 8-9, 2010), which is a Exceptionally High Flood stage. River Jehlum experienced a maximum discharge of 3,44,400 cusecs (30.7.2010) at Mangla, River Chenab 3,29,483 cusecs (07.08.2010) at Qadirabad and River Ravi 69,900 cusecs (23.8.2010) at Balloki respectively.

4.4 Country-Wide Losses/Damages Due to 2010 Floods

4.4.1 Damages to Public and Private Infrastructure

The details of country-wide losses/damages caused due to rain/flood 2010 as reported by the Provincial Departments and Federal Line Agencies are given in Table 8.

Table 8: Country-Wide Losses/Damages Due to Rain/Flood 2010

Province/ Agency	Total Affected Districts	Cropped Area Affected (Ha)	Population Affected (million)	Houses Damaged	Road Milage (Km)	Villages Affected	Water-courses damaged	Person Died	Persons Injured
Punjab	11	746,900	8.20	375,773	2,819	1,778	2,598	110	262
Sindh	17	1,043,500	7.185	879,978	8,467	11,988	6,990	411	1,235
KP	24	121,500	3.80	257,294	6,511	544	1,790	1,156	1,198
Balochistan	12	132,500	0.70	79,720	2,077	2,896	47	54	104
FATA	#	7,220	#	5,419	1,257	#	0	#	#
Gilgit-Baltistan	7	7,900	0.10	3,157	382	347	960	183	60
AJK	7	33,100	0.20	6,843	3,575	0	657	71	87
G. Total	**78**	**2,092,600**	**20.185**	**1,608,184**	**25,088**	**17,553**	**13,042**	**1,985**	**2,946**
Source of information	*NDMA as on 24.2.2011*	*Page 153 of DNA Report*	*NDMA as on 24.2.2011*	*Page 89 of DNA Report*	*Page 129 of DNA Report*	*NDMA as on 24.2.2011*	*Page 153 of DNA Report*	*NDMA as on 24.2.2011*	*NDMA as on 24.2.2011*

Data not received by NDMA

4.4.2 Irrigation Infrastructure Damages

Irrigation system/infrastructure and flood control works were damaged at several places. Major damages included Munds, Amendrah & Kuram Garhi Headworks (KP), RMB Jinnah Barrage, LMB of Taunsa & Guddu Barrages, TP Link Canal, Muzaffargarh Canal along with branches/distributaries, Head Regulators, Drains, Outlets, Flood Embankments, Tori Bund, Ghauspur Bund, M.S Bund etc, Spurs and other structures.

Damages to infrastructure is tentatively estimated at Rs 15.5 billion, 52 billion, 11.55 billion, 3.751 Billion, 461 million and 14.9 million by Punjab, Sindh, KPK, Balochistan, GB and AJK Governments respectively.

4.4.3 Damages to Power Sector

Power Sector Infrastructures severely damaged in the flood affected areas. Major damages recorded in province of KPK. Hydropower plants of Jagran (30 MW) and Malakand-III (81 MW) were flooded. Power houses of about 2000 MW including KAPCO plant and Muzzafargarh plant were partially shutdown due to expected flood hits and unavailability of fuel as road and railway infrastructure was severely damaged. Furthermore, two IPPs of 350 MW each viz AES Lalpir and AES Pakgen were flooded/ inundated for the last 30 days. A number of grid stations, transmission lines and distribution system infrastructure were fully/partially damaged. Partial damages were also occurred to some under construction power plants. Total cost involved in restoration is tentatively estimated at Rs. 13 billion.

4.5 2010 Floods: Damages and Needs Assessment

In the wake of the 2010 floods, the Government of Pakistan requested ADB and World Bank for carrying out the Damage and Needs Assessment (DNA) survey and the One UN-Organization to lead the Early Recovery Needs Assessment in parallel. The DNA Report assessed the extent of the damage and the required needs for rehabilitation and reconstruction of the damaged assets and infrastructure; and restoration of livelihoods and economic productivity. The objective of the DNA was to provide the strategic underpinnings for medium- to long-term post floods reconstruction, recovery planning, prioritization, and programming.

DNA report described a quantification and validation of physical damage and presented sector level recovery and reconstruction strategies in respect of public and private infrastructure, services, and livelihoods. The quantification of corresponding needs was then done with reference to damage and sector level reconstruction strategies. With respect to financial costs the DNA report has been generated against three assessment categories:

i. Direct Damage refers to the monetary value of the completely or partially destroyed assets, such as social, physical and economic infrastructure immediately following a disaster.
ii. Indirect Losses are income losses, and comprise both the change of flow of goods and services and other economic flows such as increased expenses, curtailed production and diminished revenue, which arise from the direct damage to production capacity and social and economic infrastructure;
iii. Reconstruction Costs measure the cost of rebuilding lost assets and restoring lost services. It is generally assessed as the replacement cost with a premium added for building back safer.

Total damages including direct and indirect losses were estimated approximately PKR 855 billion (US$ 10 billion). The direct damage caused by the floods is estimated at PKR 552 billion (US$ 6.5 billion) while indirect losses amount to PKR 303 billion (US$ 3.6 billion). Sector-wise breakdown of the cost of damages costs is given in Table 9.

The reconstruction cost has been provided across the range of three options with option one as the base case and option three as the recommended option. The reconstruction cost for the base case is estimated at PKR 578 billion (US$ 6.8 billion) while for the recommended option costs are estimated at PKR 758 billion (US$ 8.9 billion). Table 10 provides the detailed breakdown of the total reconstruction costs by sector.

Table 9: Total Costs of Damages by Sector

Sector	Direct Damages PKR millions	Indirect Losses PKR millions	Total Damage	
			PKR millions	USD millions
1. Social Infrastructure				
Housing	91,843	43,171	135,014	1,588
Health	1,562	2,661	4,222	50
Education	22,047	4,418	26,464	311
Subtotal	**115,451**	**50,249**	**165,700**	**1,949**
2. Physical Infrastructure				
Irrigation & Flood Management	23,600		23,600	278
Transport & Communications	62,491	50,420	112,911	1,328
Water Supply & Sanitation	3,194	6,112	9,306	109
Energy	13,184	13,116	26,300	309
Subtotal	**102,469**	**69,648**	**172,117**	**2,025**
3. Economic Sectors				
Agriculture, Livestock & Fisheries	315,547	113,257	428,805	5,045
Private Sector & Industries	14,463	9,468	23,932	282
Financial Sector	110	57,141	57,251	674
Subtotal	**330,120**	**179,866**	**509,987**	**6,000**
4. Cross Cutting Sectors				
Governance	3,141	2,835	5,976	70
Environment	992		992	12
Subtotal	**4,133**	**2,835**	**6,968**	**82**
Total	**552,173**	**302,599**	**854,771**	**10,056**

Source: DNA report

Table 10: Total Reconstruction Costs by Sector

Sector	Reconstruction Option 1		Reconstruction Option 2		Reconstruction Option 3	
	PKR millions	USD millions	PKR millions	USD millions	PKR millions	USD millions
1. Social Infrastructure						
Housing	126,075	1,483	143,676	1,690	187,491	2,206
Health	4,151	49	4,151	49	4,151	49
Education	42,907	505	42,907	505	42,907	505
Subtotal	***173,133***	***2,037***	***190,734***	***2,244***	***234,549***	***2,759***
2. Physical Infrastructure						
Irrigation & Flood Management	36,294	427	36,294	427	83,499	982
Transport & Communications	200,260	2,356	200,260	2,356	200,260	2,356
Water Supply & Sanitation	6,292	74	6,292	74	7,982	94
Energy	9,038	106	9,038	106	9,038	106
Subtotal	***251,884***	***2,963***	***251,884***	***2,963***	***300,779***	***3,539***
3. Economic Sectors						
Agriculture, Livestock & Fisheries	21,879	257	56,925	670	89,134	1,049
Private Sector & Industries	8,636	102	8,636	102	10,923	129
Financial Sector	39,358	463	39,358	463	39,358	463
Social Protection & Livelihoods	58,076	683	58,076	683	58,076	683
Subtotal	***127,949***	***1,505***	***162,995***	***1,918***	***197,491***	***2,323***
4. Cross Cutting Sectors						
Governance	4,900	58	4,900	58	4,900	58
Disaster Risk Management	2,295	27	2,295	27	2,295	27
Environment	17,746	209	17,746	209	17,746	209
Subtotal	***24,941***	***293***	***24,941***	***293***	***24,941***	***293***
Total	**577,908**	**6,799**	**630,554**	**7,418**	**757,761**	**8,915**

Source: DNA report

5. LESSONS LEARNT DURING 2010 FLOODS

The 2010-Floods in Pakistan clearly demonstrate absolute incapacity of the Federal, Provincial and Local Government machinery to deal with disasters and crisis, particularly on such a large scale. The floods have been attributed to heavy rainfall, climatic changes, monsoon patterns, deforestation and damming. There are many lessons to learn from the ongoing flood catastrophe in Pakistan. Some of vital lessons to learn include:

i. Pakistan Meteorological Department's Flood Warning System worked well but it has inherited capability constraints, which needs capacity building in Medium Range Forecasting from existing 2-3 days to 10 days and installation of additional weather radars at Chitral, Cherat, Sukkur, Thatta/Badin, Quetta, Pasni/Gwadar, and Regional Flood Forecasting/Warning Centres one in each province to deal with flash flood flows of Hill Torrents, besides floods in main rivers;
ii. Lack of attention to watershed management. Massive deforestation had taken place in KPK, AJK and Gilgit-Baltistan resulting in increased run-off and siltation in major reservoirs;
iii. Lack of storage dams (had Munda Dam and medium/small dams on Panjkora & Swat rivers in KP and Akhori Dam d/s Tarbela dam been in place, losses due to floods would have been minimal);
iv. Deferred maintenance of flood embankments (had these been maintained by provinces adequately, major losses would have been averted);
v. Non-professional flood management by provinces. Machinery, adequate stone reserve stock and sand bags etc. at vulnerable sections of flood embankments were not available. Evacuation routes, emergency shelters, war rooms were not properly planned;
vi. Lack of escape channels (U/S Taunsa, Guddu and Sukkur Barrages);
vii. Safety of Barrages (none of the barrages except Taunsa has been remodeled during past 63 years). Most of these are aged structures and do not have the adequate capacity to safely pass the floods of 2010 magnitude;
viii. Lack of capacity of NDMA and PDMAs (newly born entities);
ix. Inadequate budget allocation for maintenance of existing flood protection infrastructures and new flood works;
x. Institutions at Federal and Provincial levels were not adequately prepared to cope with such an unprecedented floods in the context of global climate changes.

6. FUTURE MITIGATION STRATEGIES

Pakistan needs to do all it can to stop weather disasters becoming catastrophes. The country urgently needs to step up efforts to protect people from future catastrophic flood disasters and increase the resilience of infrastructure, economies and communities including better emergency warning and evacuation systems, better flood protection for key infrastructure and plans to help communities recover once the waters recede. To prevent future catastrophic flood disasters, the government should lead in efforts to:

i. Improving and extending the Flood Forecasting System to include Upper Indus above Tarbela, and Kabul River above Nowshera (telemetry system on tributaries and additional weather radars);
ii. Development of flood management guidelines for Tarbela and Mangla reservoirs so as to enhance their flood mitigation role;
iii. Identification of future reservoirs that would have high flood mitigation role in addition to their agriculture and hydropower benefits (Munda , small/medium dams on Panjkora and Swat Rivers & Akhori);
iv. Identification of flood release channels/escape channels to desert areas/off channel storages that would provide major reduction in flood peak discharge in main rivers (d/s Taunsa and d/s Guddu and Sukkur)
v. Flood Plain Mapping/Zoning all along the Indus river and its tributaries for restricting/prohibiting by law permanent settlements in high and medium flood risk areas (provinces to enact laws);
vi. Resettlement/relocation of villages in flood plains to safe areas outside the flood bunds;
vii. Identification of low flood risk areas for future cities, towns and villages, industrial areas etc.;
viii. Rehabilitation and review the design discharge capacity of barrages on the Indus river system to enhance their safe flood discharging capacities;
ix. Review and revise the design criteria and discharge capacities of bridges/ communication infrastructure and flood protection bunds keeping in view the bench marks of 2010-floods;
x. Upgrading the flood protection facilities/bunds that provide protection to important installations such as power stations, oil refineries, industries etc.;
xi. Review of breaching sections and areas inundated as a consequence of breaches;
xii. Hill Torrent Management (flood dispersion structures);
xiii. Mutual Support Insurance System on country-wide basis to support recovery for infrastructure and affectees.

6.1 Comprehensive Flood Management Plan Studies

After the flood season 2010, Federal Flood Commission convened high level meetings on September 01, 2010 & September 08, 2010, in order to prepare a road map for Comprehensive Flood Management Plan and to review the existing Flood Early Warning System (FEWS) and Flood Plain Mapping/ Zoning. Keeping in view the colossal

damages from 2010 floods, it was decided that there is a need to review and upgrade the flood management and protective measures to cope with such a high magnitude event in future.

In order to provide detailed input for preparation of Comprehensive Flood Management Plan, following four short term studies were required to be carried out:

Package # 1:	Flood Forecasting & Early Warning System
Package # 2:	Issues and Options in Flood Management
Package # 3:	Review Design of Hydraulic Structures and Flood Protection Infrastructure in All Provinces/ Agencies
Package # 4:	Flood Plain Mapping/Zoning

Detailed TORs of above mentioned studies were prepared in consultation with all the stakeholders and sent to Ministry of Water and Power for exploring the source of financing and seeking financing window through grant funds/Technical Assistance of International Donors such as ADB, World Bank, Dutch Trust Fund, etc.

6.2 Status of Flood Damage Rehabilitation/ Reconstruction Plans

Federal Flood Commission is coordinating with all the federal and provincial concerned executing agencies for preparation of rehabilitation & reconstruction plan and PC-Is of the related projects. The rehabilitation & reconstruction plan and the PC-I prepared by the executing agencies will be technically reviewed by Federal Flood Commission and recommended to concerned forums for their approval and funding arrangement.

6.2.1 Strategy for Restoration/ Reconstruction Works

At the end of monsoon season 2010, Federal Flood Commission (FFC) organized a special meeting on September 20, 2010, under the chairmanship of Chief Engineering Advisor/ Chairman Federal Flood Commission, to review the damages occurred to Irrigation, Drainage & Flood Protection Infrastructure and "strategy" of the Provincial Departments and Federal Line Agencies for restoration/ reconstruction of damaged infrastructure. The following directions were issued to Provincial Irrigation Departments and Federal Line Agencies in the meeting.

i. Restoration/ Rehabilitation Plans would be prepared on the basis of the DNA Report which was likely to be submitted by the Banks in the first week of October, 2010.
ii. The Provinces/ Federal Line Agencies should immediately complete the emergent works on the approach adopted by the Punjab Government so that the next Rabi crop is not affected.
iii. After receipt of the DNA Report, the Provinces/ Federal Line Agencies would prepare PC-Is for the restoration/ rehabilitation plan for further processing by Federal Flood Commission.

iv. All the Provinces/ Federal Line Agencies shall furnish detailed comments and suggestions on the draft TORs for the Comprehensive Flood Management Plan to FFC within one week's time.

6.2.2 Immediate Rehabilitation Works:

The immediate rehabilitation works involved closing canal breaches, provisional repairs to structures and de-silting of canal sections, wherever needed. Most of these works have been completed on "war footing" basis in order to make the irrigation system operational for irrigation water supplies for the Rabi Season.

Immediate nature works i.e. canal breaches, flood embankments etc. have been completed to restore the irrigation system for Rabi season and also to keep the rivers flow in main streams particularly in Punjab, Khyber Pakhtunkhwa and Balochistan. However, the magnitude of damages in Sindh and adverse site conditions hampered the restoration works, which needs to be expedited in order to ensure their safety in the coming flood season.

WORK IN PROGRESS AT TORI BUND COMPLEX (MARCH 03, 2011)

Irrigation and Power Departments, Governments of Punjab, Khyber Pakhtunkhwa and Balochistan have carried out their immediate nature restoration works by diverting Provincial ADP funds. Provincial Irrigation and Power Department, Government of Sindh and Federal Line Agencies were advised in the Post Flood meetings of Federal Flood Commission held on 20th September, 2010 and January 31, 2011 to follow the model of PID, Punjab, Khyber Pakhtunkhwa and Balochistan.

RESTORATION OF LOWER SWAT CANAL IN PROGRESS

DADU – MORO BRIDGE ROAD BREACH

6.2.3 Medium and Long Term Rehabilitation Works:

After flood season 2010, Federal Flood Commission requested the Provinces/Federal Line Agencies to prepare their restoration plans for Medium Term/Long Term Projects so that at least priority reconstruction/ rehabilitation works are completed before June

2011, whereas Long Term projects requiring remodeling on bench marks of 2010-Floods are to be completed within next 2-3 years. Keeping in view the forthcoming flood season 2011, it was also felt essential that the Provinces and Federal Line Agencies will mobilize all resources to repair the infrastructure, streamline the procedures and update the SOPs for regulation of major reservoirs in order to ensure the safety and face the future floods in a much better state of preparedness.

The Rehabilitation/Reconstruction Plans of Sindh, Gilgit-Baltistan and FATA are worth Rs 14,346 billion, Rs 132.751 million and Rs 569.045 million respectively, while rest of the Provinces/Federal Line Agencies are in process of preparation of their PC-Is/ Reconstruction Plans.

AMANDARA HEADWORKS RESTORATION IN PROGRESS

Irrigation & Power Department, Government of Sindh submitted PC-Is of seventy six (76) Restoration/Strengthening of flood protection infrastructure worth Rs 16.232 billion. These schemes were technically cleared by the Scrutinizing Committee at the reduced cost of Rs 14.346 billion in its meeting held on January 06, 2011 subject to availability of funds. Sixty four (64) schemes costing Rs 13.987 billion were approved by the CDWP in its meeting held on January 21, 2011 whereas 12 Nos. schemes costing Rs 359.00 million are under process with Ministry of Water and Power for approval of DDWP.

6.3 Mechanism for Implementation of Rehabilitation/ Reconstruction Works

As mentioned in the Summary for the Council of Common Interests, Planning for reconstruction has begun with the objective of restoration of damaged/ washed away infrastructure. Reconstruction will rely on existing project implementation responsibilities and processes within the federal and provincial governments.

Additionally, government has constituted the National Disaster Management Oversight Committee (NDMOC) for monitoring progress and overall oversight. A Flood Reconstruction Unit has been established in the Planning Commission to plan and coordinate post-flood reconstruction for fast track project approval. Planning Commission will also ensure effective monitoring of projects.

6.4 Pre-emptive Measures to Avert the Possibility of the Impact of un-expected Floods in monsoon season (2011)

In order to avert the possibility of the impact of un-expected rainfalls and floods during the next monsoon season 2011, Federal Flood Commission advised Provincial Irrigation Departments of four provinces, Federal Line Agencies & WAPDA to take the following pre-emptive measures:

i. Pre-flood monitoring of all flood protection infrastructures (flood bunds, spurs barrages and allied works etc,) be ensured well before start of flood season of 2011 and report in this respect be prepared and circulated among all concerned including Federal Flood Commission.
ii. Preparation of District/Area-wise Comprehensive Flood Fighting Plan by the Provinces/Federal Line Agencies depending upon the vulnerability of the Area.
iii. Outline SOPs for implementation of Flood Fighting Plan in their respective areas, keeping in view the experience of 2010 Floods.
iv. Review the existing SOPs of major reservoirs so as to ensure their flood mitigation role and also prepare SOPs for barrages and ensure their implementation in their respective jurisdiction for safe passage of flood peak in future.
v. Ensure strict vigilance and round the clock Racki/ Monitoring of flood bunds at vulnerable locations particularly during peak flow hours besides vulnerable hill torrents and flood generating nullahs during flood season.
vi. Effective arrangement for liaison with Flood Forecasting Division (FFD) Lahore Pakistan Meteorological Department and WAPDA for issuance of flood warnings well in time upto the levels of District Administration.
vii. Ensure effective implementation of laws/bylaws related to execution of development projects in flood prone areas and Riverine areas.
viii. Updation of inventory of flood bund indicating design parameters and their existing condition with the date of last field monitoring. Also ensure proper maintenance of flood embankments to avoid major losses.
ix. Ensuring provision of adequate O&M funds by the respective Federal & Provincial Agencies in their annual development programme and completion of all needed work including 2010 flood damage restoration works well before the start of monsoon season 2011.
x. Ensure Monitoring of ongoing flood works as per existing mechanism of Federal Flood Commission.
xi. Associate local abadies/beneficiaries/NGOs for co-ordinated flood management & protective measures as social mobilization is important factor.

xii. After peak flow/flood season, reconnaissance of all the floods works be carried out. Status Report may be prepared and submitted to all concerned with in two months. Remedial measures should also be started immediately wherever required.

xiii. The Reconstruction /PC-Is of flood protection infrastructure damaged during 2010-Floods based on DNA report may be submitted at the earliest to this office for approval and further processing.

6.5 Post Flood meeting of Federal Flood Commission

Post Flood meeting of Federal Flood Commission was held on January 31, 2011 under the Chairmanship of Honorable Federal Minister for Water & Power in the Committee Room of Ministry of Water and Power, A-Block Pak. Secretariat, Islamabad in order to review the Re-construction Plans of the Provinces/Federal Line Agencies. Keeping in view fast approaching the next flood season 2011, therefore, Provinces/Federal Line Agencies were requested to mobilize all resources for repairing the infrastructure, streamline the procedures and update SOPs to ensure the safety of structures so as to face any future floods in a much better state of preparedness. After detailed deliberations, the following decisions were taken during the said meeting:

i. Chief Engineering Adviser/Chairman, Federal Flood Commission will write a letter to Chief Minister, Sindh for allocation of adequate funds for restoration works on urgent basis by diverting funds from Provincial ADP, so that all restoration works could be completed well before start of monsoon season 2011.

ii. Federal Flood Commission will depute Monitoring Teams to visit all the four provinces for holding meetings with concerned authorities for review of progress on restoration projects and random sites visit of restoration/reconstruction projects on monthly basis. The monitoring report would be submitted to M/o Water and Power regularly.

iii. PID, Sindh will submit its Re-construction Plan with time lines within a week's time to Federal Flood Commission and other concerned organizations.

iv. PID, Sindh should activate their respective field formations for vigorously carrying out restoration activities on war footing basis

v. NDMA will take lead for activating PDMAs to have (i) effective coordination with District Authorities in Disaster Management related activities, (ii) early response and (iii) efficient information collection and flow system etc.

vi. All Executing Agencies need to be fully active and move on fast track for immediate restoration of the damaged infrastructure from their own resources without waiting for Federal Government or any external assistance.

vii. Efforts would be made by all the provinces to ensure the community participation in flood damages restoration activities in order to make realization to flood affactees/farmers the ownership of flood works.

viii. WAPDA and PID, Khyber-Pakhtunkhwa will expedite installation of the washed away discharge gauges and telemetry stations, so as the same could be made operational well before start of monsoon season 2011.

ix. Flood Early Warning System (FEWS) of PMD needs up-gradation and expansion in order to include upper reaches of Indus above Khairabad Bridge and also to include effect of snow melting. PMD in consultation with NDMA and Federal Flood Commission will take action on the matter. Progress on the same would be reviewed in the next meeting.

x. WAPDA will prepare proposal regarding expansion of Telemetry System on major and other rivers, which contribute to Indus.

xi. PMD will follow up with FFC and NDMA for establishment of Flood Forecasting System for flash flooding in Khyber-Pakhtunkhwa and Hill Torrent areas of the country.

xii. Federal Flood Commission will hold urgent meeting with all the Barrage-operating authorities for preparation of SOPs for Barrages and review the design criteria of flood protection infrastructure and river training works keeping in view bench marks of 2010-Floods for management of future flood events in a better way.

xiii. NDMA and PDMAs need to be proactive to make the Union Council Level Committees more responsive, effective and efficient in disaster management activities in future events.

xiv. Next meeting of Federal Flood Commission would be held in April for review of progress on restoration projects of the Provinces/Federal Line Agencies.