

**GOVERNMENT OF PAKISTAN
MINISTRY OF WATER RESOURCES**

ANNUAL FLOOD REPORT 2018



**OFFICE OF THE CHIEF ENGINEERING ADVISOR
& CHAIRMAN FEDERAL FLOOD COMMISSION
ISLAMABAD**

ANNUAL FLOOD REPORT-2018



Heavy Rains in Lahore (July 2018)



Heavy Rains in Karachi

**OFFICE OF THE CHIEF ENGINEERING ADVISOR/
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EXECUTIVE SUMMARY

Flood constitutes one of the world's most serious environmental hazards. Thousand years of recorded history tells man's repeated failure to evade the destruction of floods. In spite of many years of experience and highly developed techniques, flood even now continues to play havoc in most part of the world.

The intensity and frequency of occurrence of floods in the region in general and Pakistan in particular has considerably increased since past several years, because of global warming and rapid climate change. That is why Pakistan has faced major flood events during the past several, which indicates that flood has now become a regular feature in the country. This is exacerbated by the inadequate surface water storage capacity for absorbing flood peaks, chronic and increasing threat of encroachments in flood plains & waterways, inadequate discharge capacity of some of Barrages/Bridges, inadequate budget allocation under PSDP and Provincial ADP for maintenance of existing infrastructure and execution of new flood projects and importantly a distorted natural drainage network.

Capacity deficits exist both at provincial and districts levels. There is a lack of effective coordination among institutions involved in flood management, caused in part by limitations of technical capacities such as dissemination of early warning, disaster preparedness measures, emergency response and structural measures for flood mitigation. The local communities do not have enough disaster preparedness information and there is lack of general awareness raising, sensitization and education of the masses regularly affected by floods, focusing especially on populations residing within the active flood plains along major, secondary and tertiary rivers including Hill Torrents.

The riverine floods are generally caused due to heavy concentrated rainfall in catchment areas of major & other rivers, which are sometimes augmented by snowmelt due to high temperature and generate exceptionally high flood flows in main rivers & their tributaries flowing across the country. The torrential rains are caused due to monsoon currents originating from Bay of Bengal and resultant depressions (strong weather system) often cause heavy downpour in the catchment areas of major and other rivers including hill torrents, which is sometime augmented by the Westerly Wave from Mediterranean Sea.

Pakistan has suffered a cumulative financial loss of more than *US\$ 38.171 billion* during the past 71 years. Around 12,330 people lost their lives, some 197,273 villages damaged/destroyed and an area more than 616,598 Sq.km was affected due to 24 major flood events. The 2010 floods were worst flooding in the past about 80 years in the region (**Table-2**).

Prior to 1976, the Provincial Governments were responsible for the planning and execution of flood protection works. Disastrous floods of 1973 & 1976 caused heavy loss of life and property and it was felt that the existing flood protection facilities and planning

were inadequate for effective protection of private and public infrastructure in the country. Heavy losses to the economy due to floods were discussed in the Inter-Provincial Conference held in January 1977 wherein it was decided to establish Federal Flood Commission (FFC) for integrated flood management on country wide-basis.

Since its establishment, FFC has so far prepared and implemented three (3) National Flood Protection Plans, i.e. National Flood Protection Plan-I (1978-88), National Flood Protection Plan-II (1988-1998) & National Flood Protection Plan-III (1998-2008) through Provincial Irrigation Departments and Federal Line Agencies. Besides this, two Flood Restoration Damages Projects i.e. 1988-FDRP & 1992-94-FDRP were also implemented by FFC with the financial assistance of external donors. A total investment of more than Rs 30.00 billion has been made on construction of around 5,483 flood protection structures during the past 39 years through PSDP/Foreign Aided Programme, besides, up gradation of country's existing Flood Forecasting & Warning System (**Table-4**).

Work on preparation of National Flood Protection Plan-IV was delayed due to low priority given to Flood Sector as result of drought like conditions over the country during 2007-08. However, the urgent flood protection works were used to be executed through PSDP funded Normal/Emergent Flood Programme. Around 356 flood protection works costing Rs 8.590 billion were executed during the period of 2007-08 to 2017-18. As a result of large scale damages during 2010 floods, followed by subsequent flood events during 2011 & 2012, the need for investment in flood sector gained importance.

Federal Flood Commission started working on formulation of National Flood Protection Plan-IV (NFPP-IV). For that purpose, consultants were engaged in May 2013 through World Bank Funded Water Sector Capacity Building & Advisory Services Project (WCAP) for preparation of NFPP-IV for next ten years. The National Flood Protection Plan-IV had been prepared in close consultation with all stakeholders at Federal and Provincial Governments level. The draft final version of NFPP-IV was submitted by the consultants to FFC in May 2015. Through consultative process based on a series of meetings with all the federal and provincial stakeholders, the final draft version of NFPP-IV costing Rs 332,246 million was submitted to the CCI for approval. NFPP-IV remained under an extensive deliberation process during the four (4) meetings of the Council of Common Interest (CCI) held on February 29, 2016, March 25, 2016 & December 16, 2016. It was finally approved in its 31st meeting held on May 02, 2017. The following decision was taken:

“The CCI approved the proposed NFPP-IV (2015-25) and decided that the Financing of NFPP-IV would be made by the Federal and Provincial Governments @ 50:50. The provinces will decide their respective share of contribution amongst themselves and report to the Federal Government”.

In compliance to CCI's above decision & to ensure commencement of work without any delay, FFC organized a joint meeting of concerned Federal and Provincial level organizations on 1st June 2017 to review priority of projects for implementation of NFPP-IV and their inclusion in Umbrella PC-I. The draft Umbrella PC-I of NFPP-IV was submitted by the Consultants (M/S NESPAK) to FFC on 28th July 2017. FFC conveyed to

consultants detailed comments on draft umbrella PC-I on 17th August 2017. A meeting of consultants & FFC was organized on 12th September 2017 in office of CEA/CFFC to review the draft umbrella PC-I of NFPP-IV in the light of observations of FFC. The draft umbrella PC-I of NFPP-IV remained under extensive review for its refinement by the consultants in consultation with FFC's Officers.

The modified umbrella PC-I of NFPP-IV was considered and cleared by Scrutinizing Committee of FFC in its meeting of 15th December 2017 subject to certain observations. The updated umbrella PC-I was submitted by the consultants to FFC on 28th February 2018, which was circulated among the Irrigation Departments of the four provinces on the same day for getting its clearance from PDWP.

The umbrella PC-I of NFPP-IV was cleared by the PDWP's of Governments of Sindh, Balochistan, Punjab and Khyber Pakhtunkhwa on 6th April 2018, 8th May 2018, 12th June 2018 and 10th August 2018 respectively. The finalized version of umbrella PC-I was submitted to Ministry of Water Resources on 16th November 2018. Ministry of Water Resources had submitted the same to Ministry of Planning, Development & Reforms on 11th January 2019. The umbrella PC-I is planned to be approved from CDWP/ECNEC shortly.

FLOODS 2018

Pakistan Meteorological Department (PMD) issued the preliminary seasonal forecast on June 08, 2018 for Monsoon Season 2018, which is described below;

- *Keeping in view the global, regional and local meteorological indicators, the seasonal outlook for Pakistan summer monsoon 2018 has been prepared. It is evident from the model output that monsoon is expected to be more active during the first half than the second one. However, the most likely salient features are stated below:*
- *In northern Pakistan, rainfall is expected to remain “Normal to slightly above normal of long term average” during first half of the season and below normal during 2nd half.*
- *In southern Pakistan, rainfall is expected to remain “near normal of long term average” during first half of the season, and largely below normal during the 2nd half.*
- *The prevailing temperatures trend in Pakistan indicates high probability of few “Extreme rainfall events” in Punjab, and “GLOF events” in Gilgit-Baltistan/Chitral regions during monsoon season.*
- *In the light of “Outlook of Summer Monsoon 2018” and already prevailing water shortage in the country, the water managers should take measures for water storages accordingly.*

As per the prediction of PMD, monsoon remained more active during the first phase as compared to 2nd phase during monsoon season 2018. Overall below normal rainfall was recorded during monsoon season 2018. Month-wise detail is given as under;

- In July, rainfall at country level was **below** normal. However, some good rains (above Normal) were occurred over Punjab, KP & G-B, whereas below normal over Sindh & Balochistan and close to Normal rainfall was received over AJK.
- In August, overall country level rainfall was below Normal.
- During September, country level rainfall was below normal. However, Balochistan Province received some good spells of rainfall.

Overall nine (9) monsoon Lows/Depressions originated during the monsoon season 2018. None of these entered into Pakistan, However, only one reached near the border of Pakistan, but that also re-curved over central India to north-northeastward. Two cyclonic storms were developed during the monsoon season 2018. One in Bay of Bengal and the other in Arabian Sea. However, none of them affected our country. Nine rainfall spells occurred during the monsoon season 2018. However, no one created High Flood situation (danger level flooding) in the major and other rivers except for River Chenab, which attained High Flood Level (201,878 cusecs i.e. inflow at Marala Barrage on 13th August 2018) for a short duration. One sharp peak of High Flood Stage (122,000 cusecs i.e. Inflow on 14th August 2018) was also recorded in River Jhelum at Mangla. River Kabul attained Medium Flood Level at Warsak (54,638 cusecs on 19th June 2018) & Nowshera (105,300 cusecs on 7th July 2018). River Ravi also attained Medium Flood Level at Balloki (68,030 cusecs on 27th September 2018). Tarbela Dam attained its Maximum Conservation Level of 1550.00 feet on 20th August 2018 whereas Mangla Dam could not attain its Maximum Conservation Level of 1242.00 feet. It attained maximum water level of 1178.60 feet on 15th September 2018. According to National Disaster Management Authority, 88 persons lost their lives and 362 houses were damaged due to 2018-Rain/Floods.

WAY FORWARD

Provincial Irrigation Departments and Federal Line Agencies (PIDs & FLAs) may carry out all urgent nature rehabilitation and O&M works of flood protection infrastructure (civil works) and Flood Forecasting & Warning System equipment including radar and Flood Telemetry Networks so as to complete the works well before the start of monsoon season 2019. The encroachments in the flood plains and waterways/ drains may be removed by the PIDs & FLAs so as to avoid loss of human lives and damages to the property in future floods. PIDs & FLAs may expedite action on the decisions taken in the Post Flood Meeting of FFC held on 5th December 2018, Post Flood 2018 Conference of NDMA held on 12th December 2018 and Pak. Army Post Flood 2018 Conference held on 13th December 2018 for timely completion of proposed works, so as to face monsoon season 2019 in a much better way. The decisions taken in FFC's Post Flood 2018 meeting held on 5th December 2018 are re-produced as under;

- i. PIDs & Federal Line Agencies to complete all ongoing flood protection works being executed through Public Sector Development Programme (PSDP), Provincial

Annual Development Programme or any other Programme, well before the start of Monsoon Season 2019.

- ii. The Irrigation, Drainage & Flood Protection Infrastructure damaged during previous floods may be restored/ rehabilitated on priority basis, so as to complete the task well before the start of Monsoon Season 2019.
- iii. Pre-flood inspection of all Flood Protection Infrastructures (flood bunds, spurs, Barrages/Head Works and their allied components etc.) may be carried out jointly with concerned Corps of Engineers, well in time, and critical reaches as identified by the inspection teams may be got repaired/ strengthened well before the start of Monsoon Season 2019.
- iv. Adequate O&M funds for Flood Protection Infrastructures may be arranged through Provincial Budget and all urgent nature O&M works related to Irrigation, Drainage & Flood Protection Infrastructures may be completed well before the start of Monsoon Season 2019.
- v. PID Punjab, NHA and Pak. Railways to make necessary arrangements of explosive and others flood fighting material at sites of pre-determined breaching sections in close coordination with concerned Corps of Engineers. Stone reserve stock/ flood fighting material may also be arranged at all critical reaches of flood embankments well before start of monsoon season 2019.
- vi. Flood Fighting Plans may be prepared by the PIDs & Federal Line Agencies including NHA and Pak. Railways keeping in mind lessons learnt during the past consecutive flood events and circulated among concerned organizations including FFC.
- vii. The encroachments may be removed from flood plains/waterways of main & other rivers including hill torrents and drainage network particularly along Bara Kas Nullah and Jhelum river downstream Mangla, besides, removal of settlement on flood protection structures well before the start of Monsoon Season 2019.
- viii. PIDs & WAPDA to carry out all essential O&M Civil & E/M works of all Barrages/Headworks well before start of monsoon season 2019.
- ix. WAPDA & Pakistan Metrological Department/FFD, Lahore may carry out all essential O&M works of Flood Forecasting and Warning System equipment well in time and ensure that System is fully functional before start of Monsoon Season 2019.
- x. The links for coordination among flood management related organizations at Federal & Provincial Government level needs to be further improved keeping in mind the experiences of past flood events. The concerned organizations may link up themselves with Mangla Dam Authorities (through video link system) for better coordination during upcoming Monsoon Season 2019.
- xi. PCIW may continue its efforts on making necessary arrangements with Indian Counterpart for obtaining discharges of Eastern Rivers and Chenab River flood flow data at Salal HEP, 56 KM upstream of Akhnoor bridge across Chenab River, besides inflows & levels of reservoirs across Eastern rivers i.e. Bhakra, Pong & Thein Dam

Projects and its transmission to end users (FFC, PMD/FFD, Lahore, WAPDA, NDMA & PDMA) during Monsoon Season 2019.

- xii. TMA & City District Government may expedite action on demarcation of water way of Lai Nullah and also take necessary steps for removal of encroachments on banks/waterway of Lai Nullah, besides, stoppage of dumping solid wastes/garbage & building material in bed of Lai Nullah.
- xiii. PIDs & FLAs including NDMA, PDMA, GBDMA, FDMA & SDMA etc. may ensure effective use of Flood Plain Inundation maps already circulated by FFC among all concerned organizations for better flood management during Monsoon Season 2019.
- xiv. Under the increasing flood threat in the context of climate change, allocation of funds for Normal/Emergent Flood Programme under PSDP may be significantly enhanced as per actual needs of the provinces.

ACKNOWLEDGEMENT

The preparation of Annual Flood Report of Federal Flood Commission commenced from 1998 with a view to compile essential information on yearly basis for documentation of various activities carried out by FFC during that year, besides, flood events experienced during monsoon season, flood flow data measured, lessons learnt from flood events and reflecting recommendations for handling future flood events in much better way.

The 2018 Annual Flood Report contains inter-alia, information about major past flood events witnessed in Pakistan, pre- flood actions/preparatory works carried out by FFC and other organizations, floods faced during monsoon season 2018 and fighting measures taken for better flood management, besides, relief measures carried out by the concerned organizations. The report focuses on floods experienced during monsoon season 2018 and damages to private and public infrastructure in various parts of country.

The services of all officers involved in the preparation of this report are greatly acknowledged.

FLOODS IN GENERAL PERSPECTIVE

1. FLOODS IN GENERAL PERSPECTIVE

1.1 FLOOD PROBLEM IN PERSPECTIVE

The riverine floods take hours or even days to develop, giving ample reaction time to locals to prepare/evacuate. However, flash floods generate quickly in mountainous regions with little warning/reaction time for locals. Flash floods can be extremely dangerous, instantly turning a babbling brook into a thundering wall of water and sweeping everything on its way downstream. Floods occur in all types of rivers and their tributaries. Localized flooding may be caused or exacerbated by drainage obstructions such as landslides, ice, debris, or dam failure. The increase in flow may be the result of sustained rainfall, rapid snow melting, Monsoon/Depression (Weather System) or tropical cyclones. Rapid flood events including flash floods, more often occur on smaller rivers, rivers with steep valleys or rivers that flow for much of their length over impermeable terrain. The cause may be localized convective precipitation (intense thunderstorms) or sudden release from an upstream impoundment created behind a dam, landslide or glacier.

Disaster experts classify floods according to their likelihood of occurring in a given time period. A hundred-year flood, for example, is an extremely large, destructive event that would theoretically be expected to happen only once every century. But this is a theoretical number. In reality, this classification means there is a one-percent chance that such a flood could happen in any given year. Over recent decades, possibly due to global climate change, hundred-year floods have been occurring worldwide with frightening regularity.

Climate change is considered to be a critical global challenge and recurring flood events have demonstrated the growing vulnerability to climate change. The impacts of climate change range from affecting agriculture to further endangering food security, to rising sea levels and the accelerated erosion of coastal zones, increasing intensity of natural disasters like floods & droughts, species extinction and the spread of vector-borne diseases.

It is generally recognized that complete prevention from floods, humanly impossible but protection from flood is feasible and a vital necessity. By proper planning, means can be devised to harness the fury of floods to safeguard human life and property. Devoid their destructive power, floods can be used in the service and the welfare of a community.

1.2 PAKISTAN'S FLOOD CONTEXT

Pakistan is a country with diverse type of land and fluctuating pattern of climate. Climate is usually considered hot and dry in Pakistan but it has shown significant obvious variations in last few years. Many districts and urban centers located along the rivers banks are ever on a great risk to confront with various types of floods i.e. riverine flood, flash flood and urban floods particularly in Punjab & Sindh provinces. The floods cause damages to hundred thousand acres of fertile agricultural lands, standing crops and affect adjoining abadies with monetary loss in billions of rupees. Major direct flood damages in

the country are caused to agricultural lands, standing crops, urban and rural abadies, besides, other private & public property.

The riverine floods are generally caused due to heavy concentrated rainfall in the rivers catchments, during monsoon season, which is sometimes augmented by snow melt flows. Monsoon currents originating from Bay of Bengal and resultant depressions (weather system) often result in heavy downpour in the Himalayan foothills, which occasionally generate destructive floods in main rivers and their tributaries. Sometimes exceptionally high flood flows in major rivers are generated due to formation of temporary natural dams by landslide or glacier movement and their subsequent collapse.

Flooding of the Indus River and its tributaries represents the greatest hazard in Pakistan. Floods occur usually in summer season (July - October). Therefore, damages to agriculture sector are mainly to the standing Kharif crops. However, in some cases the inundated lands do not dry up in time and ultimately affecting sowing Rabi crops.

The major rivers (Indus, Jhelum, Chenab, Ravi and Sutlej) and secondary rivers (Kabul, Swat etc.) cause flood losses by inundating low lying areas round the rivers bed by damaging irrigation and communication network, besides, land erosion along the rivers banks. In the upper part of the Indus Basin (Punjab & Khyber Pakhtunkhwa), floodwater spilling over the high banks of the rivers generally turns back to the main rivers channel.

In the lower parts of the country i.e. Lower Indus Basin (Sindh province); River Indus is flowing at ridge i.e. higher elevation than adjoining lands. That is why flood embankments have been provided along both sides of the river. The flood water, if breaches the embankments do not return to the main river channel. This largely extends the area and period of inundation resulting in more damages to abadies, standing crops and other private as well as public infrastructure.

Sometimes breaches are occurred in the flood embankments, when the rivers attain the Exceptionally High Flood Level. At times, the flood embankments are breached at pre-determined locations to save the main structures across main rivers. The remodeling/rehabilitation works of Barrages, on the basis of 100 years return period, were taken up by the Punjab & Sindh province. The construction of Khanki Barrage on River Chenab and rehabilitation of Jinnah Barrage and Taunsa Barrage on River Indus and Sulemanki Barrage on River Sutlej has been complete. The remodeling work regarding Trimmu and Panjnad Barrage is underway. Remolding works on Guddu Barrage across River Indus is in progress. The remodeling works on Sukkur Barrage across River Indus would be started as soon as feasibility and detailed design is completed.

1.3 FLOOD CONTROL OBJECTIVE & NEED

Flood management planning in Pakistan is being carried out to essentially cover the following three specific objectives:

- i. To reduce or eliminate damages to existing properties;

- ii. To prevent future increase in damages; and
- iii. To mitigate the residual hazards.

In Pakistan, flood control planning is a complex problem and calls for great ingenuity and experience on the part of the planners. The nature of flood problems varies in each of the four provinces and federally administered areas due to varying physiographic, climatic, demographic, and socio-economic conditions. Even the characteristics of catchment areas of various rivers differ from each other. Flood problems relating to various provinces are given as under;

PUNJAB

- Flood protection marginal bunds have been generally constructed either to protect Headworks and other irrigation structures, or to safeguard certain towns, villages & adjoining agricultural lands in the province.
- Due to general topography of the area, pre-determined breaching sections have been provided in the Right Marginal Bunds (RMBs) for operation for safety of Headworks/ barrages in case of exceptional high flood flows i.e. likely to exceed the designed level.
- In order to protect areas from erosion, spurs have been constructed in critical reaches. These spurs have protected vast areas and in some cases even large tracks of eroded lands have been reclaimed.

SINDH

- The Indus River flows on a ridge in Sindh Province and generally, surrounding areas (outside the flood embankments) are lower than the river bed; hence, water once leaving the Indus River does not return to the main channel.
- The escaped water thus causes greater damage to widespread areas, and it persists for a longer period even after flood peaks are over.
- Sindh province is situated at tail end, hence, drain out all rivers and if flood protection measures adopted in the upper Sindh are not properly planned, severe damages are likely to occur in the Province.
- In most of the reaches, a double line of flood embankments has been constructed on both sides of the river from Guddu to few kilometers short of Arabian Sea.
- These flood embankments have been further compartmentalized to contain widespread inundation.

KHYBER PAKHTUNKHWA

- The floods in the province are mainly due to flash flood flows in secondary rivers (Kabul, Swat, Panjkora, Kurram etc.) and major hill torrents/flood flow generating nullahs having steep bed slopes, which greatly increase flood velocity and severely erode the banks.
- Mostly flood protection walls/embankments and short spurs have been constructed to save the areas from spill action and erosion.

- A battery of around 40 spurs having considerable shank length with Marginal Bund have been constructed along the right bank of Indus River “Chashma Barrage – Ramak Reach” for protection of D.I. Khan City and adjoining area from devastating flood flows of Indus River.
- A large number of spurs and flood embankments/flood protection walls in critical locations have also been constructed along Kabul, Swat, Panjkora, Kurram rivers and their tributaries including flood flows generating nullahs/hill torrents.

BALUCHISTAN

- Due to peculiar physiographic and climatic characterizes in Balochistan, the bed slopes of rivers and nullahs in Balochistan are very steep.
- It generates flash flood flows with high velocity causing banks erosion and inundations of low lying area along the banks of rivers and their tributaries.
- Mostly flood protection walls/embankments & short spurs have been constructed for protection of orchards, agricultural lands and abadies.
- Flood flows regulators/ flood diversion structures have also been constructed to dissipate the thrust of flood water and use the same for agriculture in the area.

FEDERALLY ADMINISTERED AREAS (GILGIT-BALTISTAN, FATA & AJK)

The bed slopes of rivers and nullahs in Gilgit-Baltistan, FATA and AJ&K are very steep. The flash flood flows generated in main rivers and their tributaries cause severe banks erosion. Flood Protection walls and short spurs in PCC & gabion crates are constructed in order to check the spill and erosive action of flood flows in rivers/hill torrents. The main purpose of such interventions is to provide protection to abadies, agricultural lands and other private and infrastructure.

1.4 WATER RESOURCES IN PAKISTAN

Five main rivers, namely, the Indus, Jhelum, Chenab, Ravi and Sutlej and their tributaries flow through the country’s plains. The Indus, Jhelum and Chenab are known as the **Western Rivers** and Ravi, Beas, and Sutlej known as the **Eastern Rivers**. 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 feet)**, **Nanga Parbat (26,660 feet)**, **Rakaposhi (25,552 feet)** 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.

1.5 IRRIGATION NETWORK OF PAKISTAN

The Irrigation System of Pakistan is the largest integrated irrigation network in the world, serving around 45 million acres of contiguous cultivated land. The system is fed by the waters of the Indus River and its tributaries. The irrigation network of Pakistan mainly

comprises of 3 major reservoirs (Tarbela, Mangla & Chashma), 19 Barrages, 12 Inter-river Link Canals and 45 independent irrigation canal commands, besides, 435 Large, Medium & Small Dams.

The major storage reservoirs include Tarbela (existing Live Storage Capacity = 6.101 MAF against original storage capacity of 9.70 MAF), Chashma (existing Live Storage Capacity = 0.278 MAF against original storage capacity of 0.70 MAF) on River Indus and Mangla with existing Live Storage Capacity = 7.356 MAF (this includes the additional storage capacity of 2.88 MAF after Mangla Dam Raising allowing Maximum Conservation Level of 1242 feet) against original storage capacity of 5.34 MAF on River Jhelum. The schematic diagram of Indus Basin Irrigation System is given at **Figure-1**. 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 made through a time-schedule called “Warabandi”.

1.6 FLOOD PROTECTION FACILITIES IN PAKISTAN

The existing flood management strategy includes flood peaks regulation by three major reservoirs (Tarbela, Chashma on Indus & Mangla on Jhelum), protection of private & public infrastructure, urban/rural abadies and adjoining agricultural lands from spill and erosive action of major and other rivers including Hill Torrents by flood embankments/protection walls and spurs including other interventions, besides, Flood Forecasting & Early Warning System, Rescue & Relief measures in case of flooding situation. The existing flood protection facilities in the four provinces and Federally Administered Areas is given in **Table-1**.

TABLE-1
EXISTING FLOOD PROTECTION INFRASTRUCTURE

Sr. No.	Zone/Region/ Agency/District	No. of Protection Works
Punjab		
1.	Lahore Irrigation Zone	251
2.	Faisalabad Irrigation Zone	71
3.	Sargodha Irrigation Zone	325
4.	Multan Irrigation Zone	231
5.	Bahawalpur Irrigation Zone	89
6.	D.G. Khan Irrigation Zone	218
	Sub-Total (Punjab)	1,185
Sindh		
1.	Guddu Barrage Region	63
2.	Ghotki Feeder Canal Area Water Board	23
3.	Sukkur Barrage Region (Right Bank)	48
4.	Sukkur Barrage Region (Left Bank)	78
5.	Kotri Barrage	42
6.	Left Bank Canal Area Water Board	07
	Sub-Total (Sindh)	261

Khyber Pakhtunkhwa		
1.	North Irrigation Zone	439
2.	South Irrigation Zone	345
Sub-Total (KP)		784
Balochistan		
1.	North Irrigation Zone	159
2.	South Irrigation Zone	96
3.	Canal Irrigation Zone	05
Sub-Total (Balochistan)		260
Gilgit-Baltistan		
1.	Gilgit	02
2.	Hunza/Nagar	08
3.	Skardu	04
4.	Ghizar	04
5.	Astore	02
6.	Ghanche	09
7.	Diamer	01
Sub-Total (G-B)		30
FATA		
1.	Bajaur Agency	12
2.	Khyber Agency	21
3.	Kurram Agency	41
4.	Mohmand Agency	8
5.	Orakzai Agency	9
6.	North Waziristan Agency	9
7.	South Waziristan Agency	42
8.	FR Bannu	5
9.	FR D.I. Khan	26
10.	FR Kohat	15
11.	FR Lakki	7
12.	FR Tank	14
Sub-Total (FATA)		209
AJ&K		
1.	Bagh	03
2.	Bhimber	06
3.	Kotli & Mirpur	01
4.	Muzaffarabad	02
Sub-Total (AJ&K)		13
Grand Total		2,742

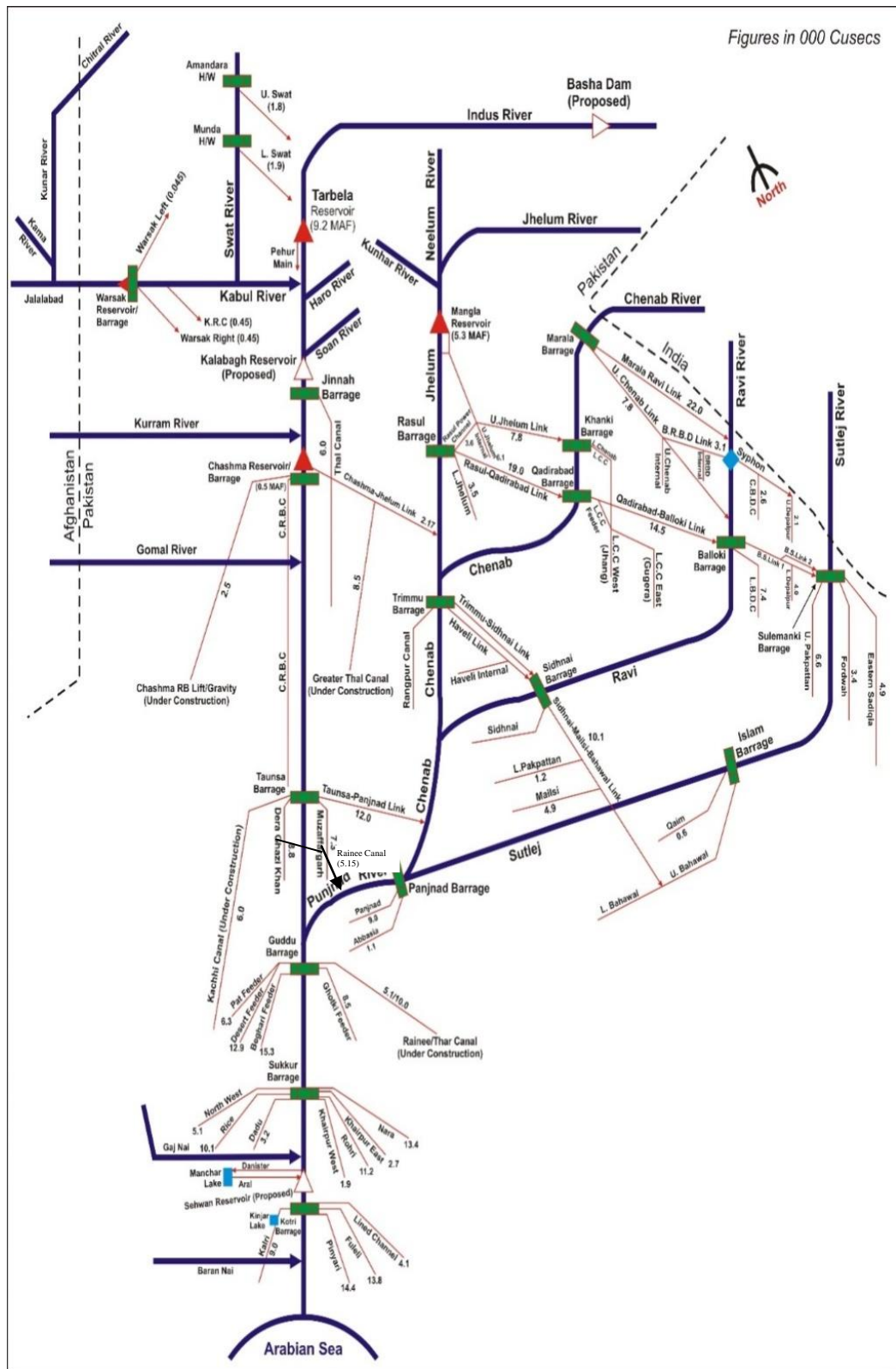


FIGURE 1: SCHEMATIC DIAGRAM OF INDUS BASIN IRRIGATION SYSTEM

1.7 IMPACTS OF GLOBAL WARMING & CLIMATE CHANGE ON FLOOD MANAGEMENT

Global warming causes climate change, which is a serious issue for the entire world. It is a serious threat to the third world as its impacts will not be felt equally across the earth. Developing countries including Pakistan are much more vulnerable to the impacts of climate change. The melting rate of glaciers in South Asia has increased, which may cause floods in Pakistan and neighboring countries in the coming years. Pakistan economy has faced significant losses due to environmental damages and degradations.

Pakistan is amongst the top ten countries on the globe experiencing frequent and intense climate change events such as floods, droughts, cyclones, heavy rains, heat waves/extremely high temperatures, etc. The average global temperature has increased due to increasing concentrations of carbon dioxide and other greenhouse gases in the atmosphere for last many years. During the last century, it increased by 0.6 degree Centigrade and is likely to increase further by 1.0 °C to 4.0 °C till the end of the current century.

The most recent extreme climate events witnessed by Pakistan are floods hitting various parts of the country during the monsoon season. The frequency of occurrence and intensity of floods has considerably increased during the past several years. The water security of the country is also threatened by the climate change. The increasing temperatures in the northern mountains of the country are likely to result in glacier melting, thereby affecting the flows of Indus River System.

1.8 HISTORICAL FLOOD EVENTS IN PAKISTAN

Since its creation, Pakistan has faced various severe flood events i.e. 1950, 1955, 1956, 1957, 1959, 1973, 1975, 1976, 1977, 1978, 19981, 1983, 1984, 1988, 1992, 1994, 1995, 2010, 2011, 2012, 2013, 2014, 2015 & 2016, the 2010 floods were worst ever in the country. The floods of various magnitudes affected vast areas in the four provinces including Gilgit-Baltistan, FATA & Azad Jammu & Kashmir. Owing to adverse impacts of climate change, in the recent years, vulnerabilities of communities to coastal & urban flooding have also increased. Flood damages are caused mainly due to riverine flooding in main rivers and flash floods in Secondary & Tertiary Rivers/Hill Torrents, Coastal flooding due to Cyclone & urban flooding due to torrential rains and inadequate storm drainage facilities, besides, GLOFs in northern parts of the country.

The unprecedented floods of 2010 were the worst floods in history of the country in which about 1985 people lost their lives, 1,608,184 houses were damaged/ destroyed, 17,553 villages were affected and total area of 160,000 Km² was affected. The historical flood events experienced in the past and their damages are given in **Table -2**.

TABLE-2
MAJOR FLOOD EVENTS WITNESSED IN PAKISTAN

Sr. No.	Year	Direct losses (US\$ million) @ 1US\$= PKR 86	Lives Lost (No)	Affected villages (No)	Flooded area (Sq-Km)
1	1950	488	2,190	10,000	17,920
2	1955	378	679	6,945	20,480
3	1956	318	160	11,609	74,406
4	1957	301	83	4,498	16,003
5	1959	234	88	3,902	10,424
6	1973	5134	474	9,719	41,472
7	1975	684	126	8,628	34,931
8	1976	3485	425	18,390	81,920
9	1977	338	848	2,185	4,657
10	1978	2227	393	9,199	30,597
11	1981	299	82	2,071	4,191
12	1983	135	39	643	1,882
13	1984	75	42	251	1,093
14	1988	858	508	100	6,144
15	1992	3010	1,008	13,208	38,758
16	1994	843	431	1,622	5,568
17	1995	376	591	6,852	16,686
18	2010	10,000 @ 1US\$= PKR 86	1,985	17,553	160,000
19	2011	3730* @ 1US\$= PKR 94	516	38,700	27,581
20	2012	2640** @ 1US\$= PKR 95	571	14,159	4,746
21	2013	2,000^ @ 1US\$= PKR 98	333	8,297	4,483
22	2014	440^^ @ 1US\$= Rs 101	367	4,065	9,779
23	2015	170 1US\$= PKR 105.00	238	4,634	2,877
24	2016	6# 1US\$= PKR 104.81	153	43	-
25	2017	-	172	-	-
26	2018	-	88	-	-
Total		38,171	12,418	197,273	

* Economic Survey of Pakistan 2011-12

** NDMA (<http://www.claimsjournal.com/news/international/2012/10/05/214891.htm>)

^ Thomson Reuters Foundation (<http://www.trust.org/item/20130909134725-rm708/>)(Agriculture sector)

^^ Economic Survey of Pakistan (2014-15)

1.9 INTEGRATED APPROACH IN FLOOD MANAGEMENT

Flood management plays important role in protecting people and their socio-economic activities in flood prone areas from flooding. The development in the river basins has been closely linked with successful implementation of flood control projects. In the past, exposure to flood risks has been handled largely through structural measures. However, strategies that rely largely on structural solutions may alter the natural environment of the river, which may result in loss of habitats, biological diversity and ecosystem productivity.

Further, structural approaches are bound to fail the moment an extraordinary or unforeseen event occurs. These traditional approaches, where the risks are merely transferred spatially, are likely to generate conflicts and inequities. Environmental degradation has the potential to threaten human security, including life and livelihoods, food and health security. This realization has recently led to calls for a paradigm shift from traditional flood management to Integrated Flood Management.

Integrated Flood Management (IFM) is a concept that addresses issues of human security against flood risks and sustainable development within the framework of Integrated Water Resources Management (IWRM). Such an integrated approach to flood management can play an important role in sustainable development and poverty reduction. Integrated Flood Management aims at minimizing loss of life from flooding while maximizing the net benefits derived from flood plains.

1.10 FLOODS AND THE DEVELOPMENT PROCESS

Historically, flood plains have been the preferred places for socio-economic activity as is evident from the very high densities of human settlement found there. Floods are a natural phenomenon, with both negative and positive impacts, and generally, should not be considered a hindrance to economic development. Floods play a major role in replenishing wetlands, recharging groundwater and support agriculture and fisheries system, making flood plains preferred areas for human settlements and economic activities. Extreme demands on natural resources due to population growth have forced people and their property to move closer to rivers in many parts of the world. Further, flood control and protection measures have encouraged people to utilize protected and reclaimed areas extensively, thereby increasing flood risks and consequent losses.

Recurrent and extreme flooding, however, pose grave risks to development and have negative impacts on lives, livelihoods and economic activity and can cause occasional disasters. Flood disasters result from the interaction between extreme hydrological events and environmental, social and economic processes. These disasters have the potential to put development back by five to ten years, particularly in developing countries. The spiraling economic losses in developed countries also have given rise to grave concerns.

The balancing of development needs and risks is essential. The evidence worldwide is that people will not, and in certain circumstances, cannot abandon flood-prone areas. There is a need, therefore, to find ways of making life sustainable in the floodplains. The best approach is to manage floods in an integrated manner.

1.11 TRADITIONAL FLOOD MANAGEMENT OPTIONS

The traditional management response to severe floods was typically an adhoc reaction – quick implementation of a project that considered both the problem and its solution to be self-evident, and that gave no thought to the consequences of flood risks for upstream and downstream areas. Thus, flood management practices have largely focused on mitigating floods intensity and reducing their localized damages to private and public property. Traditional flood management has employed both structural and non-structural interventions, besides, physical and institutional interventions. These interventions were employed prior, during and after flooding and have often overlapped. The traditional flood management interventions are listed below;

- i. **Source Control to Reduce Runoff**
 - a. Permeable pavements, afforestation artificial recharge;
- ii. **Storage of Runoff**
 - a. Detention Basins, check dams and small/medium/large reservoirs etc.;
- iii. **Capacity enhancement of Headwork/Barrages across Rivers**
 - a. Remodeling of Barrages/Headworks for enhancing their discharge capacities, besides, provision of Bypass/Escape channels, wherever feasible;
- iv. **Separation of Rivers and Population**
 - a. Land-use control, flood plan mapping & zoning, removal of illegal encroachments as per River Law/Act, construction of flood protection infrastructure.
- v. **Emergency Management during Floods**
 - a. Flood Forecasting & Warnings, flood fighting works i.e. raising/strengthening flood embankments, flood flows diversion and evacuation of flood affectees from dangers zone and their temporary settlement at safe places; and
- vi. **Flood Recovery**
 - a. Compensation of flood affectees and rehabilitation/restoration of damaged public infrastructure.

Surface water storages (large, medium & small dams), flood embankments and flood flows retention basins, is a traditional approach to attenuating flood peaks. Water storage attenuate floods by slowing the rate of rising waters, by enhancing the time it takes for the waters to attain high level and evade the synchronization of flood peaks, hence, lowering the peak level in the downstream areas. Such storages reservoirs serve multiple purposes i.e. storage of water mainly for irrigation water supplies, hydropower generation including flood management. Storage Reservoirs have to be used in an appropriate combination with other structural and non-structural measures.

Seemingly self-evident, but regularly overlooked in practice, is the need to make flood management a part not only of the planning and design, but also of the operation of reservoirs. Releases of surplus water from reservoirs at the time, when rivers in the downstream areas experiencing high flood flows can create risks, therefore, careful operation of reservoirs can minimize the loss of human life and damages to property due to properly flood flows regulation and releases in the downstream areas. In this context transboundary cooperation is indispensable.

Flood embankments are most likely to be appropriate for floodplains that are already intensely used, in the process of urbanization, or where the residual risks of intense floodplain use may be easier to handle than the risks in other areas i.e. (Landslides or other disturbances).

Land-use control is generally adopted where intensive development on a particular floodplain is undesirable. Providing incentives for development to be undertaken elsewhere may be more effective than simply trying to stop development on the floodplain. Where land is under development pressure, however, especially from informal development, land-use control is less likely to be effective. Flood protection or construction of houses at high elevation is most appropriate where development intensities are low and properties are scattered, or where the warnings times are short. In areas prone to frequent flooding, protection of the infrastructure and the communication links from floods can reduce the debilitating impacts of flood on the economy.

Flood Forecasting & issuance of timely warnings are complementary to all forms of intervention. A combination of timely, clear & accurate warning messages with a high level of community awareness gives the best level of preparedness for self-reliant action during floods. Public education programme/awareness campaign is crucial to the success of warnings intended to preclude a hazard from turning into a disaster.

Evacuation is an essential constituent of emergency planning and evacuation routes may be upward into a flood refuge at a higher elevation or outward, depending upon the local circumstances. Outward evacuations are generally necessary where the depths of water are significant, where flood velocities are high and where the buildings are vulnerable. Successful evacuations require planning and awareness among the population of what to do in a flood emergency.

Active community participation in the planning stage and regular exercises to assess the viability of the system help ensure that evacuations are effective. The provision of basic amenities such as water supply, sanitation and security in areas where affectees gather is particularly important in establishing a viable evacuation system.

1.12 THE CHALLENGES OF FLOOD MANAGEMENT

Besides many other challenges, climate change is emerging as perhaps the greatest environmental challenge for the region in general and for Pakistan in particular, causing floods, droughts and increasing hunger, poverty, displacement, soil degradation and

deforestation. Rising number of extreme climate events, shift of monsoon rainfall zone from North-east to North-west. Intense, concentrated monsoon rains in short time of interval, inconsistent behaviour of monsoon and erratic flash flood events are the major future challenges. There is strong need to educate people about these natural disasters and their frequent occurrence in the region including Pakistan.

There is a growing recognition that current approaches regarding flood management are not as sustainable as they might be. Hence, it is imperative to cope with increasing risks of flooding and the uncertainties of climate change more effectively. Increased population pressure and enhanced economic activities in flood prone areas/floodplains, such as the construction of buildings and infrastructure, further increase the risk of flooding. In developing countries with primarily agricultural economies, food security is synonymous with livelihood security. Floodplains contribute substantially to the food production that provides nutrition for the people of these countries.

Asia-Pacific region is under the very frequent and severe impacts of floods because of its geographical composition. Majority of the region's major cities are located nears river banks or coastal areas, which have concentration of population, assets, economic & industrial development and infrastructures.

In addition to riverine floods, Pakistan is also facing urban flooding, which is mainly caused due to torrential rains/heavy falls in urban areas, especially those cities which are overcrowded and having inadequate storm water drainage facilities are badly affected almost every year. Flash floods in semi mountainous regions are causing severe damages to private and public properties. The increasing urban flood risk has pushed all national and international organizations to take measures to confront the threats caused by floods and to build flood resilient cities.

Pakistan is a resource constraint country with a fast growing population, low natural resource development based and unfavorable local socio-cultural conditions, and climate change is an additional stress for the country. Educating masses about natural disasters and building up their preparedness at educational institutions can be of great help to minimize the damages of disasters. Media can play its due role in this regard as without its support, awareness cannot be boosted. Areas vulnerable to climate change-induced natural disasters must have adequate flood protection facilities, besides, reliable medium and long range Weather & Flood Forecasting & Warning System at place.

1.13 IMPACT OF RAPID URBANIZATION ON FLOOD MANAGEMENT

According to World Urbanization Prospects (2014 revision), world is experiencing a historically unprecedented transition from predominantly rural to urban living. In 1950, one-third of the world's population lived in cities. Today the number has already reached more than 50% and by 2050, city dwellers are expected to account for more than two-thirds of the world's population. This rapid rise will mainly take place in developing countries. Africa and Asia are likely to be the fastest urbanizing regions with the urban population projected to reach 56% in Africa and 64% in Asia by 2050 (currently at 40% and 48%, respectively).

People move from rural environments into cities (urban areas) to seek economic opportunities and better access to basic services. Climate change is likely to accelerate the migration rate into urban areas by altering the livelihood basis from both fishing and farming and by increasing the occurrence and intensifying the effects of natural hazards. Land use and other human activities influence the peak discharge of floods by modifying how rainfall and snowmelt are stored on and run off the land surface into streams.

Construction of roads and buildings often involves removing vegetation, soil, and depressions from the land surface. The permeable soil is replaced by impermeable surfaces such as roads, roofs, parking lots, and sidewalks that absorb little water, reduce infiltration of water into the ground, and accelerate runoff to ditches and streams. With less storage capacity for water in urban regions and more rapid runoff, urban areas streams rise more quickly during storms and have higher peak discharge rates than rural areas streams. In addition, the total volume of water discharged during a flood tends to be more in urban streams as compared to rural areas streams.

1.14 CLIMATE VARIABILITY AND CHANGE

Apart from the antecedent basin conditions, flood magnitudes depend on precipitation intensity, depth, timing and spatial distribution. A variety of climate and non-climate parameters influence flood processes. Temperature and wind affect snowmelt, which in turn affects flood magnitudes. The projected effects of global warming include changes in atmospheric and oceanic circulation, and many subsystems of the global water cycle are likely to intensify, leading to altered patterns of precipitation and runoff. Various climate model simulations show complex patterns of precipitation change, with some regions receiving less and others receiving more precipitation than they do now.

Pakistan Meteorological Department (PMD), in a recent monsoon rainfall distribution analysis, assessed that climate change has rendered a 100 km spatial shift towards west in the overall monsoon pattern in the country. Rainfall distribution patterns have not only shifted spatially but also seasonally. The analysis showed that summer monsoon rainfalls have shifted towards late season; similarly, winter rain and snowfall have also shifted towards late February and March. Changing patterns result as emergence of new vulnerable areas to floods which include Khyber Pakhtunkhwa (KP), South Eastern Punjab and Central Sindh.

According to an analysis of fifty-year data, variation in the co-efficient of variability was highest in post-monsoon and pre-monsoon seasons as compared to the winter and monsoon seasons. It further revealed that most of the northern areas (upper KP and Gilgit Baltistan) remain in the same old pattern except in the post-monsoon period while the central and southern half suffers throughout the year in terms of high rainfall variability. It is also observed that more snowfall was received in the month of February as compared to January over recent years.

FEDERAL FLOOD COMMISSION

2. FEDERAL FLOOD COMMISSION (FFC)

2.1 HISTORIC BACKGROUND

Prior to 1976, the Provincial Governments were responsible for the planning and execution of flood protection works. Disastrous floods of 1973 & 1976 caused heavy loss 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 due to floods were discussed in the Inter-Provincial Conference held in January 1977 wherein it was decided to establish Federal Flood Commission (FFC) for integrated flood management on country wide-basis.

2.2 FUNCTIONS OF FEDERAL FLOOD COMMISSION (FFC)

The existing charter of duties of FFC is given as under;

- i. Preparation of Flood Protection Plan for the country including management of Plan;
- ii. Scrutiny of flood control/protection schemes funded by the federal government and prepared by Provincial Governments and Federal Agencies;
- iii. Review of damage of flood protection works and review of plans for restoration and reconstruction works;
- iv. Measures for improvement of Flood Forecasting & Warning System;
- v. Preparation of a Research Programme for flood control and protection;
- vi. Standardization of designs and specifications for flood protection works;
- vii. Recommendations regarding principles of regulation of reservoirs for flood control;
- viii. Evaluation and monitoring of progress of implementation of the National Flood Protection Plan;
- ix. Federal Flood Commission may notify sub-committees as it deems appropriate.

Provincial governments and Federal Line Agencies undertake flood protection schemes proposed under 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 prepared and executed three National Flood Protection Plans, i.e.

National Flood Protection Plan-I (1978-1988),

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

National Flood Protection Plan -III (1998-2008).

The number of flood projects executed under those three Plans is given as under:

1. National Flood Protection Plan-I (1978-88)	
Number of schemes executed	311
Expenditure incurred	Rs 1,729.75 Million
Source of funding	GOP (100%)

Under NFPP-I, emphasis was mainly given on the implementation of structural measures (construction of flood protection structures). Pakistan Meteorological Department (PMD) and WAPDA carried out only maintenance works related to Flood Forecasting & Warning System equipment.

2. National Flood Protection Plan-II (1988-98)	
Number of schemes executed allover country	311
Expenditure incurred through Normal/ Emergent Flood Program	Rs 805.33 Million
Source of funding	GOP (100%)
Flood Protection Sector Project-I (FPSP-I)	
Expenditure incurred	Rs 4,735.29 Million
Number of schemes executed in the four provinces	256
Co-financed by GOP and ADB	GOP (20%) ADB (80%)

Besides the above, the following activities were also undertaken for improvement of Country's existing Flood Forecasting & Warning System under Flood Sector Protection Project (FPSP-I), which was jointly funded by ADB and GOP.

- Procurement & installation of Meteor-burst Telecommunication System (Phase-I) including one Master Station and 24 remote sensing stations.
- Installation of 10-CM Quantitative Precipitation Measurement Weather Radar at Flood Forecasting Division (FFD) Lahore.
- Pre-feasibilities studies for four Barrages i.e. Sulemanki, Balloki, Trimmu & Panjnad for increasing their design discharge capacity to carry increased flood flows in view of 1992 floods.
- Preparation of Flood Plain Maps of Indus River (Chashma-Taunsa, Taunsa-Guddu, Guddu-Sukkur, Sukkur-Kotri & Kotri-Seas Reach).

3. Prime Minister's River Management Programme (1994-96)	
Expenditure Incurred	Rs 613.39 Million
Number of schemes executed	10
Source of funding	GOP (100%)

4. Flood Damage Restoration Project (1988-FDRP)	
Expenditure Incurred	Rs 1,874.00 Million
Number of structures restored allover country	2,028
Source of funding	GOP (10%), IDA & ADB (90%)

5. Flood Damage Restoration Project (1992)	
Expenditure Incurred	Rs 6,888.36 Million
Number of structures restored allover country including AJ&K	1,980
Source of funding	GOP (20%), IDA, ADB & KfW (90%)

6. National Flood Protection Plan-III (1998-2008)	
Normal/ Emergent Flood Programme	
Expenditure Incurred	Rs 4,192.35 Million
Number of schemes executed in all over the country including AJ&K	362
Source of funding	GOP (100%)
Special Grant through President Directive (2000-02)	
Expenditure incurred	Rs 92.035 Million
Number of schemes executed in Gilgit-Baltistan	21
Source of funding	GOP (100%)
Flood Protection Sector Project-I (FPSP-II)	
Expenditure incurred	Rs 4,165.00 Million
Number of schemes executed in four provinces	101
Source of funding	GOP (20%) & ADB (80%)
Flood Forecasting and Warning System	Rs 432.12 Million

In addition to the above mentioned Civil Works, the following Flood Forecasting & Warning System related activities were also undertaken:

- Procurement & installation of 24 No. HF-Radio Sets;
- Procurement & installation of 20 additional remote sensing stations under existing Meteor-burst Telecommunication System (Phase-II);
- Up-gradation of 10 CM Quantitative Precipitation Measurement Weather Radar procured under FPSP-I in the premises of FFD, Lahore;

- Up-gradation of 5.36 CM Sialkot Weather Radar into 10 CM Quantitative Precipitation Measurement Weather Radar;
- Procurement & installation of a 10 CM Quantitative Precipitation Measurement Weather Radar at Mangla;
- Development of initial/1st version of Computer Based Flood Early Warning System (FEWS) through NESPAK, PMD & Delft Hydraulics;
- Expansion of Flood Plain Mapping activity covering major tributaries of River Indus i.e. Rivers Jhelum, Chenab, Ravi & Sutlej;
- Bathymetric Survey & flow measurements of Indus River and its major tributaries (*Sutlej, Ravi, Chenab & Jhelum*) for improvements in discharge rating curves & to collect data for FEWS Model & Flood Plain Mapping activities.

7. Establishment of Flood Forecasting & Warning System for Lai Nullah Basin	
Expenditure Incurred	Rs 348.00 Million
Source of funding	GOP share (3.2%), JICA Grant-in-Aid (96.8%)

The following facilities were procured and installed in the Lai Nullah Basin (Islamabad & Rawalpindi Cities):

- Two No. Telemetry rainfall gauging stations at Golra, Islamabad and Bokra, Islamabad;
- Two No. water level gauging stations at Kattarian Bridge, Rawalpindi and Gawalmandi 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;
- Nine (9) No. warning posts at various locations.

2.4 NATIONAL FLOOD PROTECTION PLAN –IV (NFPP-IV)

Preparation of Plan

The need for investment in flood sector gained importance after occurrence of 2010 floods. Federal Flood Commission initiated working on formulation of National Flood Protection Plan-IV. For that purpose, consultants were engaged in May 2013 through World Bank Funded Water Sector Capacity Building & Advisory Services Project (WCAP) for preparation of NFPP-IV for next ten years. The National Flood Protection Plan-IV had been prepared in close consultation with all stakeholders at Federal and Provincial

Governments level. The draft final version of NFPP-IV was submitted by the consultants to FFC in May 2015.

Approval of Plan by Council of Common Interest (CCI)

Through consultative process based on a series of meetings with all the federal and provincial stakeholders, the final draft version of NFPP-IV costing Rs 332,246 million was submitted to the CCI for approval. NFPP-IV remained under an extensive deliberation process during the four (4) meetings of the Council of Common Interest (CCI) held on February 29, 2016, March 25, 2016 & December 16, 2016. It was finally approved in its 31st meeting held on May 02, 2017. The following decision was taken:

“The CCI approved the proposed NFPP-IV (2015-25) and decided that the Financing of NFPP-IV would be made by the Federal and Provincial Governments @ 50:50. The provinces will decide their respective share of contribution amongst themselves and report to the Federal Government”.

Meeting to Review Priority Projects

In compliance to CCI’s above decision & to ensure commencement of work without any delay, FFC organized a joint meeting of concerned Federal and Provincial level organizations on 1st June 2017 to review priority of projects for implementation of NFPP-IV and their inclusion in Umbrella PC-I. The draft Umbrella PC-I of NFPP-IV was submitted by the Consultants (M/S NESPAK) to FFC on 28th July 2017. FFC conveyed to consultants detailed comments on draft umbrella PC-I on 17th August 2017. A meeting of consultants & FFC was organized on 12th September 2017 in office of CEA/CFFC to review the draft umbrella PC-I of NFPP-IV in the light of observations of FFC. The draft umbrella PC-I of NFPP-IV remained under extensive review for its refinement by the consultants in consultation with FFC’s Officers.

The modified umbrella PC-I of NFPP-IV was considered and cleared by Scrutinizing Committee of FFC in its meeting of 15th December 2017 subject to certain observations. The updated umbrella PC-I was submitted by the consultants to FFC on 28th February 2018, which was circulated among the Irrigation Departments of the four provinces on the same day for getting its clearance from PDWP.

Clearance of Plan by PDWP Punjab, Sindh, KP and Balochistan

The umbrella PC-I of NFPP-IV was cleared by the PDWP’s of Governments of Sindh, Balochistan, Punjab and Khyber Pakhtunkhwa on 6th April 2018, 8th May 2018, 12th June 2018 and 10th August 2018 respectively. The finalized version of umbrella PC-I was submitted to Ministry of Water Resources on 16th November 2018. Ministry of Water Resources had submitted the same to Ministry of Planning, Development & Reforms on 11th January 2019. The umbrella PC-I is likely to be approved from CDWP/ECNEC shortly.

Presently, the urgent nature flood protection works as proposed by the Provincial Irrigation Departments and Federal Line Agencies are executed through GOP funded Normal/Emergent Flood Programme. Around 345 number flood project costing Rs 7,981 billion have been approved for implementation through Normal/Emergent Flood Programme during the period 2008-09 to 2017-18. However, due to inadequate budget allocation under PSDP each year (*minimal as compared to the Provinces & Federal Line Agencies demands*) for Normal/Emergent Flood Programme, the execution of some urgent nature flood protection schemes remained un-attended or delayed. The budget demand by the Provinces and Federal Line Agencies, budget allocated and actually released during the past years to PIDs & Federal Line Agencies is given in **Table-3**.

TABLE-3
BUDGET DEMANDED BY PIDs & FLAs FOR EXECUTION OF FLOOD
PROJECTS UNDER NORMAL/EMERGENT FLOOD PROGRAMME DURING
(2009-10 TO 2017-18)

(Rs. Million)

Sr. No.	Financial Year	Funds Demanded	Budget Allocation under PSDP		Funds Released
			Original	Revised	
1	2009-10	3,500.000	1,000.000	575.110	78.358
2	2010-11	3,500.000	740.798	735.798	276.714
3	2011-12	4,000.000	894.000	844.194	567.095
4	2012-13	4,000.000	900.000	900.000	419.325
5	2013-14	4,500.000	1,000.000	1,000.000	855.533
6	2014-15	5,000.000	1,000.000	1,000.000	898.477
7	2015-16	5,000.000	1,000.000	964.430	964.430
8	2016-17	5,515.00	500.00	500.00	267.500
9	2017-18	1,910.019	500	500	244.010
	Total	36,925.019	7,534.798	7,019.532	4,571.442

2.5 NORMAL/EMERGENT FLOOD PROGRAMME (2018-19)

Federal Flood Commission is presently coordinating implementation of Normal/ Emergent Flood Programme, which was started in (1978-79). It is a yearly program in which Provincial Irrigation Departments and Federal Line Agencies submit their schemes (based on their shares) each year, which are processed by FFC for technical clearance of Scrutinizing Committee of FFC and approval of DDWP/CDWP. The award of contract, execution and disbursement is the exclusive responsibility of Provincial Irrigation Departments and Federal Line Agencies. The flood protection schemes are processed for approval and implementation before 30th June each year subject to in-time approval and release of funds by Planning Commission/Finance Division to the Line Agencies. An amount of Rs. 1000.00 million was allocated under PSDP (2018-19) for Normal/

Emergent Flood Programme. Detailed list of schemes executed/being executed under Normal/ Emergent Flood Programme during Financial Years (2018-19) is attached as **Appendix-I**.

2.6 SUMMARY OF INVESTMENT ON FLOOD PROJECTS THROUGH GOP GRANTS/ FOREIGN AID

The summary of investment on flood projects through GOP grants & foreign aids coordinated by FFC since 1978-79 to June 2018 is given in **Table-4**.

TABLE-4
SUMMARY OF FEDERAL INVESTMENT ON FLOOD PROTECTION WORKS

Sr. No.	Flood Plans/ Programs	Location	No. of Schemes	Expenditure (Rs Million)
1.	NFPP-I (1978-88)			
i.	Normal Annual Development Programme GOP funded	Countrywide	311	1,730
	<i>Sub-Total (NFPP-I)</i>		<i>311</i>	<i>1,730</i>
2.	NFPP-II (1988-98)			
i.	Normal/Emergent Flood Programme	Countrywide	170	805
ii.	First Flood Protection Sector Project (FPSP-I) Co-financed by GOP & ADB	Four Provinces	256	4,735
iii.	Prime Minister's River Management Programme (1994-96)	Punjab, KP & Balochistan	10	613
	<i>Sub-Total (NFPP-II)</i>		<i>436</i>	<i>6,153</i>
3.	NFPP-III (1998-2008)			
i.	Normal/Emergent Flood Programme	Countrywide	362	4,192.348
ii.	Second Flood Protection Sector Project FPSP-II (1998-2007) Co-financed by GOP & ADB	Four Provinces	101	4,165.00
iii.	Special package executed through President Directives (2000-02)	Gilgit-Baltistan	21	92.035
iv.	Lai Nullah Flood Forecasting & Warning System through JICA grant-in-aid	District Rawalpindi & ICT	1	348.00
	<i>Sub-Total (NFPP-III)</i>		<i>485</i>	<i>8,797</i>
4.	Normal/Emergent Flood Programme (2008-09 to 2017-18)	All over country	345	7,981
	<i>Sub-Total (NFPP-IV)</i>		<i>345</i>	<i>7,981</i>
	Total(1+2+3+4)		1,577	24,661
5.	FLOOD DAMAGE RESTORATION PROJECTS			
i.	1988-Flood Damage Restoration Project	Four Provinces	2,028	1,874
ii.	1992-Flood Damage Restoration Project	Countrywide	1,980	6,888
	Total		4,008	8,762

FLOOD MANAGEMENT MECHANISM

3. FLOOD MANAGEMENT MECHANISM

3.1 ORGANIZATIONS INVOLVED AND RESPONSIBILITIES

Flood management is a multifunctional process involving following a number of organizations. The Government Organizations, which play major role in the flood management, are:

- Provincial Irrigation Departments (PIDs), GB-PWD, Irrigation Directorate FATA, Irrigation & Small Dams Organization, Government of AJ&K.
- PMD/Flood Forecasting Division, Lahore.
- WAPDA.
- Pakistan Commissioner for Indus Waters.
- Federal Flood Commission.
- NDMA.
- Provincial Relief Organizations.
- Pak Army.
- NHA.
- Pakistan Railways.
- Provincial Disaster Management Authorities, GB-DMA, FDMA, SDMA & DDMA/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, fighting and mitigation. Major flood related functions include:

- Operation and maintenance of Barrages, Irrigation & Drainage Networks, including flood protection structures, besides, measurement of discharges at control points (Barrages/Headworks) across main rivers;
- Planning, design, construction of new Irrigation, Drainage & Flood Protection/ River Training projects;
- Collection and transmission of Rivers flows data to FFD, Lahore, FFC and other concerned organizations for taking further action at their end;
- Establishment & Operation of Flood Warning Centre during the monsoon season each year for sharing flood flows data and other information, besides, timely dissemination of the flood forecasts/warnings to concerned quarters;
- Preparation & implementation of the Flood Fighting Plans during monsoon season every year.

3.1.2 WATER AND DEVELOPMENT AUTHORITY (WAPDA)

- WAPDA is actively involved in the flood forecasting process as it provides water levels of major reservoirs (Tarbela, Chashma & Mangla), river flows and rainfall data collected through Flood Telemetric System/Gauged sites in the catchment areas of major 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 Flood Telemetric Network is directly linked with FFD, Lahore. WAPDA provides hydrometric flood data and water levels, inflows/ outflows of Tarbela, Chashma and Mangla reservoirs to FFD, Lahore, FFC and other concerned organizations;
- Coordination between FFD Lahore and WAPDA has considerably improved after the 1992-flood disaster;
- Regular meetings in the office of General Manager (Planning & Design) are held during flood season and necessary instructions are issued to Tarbela and Mangla Dam Flood Management Committees.

3.1.3 PROVINCIAL DISASTER MANAGEMENT AUTHORITIES

- Ultimate aim of flood warnings is to reduce the loss of life and damages to property of the community living in the flood prone/high risk areas;
- Provincial Disaster Management Authorities are responsible for disaster preparedness, preparation of emergency response plan, rescue and relief measures and rehabilitation plan and its approval from Provincial Government before implementation;
- They examine the vulnerability of various parts of the province to different disasters and specify prevention or mitigation measures; lay down guidelines for preparation of disaster management plans by the Provincial Department and District Authorities; evaluate preparedness at governmental levels to respond to disaster and enhance preparedness; coordinate response in the event of disaster; give directions to DDMA's regarding actions to be taken in response to disaster; and promote general education, awareness and community training etc. pertaining to all disasters including floods;
- Relief functions at the District and Tehsil/Union Council level are now performed through the District Disaster Management Authorities, who coordinate with the concerned departments to carry out 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*) provide necessary help to the civil authorities to carry out rescue and relief operations during floods;
- Provincial Governments facilitate Pak Army in providing necessary logistic support/equipment (boats, life jackets, vehicles, tents etc.) 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 serviceability of the flood fighting equipment is ensured;

- Pre-flood meetings are also held at the Corps Head Quarters and Engineer Directorate, GHQ in order to review the arrangements of PIDs, PDMAs & Federal Line Agencies for handling flood situation;
- Pre-flood inspections of the flood protection structures are carried out by the respective Commander Corps of Engineers alongwith concerned field formations of Provincial Irrigation Departments for their respective areas to ensure that the flood protection structures (Bunds, Barrages, Spurs etc.) are in satisfactory state of maintenance. Deficiencies, if any, are brought into the notice of PIDs;
- Availability of flood fighting material and sufficient stock of explosives is ensured at pre-determined breaching sections to activate the pre-determined 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, which are transmitted to the D.G. Engineers and all other CC of the Engineers;
- In the event of floods, units of the Pak 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 coordination meeting is held under the Chairmanship of Engineer-in-Chief/D.G. Engineers to discuss the performance of all flood management related agencies with the view to bring about the necessary improvements in future.

3.1.5 PAKISTAN COMMISSIONER FOR INDUS WATERS (PCIW)

- Pakistan has a unique flood-forecasting problem in the sense that major part of the flood generating in upper catchments of Rivers Sutlej, Ravi, Jhelum and Chenab lie across the border in India/ held Kashmir;
- A number of water storage reservoirs have been constructed over Eastern Rivers (Ravi & Sutlej) across the border. As a result, the free flood flow conditions are disrupted making the operation of the rainfall/runoff model extremely difficult;
- The situation underlines the need for the acquisition of rivers 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/ sharing rivers flows data with India such rivers 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 Chenab River and Eastern Rivers (Ravi & Sutlej) data normally once in a day;
- The data is then passed on to the FFD, Lahore for preparation and issuance of flood forecast to concerned organizations;
- 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 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 flows data of Chenab & Eastern River (Ravi & Sutlej).

3.1.6 ROLE OF FEDERAL FLOOD COMMISSION IN FLOOD MANAGEMENT

Pre-Monsoon Season Action Taken by FFC

- FFC chalks out pre-emptive measures for better flood management during monsoon season, which are circulated amongst all stakeholders for taking further action at their end;
- For that purpose, preparatory meeting of Federal Flood Commission was held on **28.03.2018** under the Chairmanship of Chief Engineering Advisor/ Chairman Federal Flood Commission in the Committee Room of office of CEA/CFFC in order to review the progress on post 2017 floods activities and preparatory works for monsoon season 2018. Necessary directions were issued to concerned organizations;
- The 7th quarterly meeting of Federal Flood Commission was organized on **16.04.2018** under the Chairmanship of Ms. Marvi Memon (Representative of Honourable Supreme Court of Pakistan) to review the status of compliance of directions given by the Honourable Supreme Court of Pakistan on the recommendations of Flood Inquiry Commission regarding 2010 floods;
- The 53rd Annual meeting of FFC under the Chairmanship of Federal Minister for Water Resources was organized on **04.07.2018**, which was attended by all stakeholders for presenting their status of preparedness;
- Necessary directions were issued to concerned organizations for assuring the safe passage of flood flows during monsoon season 2018.

During Monsoon Season Role of FFC

- The Flood Communication Cell established in FFC had started working on round the clock basis since 15th June 2018 and worked on 24 hours basis during the entire monsoon season (15th June - 15th October 2018) for obtaining weather, rainfall, Rivers flow data and reservoirs water levels including inflows/outflows, besides, other flood situation information as received from FFD, Lahore/PMD, PCIW, WAPDA, PIDs, NDMA, PDMAs, GBDMA, FDMA, SDMA etc.;
- FFC issued daily Flood Situation Report on daily basis to higher ups and Flood Management related agencies, based on Weather Forecasts/ Advisories and Rainfall & Rivers flow data as received from FFD, Lahore/PMD, PCIW, WAPDA & PIDs etc.;

- Responsibility for response/reaction to warnings issued by PMD/FFD, Lahore & FFC rests upon the concerned Federal and Provincial organizations including District Administrations.

Post Monsoon Season Role of FFC

- FFC prepared the list of flood protection schemes in consultation with Provincial Irrigation Departments and Federal Line Agencies and re-prioritized in light of budget allocated under PSDP i.e. Rs 1000 million allocated under PSDP (2018-19) for execution of urgent nature flood protection schemes through Normal/Emergent Flood Programme;
- FFC technically scrutinizes the PC-Is of all such flood projects through S.C of FFC and submit to Ministry of Water Resources for approval of DDWP/CDWP. Total six meetings of Scrutinizing Committee of FFC were organized during year 2018, wherein flood protection schemes were technically examined and recommended to Ministry of Water Resources for approval of DDWP/CDWP;
- Total six meetings were organized by FFC for review of progress on implementation of flood projects under GOP funded Normal/Emergent Flood Programme;
- The 8th quarterly meeting of Federal Flood Commission was organized on 30.10.2018 to review the status of compliance of directions given by the Honourable Supreme Court of Pakistan on the recommendations of Flood Inquiry Commission regarding 2010- floods;
- The Post Flood Meeting was organized on 05.12.2018, which was attended by all stakeholders. Necessary directions were issued to concerned organizations for taking immediate steps for implementation of decisions taken in the said meeting;
- The sites inspections of flood protection schemes being executed under Normal/Emergent Flood Programme were carried out by the FFC's Monitoring Teams.

3.1.7 FLOOD FORECASTING DIVISION (FFD), LAHORE

- FFD, Lahore, the specialized unit of Pakistan Meteorological Department, plays a pivotal role in the Flood Forecasting & issuance of Warnings to concerned quarters;
- It obtains hydro-meteorological data from the various National and International sources, which is then analyzed to produce weather /flood forecasts & warnings and disseminated to various Federal/Provincial organizations and electronic/print media through various means and also uploaded on PMD Website.

3.1.8 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) serves as 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 an effective national disaster management system and for matters connected therewith and incidental thereto. As per National Disaster Management Authority Act-2010, the main functions of NDMA are as under:
 - i. Act as implementing, coordinating and monitoring body for disaster management;
 - ii. Prepare the National Plan to be approved by the National Disaster Management Commission;
 - iii. Implement, coordinate and monitor the implementation of the national policy;
 - iv. Lay down guidelines for preparing Disaster Management Plans by different ministries or departments and the provincial authorities;
 - v. Provide necessary technical assistance to provincial government and provincial authorities for preparing their Disaster Management Plans in accordance with the guidelines laid down by the National Disaster Management Commission;
 - vi. Coordinate response in the event of any threatening disaster situation or disaster;
 - vii. Lay down guidelines for 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;
 - viii. 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 in writing;
 - ix. Promote general education and awareness in relation to disaster management;
 - x. Perform such other functions as the National Disaster Management Commission may require performing.

3.2 FLOOD WARNING DISSEMINATION SYSTEM

- Monsoon Season normally starts in 1st week of July (*sometimes, it starts little early*) and ends in last week of September (*sometimes prolongs up to mid-October*).
- The Flood Warning Centers of all flood management related agencies start functioning from 15th June every year for collecting weather & flood flows data and keep continue upto 15th October.
- During this period, effective interaction and communication between various floods related provincial as well as federal agencies is maintained on round-the-clock basis in order to counter any eventuality due to monsoon rains/floods.

**CONTINGENCY PLANNING
FOR
MONSOON SEASON 2018**

4. PREPAREDNESS & CONTINGENCY PLANNING BY FEDERAL FLOOD COMMISSION FOR MONSOON SEASON 2018

FFC mainly plays coordination role among Provincial and Federal Government Organizations dealing with flood management in the country for avoiding loss of life and minimizing damages to agricultural lands and other public and private property. However, managing the flood water is the sole responsibility of Provincial Irrigation Department and Federal Line Agencies. As per practice, FFC holds meetings prior to start of Monsoon Season every year, to review the status of preparedness/ flood fighting arrangements made by Federal/Provincial Organizations for upcoming Monsoon season. Two meetings i.e. the first on 28th March 2018 and 53rd Annual Meeting of FFC was organized on 4th July 2018 to review the arrangement made by the concerned organizations for flood management during monsoon season 2018. Further detail is given as under;

4.1 PREPARATORY MEETING OF FFC

FFC chalks out pre-emptive measures for better flood management during monsoon season each year, which are circulated amongst all stakeholders for taking further action at their end. For that purpose, first preparatory meeting of Federal Flood Commission was held on March 28, 2018 under the Chairmanship of Chief Engineering Advisor/ Chairman Federal Flood Commission in the Committee Room of office of CEA/CFFC in order to review the progress on post 2017 floods activities and preparatory works for monsoon season 2018. The following directions were issued to PIDs/Federal Line Agencies, WAPDA, PMD & other concerned agencies etc;

- (i) **Provincial Irrigation Departments & Federal Line Agencies (PIDs & FLAs)** to ensure pre-flood inspection of flood protection infrastructure (flood bunds, spurs, Barrages/ Headworks and allied works etc.) along with concerned Corps of Engineers of Pak Army and ensure strengthening of all weak sections of bunds/ spurs etc well before start of monsoon season 2018.
- (ii) **Provincial Irrigation Departments & Federal Line Agencies (PIDs & FLAs)** to ensure completion of all approved/ ongoing flood protection schemes taken up under Normal/ Emergent Flood Programme, rehabilitation/strengthening works of all critical points/ weak sections and 2017-Flood Damages Restoration Works, if any, including O&M works related to Barrages/ Head Works/Bridges, Irrigation, Drainage and Flood Protection Infrastructure well before the start of 2018 monsoon season/ **30th June 2018**.
- (iii) **Provincial Irrigation Departments & Federal Line Agencies** will vigorously follow-up their cases regarding pending approval of new flood protection schemes & release of funds under Normal/ Emergent Flood Programme of PSDP (2017-18) so as to complete the same well before the start of monsoon season 2018
- (iv) **PIDs and FLAs** to take up the matter with respective **Provincial Cabinets** regarding approval and enactment of River Act (Draft prepared by FFC) for flood plains regulation i.e. removal of existing encroachments and restricting new settlements in the flood plains. The present status shall be reported to FFC within a fortnight by all the PIDs.

- (v) **PIDs & FLAs** to ensure removal of encroachments from flood plains/High Risk Zones, waterways, which are under the threat of flood water and also causing hindrance in flood flows. The progress on the job would be submitted to FFC on monthly basis till completion of the task. The entire exercise would be completed well before the start of monsoon season 2018.
- (vi) **PIDs/ PDMAs/ FDMA/ GBDMA/ SDMA and other Federal Line Agencies including NHA & Pak Railway**, to prepare their Contingency Plan for monsoon season 2018 and share hard and soft copies with FFC for uploading on the web site.
- (vii) **PMD** to expedite the work on procurement and installation of Radars at Sialkot, Multan, Karachi and Mardan. The progress on the same be shared on regular basis with FFC.
- (viii) **SUPARCO** to conduct the training regarding rivers flow monitoring for all major rivers, particularly the flood flows of Eastern Rivers to officers of all concerned organizations dealing with flood management at Federal as well as Provincial government level before start of monsoon season 2018.
- (ix) **Chief Engineer/ Project Director MDRP, WAPDA**, to complete all preparatory works like functioning of Flood Information & Regulation Centre (FI & RC) on round the clock basis, arrangement of stockpiles of construction materials, testing of Spillway gates & warning hooters, arrangement of Plant & Equipments for use in emergency, calibration of seepage measuring devices & instrumentations and Mock-Exercise for Flood Mitigation before the start of monsoon season 2018, and also directed to share the progress to FFC on regular basis till completion of the task.
- (x) **Chief Engineer/Project Director MDRP, WAPDA**, to submit the revised SOPs of Mangla Dam, incorporating the change in MOL from EL 1040 feet SPD to EL 1050 feet SPD for consideration of Ministry of Water Resources.
- (xi) **General Manager, TDP/ WAPDA**, to submit the final report of “Sixth Periodic Inspection- 2017” before start of monsoon season 2018. TDP authorities will also submit, the revised SOPs reflecting the change in MOL and the revised filling criteria recommended by the team of 6th Periodic Inspection for consideration of Ministry of Water Resources.
- (xii) **Project Director/Chief Engineer, MDRP, WAPDA** in coordination with **Engineer’s Directorate**, to complete the Phase-II works of rehabilitation of Barakas Nullah at the earliest. Meanwhile, necessary arrangements be made for safe passage of monsoon season 2018.
- (xiii) **Project Director (H & WM) WAPDA** to complete the repair/rehabilitation work of non-functional Flood Telemetry Stations upto **30th April, 2018**.
- (xiv) **NHA** to follow up the case with Planning Commission regarding allocation and transfer of funds to Irrigation Department, Government of the Punjab for construction work of LMB & RMB/Flood Embankments upstream of Shaheed Benazir Bhutto Bridge across River Indus. NHA to ensure physical completion of proposed interventions well **before the start of monsoon season 2018**. The

progress on the project would be shared with FFC on monthly basis till completion of project.

- (xv) **Pak Railway** to pursue the case regarding construction of new bridge proposed upstream of existing Ravi Bridge in close coordination with Irrigation Department Government of Punjab, progress on the same will be shared with FFC regularly till completion of the task.
- (xvi) **Deputy Commissioner, Rawalpindi** to expedite removal of encroachments from the waterway and banks of Lai Nullah. The compliance report would be regularly submitted to FFC on monthly basis till completion of the task. The progress on demarcation of Lai Nullah would be accelerated so as to complete the task well before the start of 2018 Monsoon season.
- (xvii) **PID, Punjab** to coordinate with IRI, Nandipur, Lahore for early completion of ongoing Hydraulic Model Studies of all Barrages/ Bridges i.e. Garh Maharaja, Head Muhammad Wala and Revaz bridges. The progress will be shared with FFC regularly till completion of the task.
- (xviii) **PID, Punjab** to speed up progress on ongoing Mashka bund & Jhelum Flood Bund and will complete the same before 30th June, 2018.
- (xix) **Irrigation Department, Government of Sindh** to speed up progress on the under construction Ring Flood Bund being constructed around Kashmore Garrison, so as to fully complete the project before the start of Monsoon Season 2018. The progress on the work be shared with all concerned organizations including FFC till completion of the job.
- (xx) **PIDs & FLAs** to submit the comprehensive Contingency Plan for monsoon season 2018 upto 15th May, 2018 to Federal Flood Commission for uploading on the web site.
- (xxi) **WASA Rawalpindi** to complete all necessary desilting works of critical sections of Lai Nullah well before start of monsoon 2018 and the progress on the same be shared to FFC regularly till completion of the task.
- (xxii) **PDMA/ GBDMA/ SDMA/ FDMA** will submit Contingency Plan for monsoon season 2018 to FFC before start of Monsoon Season 2018 for uploading on FFC's website.
- (xxiii) **Provincial Irrigation Departments & Federal Line Agencies** will finalize District/ Division-wise Flood Fighting Plans, keeping in mind lessons learnt during the past flood events and ensure their circulation among concerned organizations including FFC, **before 15th June 2018.**
- (xxiv) **PID Punjab including NHA, Pak Railways** will ensure arrangements of explosive and others material at sites of pre-determined breaching sections and stone reserve stock/ flood fighting material to be arranged at all critical reaches of flood embankments as identified during pre-flood inspections before start of monsoon season 2018 (**before 15th June 2018**)
- (xxv) **PMD, FFD & WAPDA** will ensure completion of all essential repair/ maintenance works of Flood Forecasting & Warning System equipment and ensure that the System/ Radars Network is fully functional **by/ before 15th June 2018.**

4.2 MEETING OF FFC TO REVIEW STATUS OF COMPLIANCE OF DIRECTIONS GIVEN BY THE HONOURABLE SUPREME COURT OF PAKISTAN ON THE RECOMMENDATIONS OF FLOOD INQUIRY COMMISSION

The 7th quarterly meeting of Federal Flood Commission was organized on 16th April 2018 to review the status of compliance of directions given by the Honourable Supreme Court of Pakistan related to Constitution Petition No. 62 of 2010, filed by Ms Marvi Memon versus Federation of Pakistan, through Secretary Cabinet & others. The following decisions were taken:

- i. FFC will upload the minute of meeting on its official website.
- ii. PIDs & FLAs to vigorously take up the matter with respective Deputy Commissioners for removal of encroachments at all critical locations well before the start of upcoming monsoon season (2018). The complete details (on the prescribed format) of encroachments removed be shared with SUPARCO for verification purpose under intimation to FFC.
- iii. The verification report would be submitted by SUPARCO to FFC for consideration in the next quarterly review meeting.
- iv. SUPARCO will also carry out exercise itself and submit to FFC the list of all critical encroachments identified in flood plains, waterways and settled over irrigation, drainage & flood protection infrastructures, for consideration during the next meeting of FFC.
- v. H&WM Wing of WAPDA to expedite work on up-gradation of entire Flood Telemetry Network through WCAP, so as to complete the job at the earliest. The progress may be shared with FFC till completion of the job.
- vi. Pakistan Metrological Department/ FFD, Lahore to pursue the case with Planning Commission and other concerned organizations (like Economic Affairs Division) for approval of PC-I and arrangement of funds through external donor agencies for up-gradation & expansion of its Radar network, besides, establishment of other flood forecasting and early warning systems related activities in the country. The status report will be shared with FFC for consideration in next review meeting.
- vii. PMD would take up the matter with PM office through official channel for presentation regarding expansion of weather Radar Network in the country.
- viii. Forest Departments of four Provinces and Federally Administered Areas including Watershed Management Authorities of Mangla & Tarbela Dams Projects, will submit to FFC detailed progress made on watershed management/ forestation promoting activities carried out so far in the catchment areas of rivers/hill torrents in order to check land sliding and excessive bed erosion, besides, flood mitigation. PIDs and FLAs will also follow up the matter accordingly.

- ix. WAPDA to submit PC-II to FFC without further delay so that a consultative meeting of all stakeholders may be arranged by FFC to discuss the PC-II well before next monsoon season.
- x. Pending nominations of Focal persons from the concerned organizations will be submitted to FFC well before the next quarterly review meetings.
- xi. PID Punjab to coordinate with Project Implementation Unit (PIU) & Provincial Energy Department and furnish updated progress reports regarding strengthening work of LMB of Taunsa Barrage and construction of hydro power station on right side of Taunsa Barrage to FFC on regular basis till completion of both projects.
- xii. The Cantonment Boards of Chaklala & Rawalpindi to complete the ongoing process of demarcation of boundaries of Lai Nullah/waterway of Lai nullah in consultation with Revenue department. Thereafter, case may be initiated for removal of encroachments over the banks & bed of Lai nullah. The status report would be submitted to FFC before next review meeting.
- xiii. WASA Rawalpindi to ensure completion of de-silting work and removal of buildings waste, garbage and encroachments in critical reaches of Lai Nullah well before start of monsoon season 2018. The progress on the job would be shared with FFC on regular basis till its completion.
- xiv. PID Punjab & Sindh to expedite the ongoing/ planned rehabilitation/ remodeling works of Barrages and submit progress report to FFC regularly on monthly basis till completion of all projects.
- xv. NHA to ensure appropriate level participation during future progress review meetings of FFC, expedite action on remaining works and submit progress report on regular basis to FFC till completion of all projects.
- xvi. WAPDA to provide progress on project on regular basis till completion of the project.
- xvii. PCIW to ensure his kind participation during future progress review meetings of FFC and make a detailed presentation on the issue during the next meeting. The updated progress report may also be shared with FFC regularly on monthly basis.
- xviii. PIDs & FLAs will furnish details of O&M funds demanded/required, allocated and released/utilized each year since (2010 -11 – 2017 -18) to FFC alongwith the detail of critical locations requiring attention and funds needed etc.
- xix. PID, Sindh & Balochistan including FLAs to vigorously pursue their cases with concerned authorities for early approval and enforcement of River Act i.e. before start of next monsoon season.
- xx. KMC & KDA to continue their efforts for removal of encroachments and garbage from storm drains and keep the forum updated of progress. All necessary information, as stated above be also shared with FFC for consideration during the next meeting.

- xxi. PID, Sindh/SIDA to submit to FFC latest status on short/medium and long term measures recommended under the holistic study carried out through Consultants (M/s Louis Berger) for consideration during next meeting of FFC.
- xxii. WAPDA and PID Sindh to continue consultations to resolve the issue among themselves and submit progress to FFC regularly on monthly basis.

4.3 FLOOD COMMUNICATION CELL OF FFC

The Flood Communication Cell of Federal Flood Commission had started functioning on round-the-clock basis from 15th June 2018 till end monsoon season (15th October 2018) for collection, compilation rainfall, rivers flow data and reservoir water levels and its transmission to concerned agencies at Federal and Provincial Government level on 24 hours/daily basis in normal/low flood stage and 6-hourly basis in case of high flood levels in main rivers. For that purpose, FFC issued daily flood situation report containing weather situation, reservoir and rivers flood data at important control structures through its Flood Communication Cell till end monsoon season 2018.

4.4 53RD ANNUAL MEETING OF FFC HELD ON 4TH JULY 2018

The 53rd Annual Meeting of Federal Flood Commission was held on 4th July 2018 under the Chairmanship of Honourable Federal Minister for Water Resources in the Committee Room of office of CEA/CFFC Islamabad, in order to review the status of preparedness of the Provinces & Federal Line Agencies for Monsoon Season 2018. The following directions were given to PIDs/ Federal Line Agencies, WAPDA, WASA & PMD etc:

i. **PIDs & FLAs**

- (a) To ensure completion of all ongoing flood protection schemes taken up under ADP & PSDP, besides, strengthening/rehabilitation works of all critical reaches including O&M works related to Barrages/ Headworks/ Bridges **before 31st July 2018**.
- (b) Priority lists of new flood protection schemes proposed to be implemented under PSDP (2018-19) through Normal/Emergent Flood Programme be submitted to FFC **before 31st July 2018**. The PC-Is of proposed schemes alongwith clearance of PDWP be submitted to FFC before **31st August 2018** for technical clearance by FFC and admin approval by DDWP/ CDWP.
- (c) To remain vigilant and ensure Round-the-Clock patrolling of flood protection infrastructure, especially vulnerable sections, besides, operation of dams and Barrages/ Headworks as per existing SOPs.
- (d) To take-up the matter with respective Provincial Cabinets regarding approval of River Act prepared under NFPP-IV by FFC for Flood Plains Regulation and its enactment for removal of existing encroachments and restricting new settlements in the flood plains.

- (e) To ensure removal of encroachments from flood plains/waterways causing hindrance in flood flows. The compliance report be submitted to FFC on regular basis till completion of the task.
 - (f) Including PDMAs/ FDMA/ SDMA & GB-DMA to submit to FFC hard & soft copy of awaited Contingency Plans prepared for monsoon season 2018 for official use and uploading on its website.
 - (g) To ensure proper and effective coordination with concerned PDMAs/ District Administrations and WASA's/Municipal Corporations in order to ensure that all necessary arrangements were put in place for effective management of urban floods, Flash Floods & GLOFs etc.
- ii. **Provincial Governments**
- a. To direct the WASAs/Municipal Corporations and District Administrations to clear the storm drains and sewerage system and make all necessary arrangements for pumping storm water in case of severe monsoon rains so as to avoid urban flooding during 2018 monsoon season.
 - b. To ensure that funds allocated under Normal/ Emergent Flood Programme shall only be utilized for Flood Protection Schemes under this programme and transfer to other sectors shall be taken as a violation.
- iii. **PID, Punjab** to expedite the work on Mashka and Minchin Flood Bund project and complete before **31st July 2018**. The compliance report be submitted to FFC for taking further action. Work on Jhelum Flood Bund be also completed in stipulated period.
- iv. **Water and Development Authority (WAPDA)**
- (a) **General Manager, Tarbela Dam**, to pursue the matter with WAPDA Authorities for early approval of revised filling criteria. The same may be circulated among concerned organization as soon as approval accorded by the authority. The approved filling criteria be immediately implemented during current monsoon season.
 - (b) **(H&WM Wing)** to submit to FFC the proposal for procurement and installation of 18 new Flood Telemetry Stations before **31st July 2018** for further action. Effort shall be made to install all stations before start of monsoon season 2019 as per the commitment by WAPDA.
 - (c) To arrange funds (Rs 5.00 million) and prepare proposal for construction of flood embankment along Shori Nullah for Protection of Kachhi Canal and Kashmore Garrison on priority basis so as to complete the same at the earliest.
- v. **Engineers Directorate, GHQ** to expedite the design work for rehabilitation of Barakas Nullah Phase-II works. The tendering formalities, contract award and implementation of physical work be carried out on fast track basis, so that Phase-II works could be completed in minimum short span but not later than **30th June 2020**.

- vi. **Pakistan Commissioner for Indus Waters (PCIW)**
- (a) To ensure continuity of all necessary arrangements being in place for obtaining reservoirs/rivers flows data and other information from Indian counterpart (ICIW) on River Chenab and Eastern Rivers during 2018 monsoon season 2018 and its timely transmission to all stakeholders including FFD, Lahore.
 - (b) To write a letter to Indian Counterpart (ICIW) requesting for early response on all pending issues relating to exchange of river flow data.
- vii. **PMD** to closely watch the weather situation during 2018 monsoon season. Further PMD in collaboration with **PCIW and SUPARCO** shall also carefully determine the validity/ reliability of data provided by India through its own Radar Network and other Flood Forecasting & Warning System facilities, while using the same for flood management operation in the country.
- viii. **SUPARCO** to share its Rivers monitoring report with PCIW, PMD/ FFD, Lahore and FFC on daily basis for effective use in flood forecasting activities relating to all major Rivers, particularly the flood flows of Eastern Rivers from India.
- ix. **National Disaster Management Authority (NDMA)**
- (a) In consultation with Pak Army, PDMAs and DDMA to ensure completion of all necessary arrangements regarding any likely rescue and relief activities that may arise during flood emergency condition.
 - (b) To ensure that all rescue and relief items including flood fighting equipments, available with PDMAs/ DDMA have been placed at vulnerable districts for their immediate use in case of emergency situation.
- x. **Federal Flood Commission (FFC)**
- (a) In consultation with PIDs and FLAs, to submit detailed proposal regarding revised distribution of funds under Normal/ Emergent Flood Programme considering the vulnerability of areas after reviewing the existing fund distribution mechanism, to Ministry of Planning, Development and Reforms for approval through Ministry of Water Resources.
 - (b) To prepare roadmap for management of urban flooding in consultation with the WASAs/Municipal Corporations & District Administrations under NFPP-IV and submit to Ministry of Planning, Development & Reforms through Ministry of Water Resources for approval and implementation.
- xi. **WASA Rawalpindi** to complete all necessary desilting works of critical sections of Lai Nullah upto 15th July, 2018 and the progress on the same be shared with FFC on regular basis till completion of the task.

- xii. **Deputy Commissioner, Rawalpindi** to ensure removal of encroachments from the waterway and banks/bed of Lai Nullah. The compliance report would be submitted to FFC for taking further action in the matter, if any.

4.5 QUARTERLY MEETING OF FFC TO REVIEW STATUS OF COMPLIANCE OF DIRECTIONS GIVEN BY THE HONOURABLE SUPREME COURT OF PAKISTAN ON THE RECOMMENDATIONS OF FLOOD INQUIRY COMMISSION

The 8th quarterly meeting of Federal Flood Commission was held on 30th April 2018 to review the status of compliance of directions given by the Honourable Supreme Court of Pakistan related to Constitution Petition No. 62 of 2010, filed by Ms Marvi Memon versus Federation of Pakistan, through Secretary Cabinet & others. Following decisions were taken related to flood preparedness of the four Provincial Irrigation Departments and Federal Line Agencies, WAPDA & PMD etc.:

- i. All concerned organizations will furnish para-wise replies on all the relevant decisions of meeting.
- ii. FFC will upload the minutes of meeting on its official website.
- iii. Irrigation Department, Govt. of Punjab, Sindh, KP, Balochistan and AJ&K will identify different kinds of encroachments & remove all the encroachments in flood plains/ waterways and share the details with SUPARCO for verification, under intimation to FFC.
- iv. SUPARCO will also carry out exercise itself and submit to FFC the list of all critical encroachments identified in flood plains, waterways and settled over irrigation, drainage & flood protection infrastructures.
- v. PIDs to directly take up the matter of removal of encroachments in floodplains/ waterways with concerned DCOs under intimation to FFC.
- vi. On the details of encroachments received from concerned PIDs& FLAs, FFC will write letters to concerned Chief Secretaries for removal of encroachments.
- vii. PDMA Sindh will share with FFC Evacuation/ Contingency/ Resettlement plan for displacement of 3.5 Million people settled in Flood Plains in Sindh Province.
- viii. SUPARCO will arrange presentation for all stakeholders within fortnight regarding the verification of encroachments.
- ix. H&WM Wing of WAPDA to keep on providing the progress on up-gradation of entire Flood Telemetry Network till completion of the job.
- x. Pakistan Metrological Department/ FFD, Lahore to keep on providing the status of PC-I. Moreover, brief containing details about each radar containing date of start, date of completion and activities to be carried out may be furnished to FFC at the earliest.
- xi. Forest Departments of four Provinces and Federally Administered Areas including Watershed Management Authorities of Mangla & Tarbela Dams Projects, will

submit to FFC detailed progress made on watershed management/ afforestation promoting activities carried out so far in the catchment areas of rivers/hill torrents in order to check land sliding and excessive bed erosion, besides, flood mitigation. PIDs and FLAs will also follow up the matter accordingly.

- xii. WAPDA to submit PC-II to FFC before 30th November 2018 so that a consultative meeting of all stakeholders may be arranged by FFC on the PC-II.
- xiii. Pending nominations of Focal persons from the concerned organizations will be submitted to FFC well before the next quarterly review meeting.
- xiv. PID Punjab to keep on providing the updated progress on Construction of Hydro Power Station on right side of Taunsa Barrage to FFC on regular basis.
- xv. PID, Punjab will furnish detailed report on physical activities of project.
- xvi. Deputy Commissioner, Rawalpindi, to direct the concerned Revenue authorities to carry out comprehensive survey / demarcation of Lai Nullah, at earliest and ensure removal of encroachments from Lai Nullah and its tributaries.
- xvii. PID Punjab & Sindh to provide brief on each barrage containing date of start, date of completion and activities of project.
- xviii. The progress report on all the projects will be provided on monthly basis till completion of projects.
- xix. FFC to write a D.O letter to NHA with copy to Supreme Court Registrar regarding lack of seriousness by NHA on the matter.
- xx. WAPDA to provide progress on project on regular basis till completion of the project, besides to share a brief on the details of project.
- xxi. PCIW to ensure his kind participation during future progress review meetings of FFC and make a detailed presentation on the issue during the next meeting.
- xxii. PCIW to ensure his kind participation during future progress review meetings of FFC and make a detailed presentation on the issue during the next meeting.
- xxiii. All concerned organizations to vigorously pursue their cases with concerned authorities for early approval and enforcement of Federal River Act under intimation to FFC. Any future correspondence with Law department and Minister for Law will be shared with FFC.
- xxiv. KMC to ensure participation in future meetings and share the details of efforts for removal of encroachments and garbage from storm drains
- xxv. PID, Sindh to keep on sharing the latest status of the project.
- xxvi. WAPDA and PID Sindh to continue consultations to resolve the issue among themselves and submit progress to FFC regularly on monthly basis.

4.6 POST FLOOD MEETING OF FFC TO REVIEW STATUS OF COMPLIANCE OF DECISIONS TAKEN IN 53RD ANNUAL MEETING OF FFC AND DAMAGES OCCURRED TO IRRIGATION, DRAINAGE & FLOOD PROTECTION INFRASTRUCTURE

The Post Flood meeting of FFC to review the status of compliance of decisions taken in 53rd Annual Meeting of FFC held on 4th July 2018 and Pak-Army Pre-Flood Coordination Conference held on 26th April 2018, besides, evaluation of flood damages occurred to Irrigation, Drainage and Flood Protection Infrastructure during monsoon season 2018 and to review the restoration and rehabilitation plan prepared by the provinces, if any, depending on damages. During the meeting following decisions were taken;

- (i) **Provincial Irrigation Departments & Federal Line Agencies (PIDs & FLAs)** to ensure completion of all approved/ongoing flood protection schemes taken up under Normal/ Emergent Flood Programme, rehabilitation/strengthening works of all weak sections and Flood Damages Restoration Works including O&M works related to Barrages/Head Works/Bridges, Irrigation, Drainage and Flood Protection Infrastructure well before the start of 2019 monsoon season.
- (ii) **PIDs & FLAs** to submit the details of all flood protection schemes implemented/being implemented through Provincial Annual Development Programme (ADP) and external donors etc. to Federal Flood Commission for updating of country wide inventory of flood protection infrastructure by/ before **28th February 2019.**
- (iii) **PIDs & FLAs** to submit PC-Is of all new proposed flood protection schemes (along with clearance by PDWP) of works to be under taken through Normal/ Emergent Flood Programme (2018-19) to FFC **without further delay** for technical clearance of Scrutinizing Committee of FFC and approval of DDWP/CDWP and execution before 30th June 2019.
- (iv) **PID KP and Balochistan** to submit demand for release of funds allocated under PSDP (2018-19) for Normal/Emergent Flood Programme to FFC **without further delay** for taking up the case with Planning Commission through Ministry of Water Resources.
- (v) **PIDs and FLAs** to take up the matter with respective Provincial Authorities regarding approval and enactment of River Act (Draft prepared by FFC) for flood plains regulation i.e. removal of existing encroachments and restricting new settlements in the flood plains. The progress on the case to be shared with FFC on fortnightly basis.
- (vi) **PIDs & FLAs** to ensure removal of encroachments from flood plains/ High Risk Zones, waterways, which are under the threat of flood waters and also causing hindrance in flood flows. The progress on the job would be submitted to FFC on monthly basis till completion of the task. The entire exercise be completed well before the start of 2019 monsoon season.

- (vii) **PID, Punjab & Pak. Railway** will coordinate with IRI, Nandipur, Lahore for early completion of ongoing Hydraulic Model Studies on Revaz Railway Bridge. The progress report will be shared with FFC regularly on monthly basis.
- (viii) **PID, Punjab** to speed up progress on Satrah Drain project for desilting of Palku Nullah and complete the same by end February 2019.
- (ix) **PID, Punjab** to submit PC-I of project titled “Increasing Discharge Capacity of Shahdara Railway Bridge across River Ravi” duly amended in the light of FFC’s observations on top priority basis and process the same for approval of concerned fora and ensure its implementation on fast track being a highly sensitive project with respect to vulnerability and threat of high flows from cross border.
- (x) **PID, Punjab** in consultation with Chief Engineer, Kachhi Canal Project, WAPDA, to include the proposal for construction of flood embankment along the right bank of Shori Nullah meant for protection of Kachhi Canal and Kashmore Garrison in the PC-I of X-drainage structures of D.G Khan Canal, which are being done by PID Punjab as deposit work for WAPDA.
- (xi) **PID Punjab** to complete the RMB and LMB at Benazir Bridge before start of monsoon season 2019. Progress on the same be shared with FFC regularly on monthly basis till completion of the task.
- (xii) **PID, Sindh** to speed up progress on the under construction Ring Flood Bund being constructed around Kashmore Garrison, so as to fully complete the project before start of monsoon season 2019. The progress (on monthly basis) on the work be shared with all concerned organizations including FFC till completion of the job.
- (xiii) **GB-PWD** to submit to FFC detailed plan (both hard and soft) showing all Nullahs in Gilgit-Baltistan, their flood limits and vulnerabilities to the public and private properties.
- (xiv) **PMD/ FFD, Lahore** to share with FFC within a month’s time comprehensive report on existing Flood Forecasting facilities, Radar Network, the projects taken in hand and those planned to be implemented in future (Para-4).
- (xv) **PMD/ FFD, Lahore** to make the radar installed at Gawadar by UNDP functional in coordination with NDMA and share the progress with FFC.
- (xvi) **Engineers Directorate, GHQ, Rawalpindi** to submit detailed design drawings for rehabilitation of Barakas Nullah through concerned Corps of Engineers to WAPDA for approval of design by the Central Design Office (CDO), WAPDA and to complete rehabilitation of Barakas Nullah within the target period.
- (xvii) General Manager (M-3 & M-4), National Highway Authority to submit compliance report of recommendations made in the joint site visit of Sidhna Breaching Section, to FFC before 15th December 2018.
- (xviii) **Mangla Dam Organization (MDO), WAPDA** to coordinate with CDO WAPDA and Pak Army 2-Corp Mangla, for early approval of design of rehabilitation of Barakas Nullah and submit the report to FFC regularly till completion of the task.

- (xix) **Tarbela Dam Authority** to obtain the approval of revised filling criteria of Tarbela Dam Project from WAPDA Authority and circulate the same among all stakeholders.
- (xx) **WAPDA's (H&W Wing)** to make utmost efforts for timely completion of repair/ rehabilitation work of non-functional Flood Telemetry Stations. The progress report be shared with FFC on monthly basis till completion of task.
- (xxi) **Ministry of Water Resources** as per FFC's request and clarification given to process the proposal for procurement and installation of eighteen (18) Flood Telemetric Stations submitted by WAPDA on priority basis so that the project could be completed within given time frame.
- (xxii) **Deputy Commissioner, Rawalpindi** will ensure removal of encroachments from the waterway and banks/ bed of Lai Nullah before start of monsoon season 2019. The progress on demarcation of Lai Nullah in Rawalpindi City be accelerated so as to complete the task at the earliest.
- (xxiii) **Managing Director WASA Rawalpindi** to prepare plan for dredging/ desilting of Lai Nullah at critical reaches including site survey, arrangement of funds and start of work so that the same could be completed well before start of monsoon-2019. The progress on the job be shared with FFC on monthly basis till completion of task.

4.7 MISCELLANEOUS ACTIVITIES OF FFC DURING 2018

In addition to the above activities, FFC organized/ attended various meeting for overall better flood management in the country. The details of meetings are given as under:

- i. Meeting to resolve the issue of proposed breaching section at Sultan Bahoo Bridge constructed across River Chenab located 32 KM D/S Trimmu Barrage organized on 28th January 2018.
- ii. 2 Focused Group Discussion Sessions were organized in collaboration with UNDP to Mainstream Climate Change into Budgetary Frame work on 26th February 2018 and 21st March 2018.
- iii. Meeting to enhance the Water Capacities at National level in collaboration with UNESCO was organized on 27th March 2018.
- iv. FFC in collaboration with WWF has started working on project titled "Integrated Flood Plain Management along Indus River to Build Resilience of Riverine Ecosystem and Vulnerable Communities". Various meetings were organized/ attended by FFC for the project. The PC-I of project is in final stages of preparation.
- v. A briefing was organized by FFC from National Disaster Risk Management Fund (NDRMF) representatives, so that various stakeholders can get the benefit of funding being offered by NDRMF.
- vi. Representative from FFC also attended Post Flood Meetings of NDMA and Pak Army held on 12th and 13th December 2018 respectively.

- vii. Meetings were held with Turkish Corporation & Coordinating Agency (TIKA) on 12th February and 25th September 2018. The proposal for capacity building of FFC has been shared with TIKA.
- viii. Meeting to review the model study reports of Alexandra and Shershab Railway Bridges was organized on 10th July 2018.
- ix. Various other meetings were organized with Australian Delegation, JICA Mission, KOICA were organized throughout the year in order to seek financial assistance for interventions proposed in PC-I of NFPP-IV.
- x. PC-I for strengthening of O/o CEA/CFFC costing Rs. 494.788 Million was forwarded to Ministry of Water Resources on 18th August 2018.
- xi. During Financial Year 2017-18, a total of schemes were visited during Financial Year 2017-18.

2018 MONSOON SEASON AND ANALYSIS

5. 2018 MONSOON SEASON AND ANALYSIS

5.1 MONSOON SEASON 2018

Pakistan Meteorological Department (PMD) issued the preliminary seasonal forecast on June 08, 2018 for Monsoon Season 2018, which is described below:

- *Keeping in view the global, regional and local meteorological indicators, the seasonal outlook for Pakistan summer monsoon 2018 has been prepared. It is evident from the model output that monsoon is expected to be more active during the first half than the second one. However, the most likely salient features are stated below:*
- *In northern Pakistan, rainfall is expected to remain “Normal to slightly above normal of long term average” during first half of the season and below normal during 2nd half.*
- *In southern Pakistan, rainfall is expected to remain “near normal of long term average” during first half of the season, and largely below normal during the 2nd half.*
- *The prevailing temperatures trend in Pakistan indicates high probability of few “Extreme rainfall events” in Punjab, and “GLOF events” in Gilgit-Baltistan/Chitral regions during monsoon season.*
- In the light of “Outlook of Summer Monsoon 2018” and already prevailing water shortage in the country, the water managers should take measures for water storages accordingly.

As per the prediction of PMD, monsoon remained more active during the first phase as compared to 2nd phase during monsoon season 2018. Overall below normal rainfall was recorded during monsoon season 2018. Month-wise detail is given as under:

- In July, rainfall at country level was **below** normal. However, some good rains (above Normal) were occurred over Punjab, KP & G-B, whereas below normal over Sindh & Balochistan and close to Normal rainfall was received over AJK.
- In August, overall country level rainfall was below Normal.
- During September, country level rainfall was below normal. However, Balochistan Province received some good spells of rainfall.

Overall nine (9) monsoon Lows/Depressions originated during the monsoon season 2018. None of these entered into Pakistan, However, only one reached near the border of Pakistan, but that also re-curved over central India to north-northeastward. Two cyclonic storms were developed during the monsoon season 2018. One in Bay of Bengal and the other in Arabian Sea. However, none of them affected our country. Nine rainfall spells occurred during the monsoon season 2018. However, no one created High Flood situation (danger level flooding) in the major and other rivers except for River Chenab,

which attained High Flood Level (201,878 cusecs i.e. inflow at Marala Barrage on 13th August 2018) for a short duration. One sharp peak of High Flood Stage (122,000 cusecs i.e. Inflow on 14th August 2018) was also recorded in River Jhelum at Mangla. River Kabul attained Medium Flood Level at Warsak (54,638 cusecs on 19th June 2018) & Nowshera (105,300 cusecs on 7th July 2018). River Ravi also attained Medium Flood Level at Balloki (68,030 cusecs on 27th September 2018). Tarbela Dam attained its Maximum Conservation Level of 1550.00 feet on 20th August 2018 whereas Mangla Dam could not attain its Maximum Conservation Level of 1242.00 feet. It attained maximum water level of 1178.60 feet on 15th September 2018. According to National Disaster Management Authority, 88 persons lost their lives and 362 houses were damaged due to 2018-Rain/Floods.

The details of major rainfall events received during Monsoon Season are given in Table-5 below:

TABLE-5
DETAILS OF MAJOR RAINFALL EVENTS

Sr. No	Date	City with rainfall
1.	03-07-2018	(Luckshami= 177 mm, Misri Shah =159 mm, Shahi Qilla = 141 mm, City =139 mm, Shahdara =136 mm, Mughal Pura & Iqbal Town = 135 mm each, Upper Mall =130 mm, Gulshan-e-Ravi = 122 mm, Gulberg =121 mm, Samanabad =115 mm, Taj Pura = 110 mm, Airport=90 mm, Punjab University = 85 mm, Township = 75 mm), Mangla & Brarkot = 74 mm each
2.	04-07-2018	Lahore (Township=169 mm, Shahdara=157 mm, Iqbal Town=135 mm, Shahi Qilla=129 mm, Samanabad=122 mm, Luckshami=116 mm, Gulshan-eRavi=114 mm, Airport=113 mm, Misri Shah=110 mm, Johar Town=109 mm, City=102 mm, Taj Pura=100 mm, Upper Mall=93 mm, Mughal Pura=92 mm, Gulberg=77 mm), Joharabad=110 mm, Sargodha=83 mm, Bhakkar=72 mm, Kasur=70 mm
3.	05-07-2018	Bahawalpur=75 mm
4.	13-07-2018	Islamabad= 73 mm, Sialkot=70 mm.
5.	16-07-2018	Risalpur=95 mm.
6.	17-07-2018	Harman=90 mm.
7.	18-07-2018	Shinkiari=96 mm
8.	21-07-2018	Lahore=137 mm.
9.	22-07-2018	Kotli & Haraman=91 mm and Muzaffarabad=70mm.
10.	23-07-2018	Islamabad (Golra = 115 mm, Bokra = 95mm, Shamsabad = 78 mm, Saidpur = 58 mm, New Airport & Zero Point = 50 mm each, Old Airport = 42 mm), Kamra=90 mm, Peshawar=82 mm, Daggar=70 mm.
11.	26-07-2018	Brarkot=92 mm, Rawalakot=80 mm, Islamabad (Shamsabad=77, Old Airport=72), Murree=76 mm.
12.	27-07-2018	Mangla=95, Lahore=80 mm Ravi Syphon=76 mm.
13.	28-07-2018	Joharabad=103 mm.
14.	06-08-2018	Tandali=75 mm.
15.	07-08-2018	Rawalpindi (Shamsabad=206, Old Airport=163), Islamabad= (Zeropoint=164, Bokra=112, Saidpur=107, Golra=54), Shinkiari= 148 mm, Domel=103, Kotli=102, Muzaffarabad &

		Daggar=101 each, Marala=98 mm, Sialkot & Tandali=97 mm, Kallar=88 mm, Balakot=80 mm, Bandi Abbaspur=79 and Garhidupatta=72 mm.
16.	08-08-2018	Warsak=85 mm, Cherat=80 mm, Rashidabad (Kalpani) & Risalpur=71 mm each.
17.	12-08-2018	Kund =91 mm.
18.	13-08-2018	Islamabad=74 mm
19.	14-08-2018	Marala=107, Kotli=100, Jhelum=95 mm, Rawalpindi= 91, Islamabad=76 mm, Risalpur=82mm.
20.	15-08-2018	Kamra=76 mm.
21.	18-08-2018	Daggar & Tandall=80 mm each
22.	21-08-2018	Marala=141 mm
23.	22-08-2018	Kamra=71 mm
24.	23-08-2018	Islamabad=89 mm.
25.	25-08-2018	Islamabad=71 mm
26.	26-08-2018	Mangla=78 mm
27.	23-09-2018	Narowal=72 mm
28.	24-09-2018	Narowal =85 mm

5.2 DROUGHT SITUATION

PMD had issued two drought alerts in June 2018 and September 2018. The latest drought alert issued on 6th September 2018 is given as under:

Due to deficient summer/monsoon rainfall, moderate drought like condition has emerged over most of the southern parts of Pakistan. The moderate to severe drought is prevailing in most parts of Sindh (Tharparkar, Mityari, Hyderabad, Jacobabad, Dadu, Karachi, Kambar Shadadkot, Umerkot, Sanghar, Sajwal, Shaheed Benzairabad, Jamshoro and Khairpur), Balochistan (Dalbandin, Gawadar, Jiwani, Panjgur, Pasni, Nokkundi, Ormara, Quetta and Turbat), and mild to moderate drought at few places of south Punjab (Multan and Mianwali) and GB (Bunji, Chilas, Gilgit and Gupis).

Drought conditions may get severe in the coming days especially in southern parts of the country. Dry conditions will cause water stress in the cultivated lands/areas of the country due to limited supply of irrigation water for Kharif crops.

5.3 LIKELIHOOD OF RAINS IN WINTER + SNOWFALL

There are 60-70 % chances of the development of El Nino during winter season. According to the analysis of latest atmospheric conditions, although better snowfall is expected during coming winter but it will be available as a water resource when melting will start in April next year.

5.4 FLOOD PEAKS RECORDED DURING MAJOR HISTORICAL FLOODS

Highest ever recorded flood peaks during major flood events at various control points of Indus Basin are given in **Table-6**. Flood peaks recorded at important control structures across major rivers during 2018 monsoon season are given in **Table-7**.

The flood flows (inflows & outflows) of major rivers at important control structures i.e. Reservoirs & Barrages is attached as **Appendix-II**, whereas rainfall data of monsoon season 2017 is attached as **Appendix-III**.

TABLE-6
MAJOR FLOOD EVENTS & HISTORIC FLOOD PEAKS RECORDED IN MAJOR RIVERS

Dam/ Barrage Site	Designed Capacity	Highest Recorded		1973 Peak Date	1976 Peak Date	1988 Peak Date	1992 Peak Date	2010 Peak [^] Date	2011- Peak [^] Date	2012- Peak [^] Date	2013- Peak [^] Date	2014- Peak [^] Date	2015- Peak [^] Date	2017-Peak	
		Year	Flow (Cusecs)											Inflow/ Date	Outflow/ Date
Indus River															
Tarbela Reservoir	1,500,000	1929	8,75,000	<u>420,000</u> July 1973	<u>304,000</u> 3.8.76	<u>556,900</u> 22.7.88	<u>500,000</u> 10.9.92	<u>833,000</u> 30.7.10	<u>272,200</u> 28.6.11	<u>295,000</u> 4.8.12	<u>392,000</u> 14.8.13	<u>299,000</u> 28-7-14	<u>486,900</u> 26-7-15	<u>344,000</u> 02-8-17	<u>336,900</u> 03-08-2017
Jinnah Barrage	950,000	1942	950,000	<u>564,000</u> 20.7.73	<u>862,000</u> 2.8.76	<u>598,000</u> 2.8.88	<u>849,245</u> 10.9.92	<u>937,453</u> 30.7.10	<u>293,900</u> 26.7.11	<u>285,300</u> 18.7.12	<u>479,603</u> 13.8.13	<u>258,000</u> 25-7-14	<u>532,998</u> 2-8-15	<u>427,460</u> 03-08-17	<u>419,460</u> 03-08-2017
Chashma Barrage	950,000	2010	1,036,700	<u>510,000</u> 22.7.73	<u>787,000</u> 3.8.76	<u>580,000</u> 3.8.88	<u>668,000</u> 11.8.92	<u>1,036,700</u> 1.8.10	<u>356,500</u> 28.7.11	<u>298,300</u> 8.7.12	<u>637,482</u> 14.8.13	<u>282,000</u> 17-8-14	<u>636,512</u> 3-8-15	<u>458,245</u> 05-08-17	<u>446,361</u> 05-08-2017
Taunsa Barrage	1,000,000	2010	960,000	<u>568,000</u> 29.7.73	<u>675,000</u> 7.8.76	<u>560,000</u> 21.7.88	<u>655,000</u> 14.9.92	<u>960,000</u> 2.8.10	<u>249,200</u> 31.8.11	<u>243,400</u> 10.9.12	<u>516,017</u> 17.8.13	<u>261,000</u> 30-7-14	<u>604,714</u> 5-8-15	<u>429,861</u> 06-08-17	<u>423,861</u> 06-09-2017
Guddu Barrage	1,100,000	1976	1,199,672	<u>1,084,000</u> 18.8.73	<u>1,199,672</u> 15.8.76	<u>1,163,000</u> 30.7.88	<u>1,087,000</u> 18.9.92	<u>1,148,738[*]</u> 8.8.10	<u>272,300</u> 3.9.11	<u>236,100</u> 12.9.12	<u>567,418</u> 20.8.13	<u>367,000</u> 18-9-14	<u>769,872</u> 3-8-15	<u>459,811</u> 09-08-17	<u>428,640</u> 09-08-2017
Sukkur Barrage	900,000	1976	1,161,000	<u>1,077,000</u> 21.8.73	<u>1,161,000</u> 16.8.76	<u>1,116,000</u> 30.7.88	<u>1,068,000</u> 20.9.92	<u>1,130,995^{**}</u> 10.8.10	<u>260,800</u> 6.9.11	<u>214,800</u> 14.9.12	<u>510,875</u> 24.8.13	<u>321,000</u> 20.9.14	<u>709,316</u> 5-8-15	<u>390,863</u> 11-08-17	<u>333,108</u> 11-08-2017
Kotri Barrage	875,000	1956	980,000	<u>786,000</u> Aug 1973	<u>765,000</u> Aug 1976	<u>649,600</u> 17.8.88	<u>689,300</u> 30.9.92	<u>964,900</u> 27.8.10	<u>261,400</u> 14.9.11	<u>166,000</u> 21.9.12	<u>381,696</u> 30.8.13	<u>145,000</u> 25-9-14	<u>634,919</u> 15-8-15	<u>251,298</u> 18-08-2017	<u>210,923</u> 18-08-2017
Jhelum River															
Mangla Reservoir	1,230,000	1929	1,100,000	<u>2,20,000</u> 9.8.73	<u>480,060</u> 3.8.76	<u>425,515</u> 16.7.88	<u>1,030,000</u> 10.9.92	<u>344,400</u> 30.7.10	<u>141,300</u> 16.9.11	<u>1150,00</u> 18.9.12	<u>179,000</u> 13.8.13	<u>634,000</u> 5-9-14	<u>150,000</u> 12-8-15	<u>94,000</u> 17-08-2017	<u>67,882</u> 22-09-2017
Rasul Barrage	8,50,000	1929	1,000,000	<u>2,70,000</u> 9.8.73	<u>2,69,000</u> 4.8.76	<u>261,664</u> 17.7.88	<u>952,170</u> 10.9.92	<u>263,796</u> 30.7.10	<u>105,800</u> 17.9.11	<u>42500</u> 4.8.12	<u>43,080</u> 19.8.13	<u>516,000</u> 6-9-14	<u>110,100</u> 27-7-15	<u>60,260</u> 22-09-2017	<u>39,230</u> 22-09-2017
Chenab River															
Marala Barrage	1,100,000	1957	1,100,000	<u>770,000</u> 9.8.73	<u>549,000</u> 1.8.76	<u>751,000</u> 25.9.88	<u>845,000</u> 10.9.92	<u>314,378</u> 6.8.10	<u>150,400</u> 16.9.11	<u>183,200</u> 4.8.12	<u>377,290</u> 15.8.13	<u>861,464</u> 6-9-14	<u>183,431</u> 12-7-15	<u>208,616</u> 18-07-2017	<u>187,472</u> 19-07-2017
Khanki Barrage	8,50,000	1957	1,066,000	<u>1,000,000</u> 10.8.73	<u>615,000</u> 2.8.76	<u>864,000</u> 26.9.88	<u>910,500</u> 10.9.92	<u>334,437</u> 7.8.10	<u>171,400</u> 17.9.11	<u>194,800</u> 4.8.12	<u>410,331</u> 15.8.13	<u>947,000</u> 7-9-14	<u>160,000</u> 13-7-15	<u>178,546</u> 03-08-2017	<u>170,021</u> 13-07-2017
Qadirabad Barrage	8,07,000	1992	9,48,530	<u>854,000</u> 10.8.73	<u>629,000</u> 2.8.76	<u>892,000</u> 26.9.88	<u>948,530</u> 11.9.92	<u>329,483</u> 7.8.10	<u>171,000</u> 17.9.11	<u>194,800</u> 5.8.12	<u>407,803</u> 15.8.13	<u>904,000</u> 7-9-14	<u>174,100</u> 13-7-15	<u>179,842</u> 19-07-2017	<u>157,842</u> 19-07-2017
Trimmu Barrage	6,45,000	1959	9,43,000	<u>753,000</u> 12.8.73	<u>706,000</u> 10.8.76	<u>584,000</u> 19.7.88	<u>888,000</u> 14.9.92	<u>328,926</u> 11.8.10	<u>132,900</u> 20.9.11	<u>87,800</u> 7.8.12	<u>272,609</u> 20.8.13	<u>703,000</u> 10-9-14	<u>150,865</u> 29-7-15	<u>102,145</u> 05-08-2017	<u>89,345</u> 05-08-2017
Panjinad Headworks	7,00,000	1973	8,03,000	<u>803,000</u> 17.8.73	<u>710,000</u> 12.8.76	<u>507,000</u> 27.7.88	<u>744,152</u> 18.08.92	<u>310,117</u> 13.8.10	<u>151,300</u> 24.9.11	<u>65,600</u> 17.9.12	<u>317,261</u> 28.8.13	<u>454,000</u> 16-9-14	<u>139,366</u> 30-7-15	<u>78,988</u> 08-08-2017	<u>63,488</u> 08-08-2017
Ravi River															
Jassar	275,000	1955	6,86,000	<u>228,000</u> 10.8.73	<u>170,000</u> 9.8.76	<u>582,000</u> 25.9.88	<u>149,000</u> 11.9.92	<u>195,000</u> 23.8.10	<u>27,700</u> 19.9.11	<u>30,500</u> 26.8.12	<u>67,700</u> 16.8.13	<u>68,000</u> 7-9-14	<u>32,350</u> 16-7-15	<u>46,319</u> 10-08-2017	<u>46,439</u> 10-08-2017
Shahdara	250,000	1988	5,76,000	<u>237,380</u> 11.8.73	<u>170,000</u> 10.8.76	<u>576,000</u> 27.9.88	<u>63,000</u> 12.9.92	<u>41,900</u> 21.8.10	<u>43,000</u> 14.8.11	<u>40,800</u> 22.8.12	<u>74,880</u> 17.8.13	<u>91,000</u> 8-9-14	<u>30,000</u> 18-7-15	<u>39,313</u> 02-08-2017	<u>39,313</u> 02-08-2017

Dam/ Barrage Site	Designed Capacity	Highest Recorded		<u>1973</u> Peak Date	<u>1976</u> Peak Date	<u>1988</u> Peak Date	<u>1992</u> Peak Date	<u>2010</u> Peak [^] Date	<u>2011-</u> Peak [^] Date	<u>2012-</u> Peak [^] Date	<u>2013-</u> Peak [^] Date	<u>2014-</u> Peak [^] Date	<u>2015-</u> Peak [^] Date	<u>2017-Peak</u>	
		Year	Flow (Cusecs)											Inflow/ Date	Outflow/ Date
Balloki Barrage	2,25,000	1988	3,99,000	<u>2,44,000</u> 13.8.73	<u>234,000</u> 11.8.76	<u>399,000</u> 28.9.88	<u>112,157</u> 13.9.92	<u>69,900</u> 23.8.10	<u>72,100</u> 15.8.11	<u>60,800</u> 23.8.12	<u>117,770</u> 18.8.13	<u>132,000</u> 9-9-14	<u>67,180</u> 19-7-15	<u>69,980</u> 11-08-2017	<u>36,790</u> 11-08-2017
Sidhnai Barrage	1,50,000	1988	3,30,000	<u>2,10,000</u> 18.8.73	<u>244,000</u> 15.8.76	<u>330,000</u> 2.10.88	<u>95,500</u> 16.9.92	<u>27,600</u> 28.7.10	<u>30,300</u> 19.8.11	<u>28,600</u> 14.9.12	<u>87,904</u> 23.8.13	<u>86,000</u> 12-9-14	<u>43,889</u> 28-7-15	<u>31,967</u> 07-08-2017	<u>26,954</u> 07-08-2017
Sutlej River															
Suleimanki Headworks	3,25,000	1955	5,98,872	<u>177,000</u> 15.8.73	<u>119,000</u> 6.9.76	<u>399,000</u> 30.9.88	<u>197,000</u> 3.9.92	<u>58,300</u> 30.9.10	<u>82,000</u> 29.8.11	<u>21,700</u> 30.8.12	<u>82,370</u> 22.8.13	<u>26,000</u> 7-9-2014	<u>61,421</u> 17-8- 2015	<u>33,934</u> 13-08-2017	<u>20,893</u> 15-08-2017
Islam Headworks	3,00,000	1955	4,93,000	<u>166,000</u> 17.8.73	<u>111,000</u> 8.9.76	<u>306,000</u> 4.10.88	<u>183,000</u> 7.9.92	<u>31,500</u> 20.9.10	<u>49,600</u> 3.9.11	<u>14,200</u> 13.9.12	<u>70,932</u> 25.8.13	<u>20,000</u> 8-9-2014	<u>45,479</u> 21-8- 2015	<u>16,971</u> 16-08-2017	<u>14,221</u> 16-08-2017

* It does not include flood flows passed through breaches occurred in LMB Guddu Barrage; ** It does not include flood flows passed through breaches occurred in Tori Flood Bund. ^ Based on the Inflows experienced upstream of the Dam/ Barrage site.

TABLE-7
FLOOD PEAKS RECORDED DURING 2018 MONSOON SEASON IN MAJOR RIVERS

<i>RIVER</i>	<i>SITES</i>	<i>IN FLOW</i>	<i>RETENSION DATE & TIME</i>	<i>OUT FLOW</i>	<i>CLASSIFICATION (on outflows)</i>	<i>RETENSION DATE & TIME</i>
<i>INDUS</i>	Tarbela	295,000 295,000	24-07-2018 @ 1200	242,300 228,100	Normal Normal	24-08-2018 @ 1200 hrs
	Kalabagh	319,154	15-08-2018 @ 1200 hrs	311,154	Low Flood	15-08-2018 @ 1200 hrs
	Chashma *	335,912	15-08-2018 @ 1800 hrs	319,912	Low Flood	15-08-2018 @ 1800 hrs
	Taunsa	297,265	17-08-2018 @ 1200 hrs	276,215	Low Flood	17-08-2018 @ 1200 hrs
	Guddu	256,035	20-08-2018 @ 0600 hrs	227,270	Low Flood	20-08-2018 @ 0600 hrs
	Sukkur	211,595	21-08-2018 @ 0600 hrs	156,025	Normal	21-08-2018 @ 0600 hrs
	Kotri	102,375	26-08-2018 @ 0600 hrs	60,740	Normal	26-08-2018 @ 0600 hrs
<i>KABUL</i>	Warsak	54,638	19-06-2018@0600 hrs	54,638	Medium Flood	19-06-2018@0600 hrs
	Nowshera	105,300	24-07-2018 @ 0600 hrs	105,300	Medium Flood	24-07-2018 @ 0600 hrs
<i>JHELUM</i>	Mangla	122,000	14-08-2018 @ 0600 hrs	69,127	Normal	07-07-2018 @ 1800 hrs
	Rasul	59,543	08-07-2018 @ 2359 hrs	39,230	Normal	08-07-2018 @ 1800 hrs
<i>CHENAB</i>	Marala	201,878	13-08-2018 @ 1200 hrs	168,278	Medium Flood	13-08-2018 @ 1200 hrs
	Khanki	189820	13-08-2018 @ 2359 hrs	182,025	Medium Flood	13-08-2018 @ 2359 hrs
	Qadirabad	194,031	14-08-2018 @ 0600 hrs	172,031	Medium Flood	14-08-2018 @ 0600 hrs
	Trimmu	93,680	16-08-2018 @ 2359 hrs	81,680	Normal	16-08-2018 @ 2359 hrs
	Panjinad	57,464	21-08-2018 @ 1200 hrs	42,664	Normal	21-08-2018 @ 1200 hrs
<i>RAVI</i>	Jassar	66,641	25-09-2018@0600 hrs	66,641	Low Flood	25-09-2018@0600 hrs
	R.SYPHON	37,936	14-08-2018 @ 1800 hrs	37,936	Normal	14-08-2018 @ 1800 hrs
	Shahdara	37,587	14-08-2018 @ 1800 hrs	37,587	Normal	14-08-2018 @ 1800 hrs
	Balloki	68,030	27-09-2018 @ 0600 hrs	39,310	Normal	16-08-2018 @ 2359 hrs
	Sidhnai	24,157	30-09-2018 @ 1200 hrs	8,857	Normal	01-08-2018 @ 1800 hrs
<i>SUTLEJ</i>	Suleimanki	46,586	28-09-2018 @ 2359 hrs	34,722	Normal	28-09-2018 @ 2359 hrs
	Islam	18,535	03-10-2018 @ 0600 hrs	16,420	Normal	03-10-2018 @ 0600 hrs

5.5 COUNTRY-WIDE LOSSES/ DAMAGES DUE TO 2018 RAINS/ FLOODS

As per information obtained from NDMA, the lives lost and damages caused to private as well as public infrastructure in Punjab, Khyber Pakhtunkhwa, Balochistan, Gilgit-Baltistan & AJK due to torrential rains & flash floods during monsoon season 2018 is given in **Table-8**

TABLE-8
COUNTRY-WIDE LOSSES/ DAMAGES DUE TO RAIN/FLOOD 2018

Province/ Region	Persons Died	Persons Injured	Houses Damaged
Punjab	31	72	8
Sindh	-	-	-
KP	22	40	182
Balochistan	1	-	-
AJ & K	21	30	60
G-B	4	1	100
FATA	9	15	12
G. TOTAL	88	158	362

5.6 INFRASTRUCTURE DAMAGED DURING FLOOD SEASON 2018 AND PLANNING FOR RESTORATION/ REHABILITATION

No significant damages occurred to flood protection infrastructure in Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan, FATA and AJ&K during monsoon season 2018 as reported by the concerned organizations. However, around 100 small scale flood protection works were damaged in Gilgit Baltistan as reported by GB-PWD. The restoration works costing Rs 293.00 Million had been started by GB-PWD and are expected to be completed by 30th June 2019.

**LIST OF FLOOD PROTECTION SCHEMES TAKEN
UP UNDER GOP FUNDED NORMAL/EMERGENT
FLOOD PROGRAMME DURING
FINANACIAL YEAR (2018-19)**

Sr. No.	Number of schemes	Estimate/ Approved Cost	Expenditure (31-12-2018)	Physical Progress (%)	Remarks
I	Punjab				
1	Extension of existing J-Head Spur by 2400 feet at RD 188+000 of Link No. 1	<u>133.597</u> 29/03/2018	N.R	N.R	*Work awarded. * Likely to be started shortly
2	Construction of 09 Nos. stone studs to protect vilaaages and abadies (Manjhota, Sawang, Sasti and Sangi) from flood flows of Sanghar Hill Torrent	<u>55.431</u> 07/03/2018	N.R	N.R	* Work awarded. * Likely to be started shortly
3	Checking erosion from RD 458 to 465 Extension Minchin Flood Bund in Dallas Canal Division Rahimyar Khan	<u>136.906</u> 29/03/2018	N.R	N.R	Tendering stage
4	Checking erosive action of River Chenab near Shakar Kot and Randhir Khokran villages along right bank of River Chenab	<u>198.253</u> Under process for approval	-	-	PC-I under preparation with PID, Punjab
5	Construction of diversion structures on River Jhelum near Gaga, village, Tehsil Bhera	<u>15.070</u> Under process for approval	-	-	Scheme dropped by PID, Punjab
	Sub Total	524.187			
II	Sindh				
6	Providing Stone Pitching along Baiji Bund mile 2/4 to 3/4 and 7/4 to 8/4 in Ghotki District.	<u>58.423</u> 7/01/2016	39.678	100%	Completed
7	Proposal for closing breach mile 1/1 to 2/6 Qadirpur Shank Bund, Shank Projection mile 0/o to 0/3, raising & strengthening mile 0/0 to 1/2 Qadirpur bund, Qadirpur Shank bund mile 0/0 to 1/7 and providing stone pitching mile 1/7 to 2/6 Qadirpur Shank bund and Shank Projection mile 0/0 to 0/3 R/s (Breach Portion)	<u>259.112</u> 11/02/2016	206.028	100%	Completed
8	Providing stone apron along Qadirpur loop bund mile 10/4 to 11/4	<u>160.000</u> 4/08/2016	48.300	90%	Lagging behind schedule
9	Providing Stone Apron, Stone Pitching 4 Nos Stone Stud and Earth Work along Moria Loop Bund mile 0/0 to 1/0 in Northern Dadu Division, Larkana.	<u>201.110</u> 4/08/2016	108.843	97%	Lagging behind schedule
10	Providing Stone Pitching and Stone Apron along Qadirpur Loop Bund Mile 7/2 to 8/4.	<u>202.412</u>	Nil	Nil	Scheme was cleared in S.C meeting on 19.11.2018. Modified PC-I awaited
	Sub Total (Sindh)	881.057	404.370		

Sr. No.	Number of schemes	Estimated/ Approved Cost	Expenditure (31-12-2018)	Physical Progress (%)	Remarks
III KHYBER PAKHTUNKHWA (North Zone)					
11	Construction of flood protection works along Barando River in District Buner	<u>10.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID KP
12	Construction of flood protection works downstream of Fizzaghat along left bank of Swat River in District Swat	<u>20.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID KP
13	Construction of flood protection work for protection of agriculture lands U/S & D/S of causeway along Ismaila Drain (Naranji Nullah) in village Ismaila, District Swabi.	<u>15.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID KP
14	Construction/Improvement of flood protection works along Bullar Nullah for protection of Daulat Minor at RD-40000-49500 and agriculture land, vilaaage abadies at village Gidar (mahmood Abad), Gumbat and Kandar Area.	<u>15.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID KP
KHYBER PAKHTUNKHWA (South Zone)					
15	Construction of flood protection structure at vulnerable locations of rivers and its tributaries in Bannu & Lakki Marwat District.	<u>25.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID KP
16	Construction of flood protection structure at vulnerable locations of rivers and its tributaries in Kohat, Hangu & Karak Districts.	<u>25.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID KP
Sub Total (KP)		110.000			
IV BALOCHISTAN					
17	Flood Protection bund for Sardari Sher Whad District Khuzadar	<u>25.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID Balochistan
18	Flood Protection bund for Shah Norani	<u>25.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID Balochistan
19	Flood Protection bund for Jhal Magsi Town District Jhal Magsi	<u>30.000</u> Under process for approval	Nil	Nil	PC-I under preparation with PID Balochistan
Sub Total (Balochistan)		80.000			

Sr. No.	Number of schemes	Estimated/ Approved Cost	Expenditure (31-12-2018)	Physical Progress (%)	Remarks
V	GILGAT-BALTISTAN				
20	Construction of flood protection work at Darel / Tangir valley, District Diamer.	<u>30.900</u>	23.315	90%	* Work in progress
21	Construction of flood protective bund at Sailing (Ph-II), District Ghanche	<u>12.786</u> 16/2/2010	11.619	100%	Work completed
22	Construction of flood protection bund at Ghursey (Ph-IV), District Ghanche	<u>24.113</u> 17/5/2012	8.492	65%	* Work in progress
23	Construction of flood protection works at Pakora Hoto, District Skardu (Revised)	<u>25.000</u> 4/5/2016	20.500	99%	* Work in progress * Lagging behind schedule due to funding constraints.
	Sub Total (GB)	109.227	77.118		
VI	FATA				
24	Construction of flood protection bund for protection of land of Anwar kach on local algal in Sherani Area F.R. D.I.Khan	<u>6.170</u> 3/02/2017	1.748	100%	Physically completed
25	Construction of flood protection scheme for the land of Asghar & Mulvi Rashid kach in KAZA Nar near Torwam Area/land near Torwam Bridges in Tiarza Tehsil South Waziristan Agency	<u>8.000</u> 3/02/2017	7.964	100%	Physically completed
26	Flood protection schemes raza kach on Kurram River Shewa Tehsil North Waziristan Agency	<u>7.000</u> 3/02/2017	4.400	100%	Physically completed
27	Flood Protection schemes in Kurram Agency	<u>6.000</u> 3/02/2017	1.748	100%	Physically completed
28	Construction of Flood protection wall for Protection of land of Wasil Shah Habib Shah Bismillah Jan, Ajab Shah Kach on R/L of Tangi Algal, Majeed Kach on Saraghazai Khawara in Sherani Area, FR D.I.Khan	<u>21.535</u> 7/03/2018	8.148	100%	Work reportedly in progress
	Sub Total (FATA)	48.705	28.398		

Sr. No.	Number of schemes	Estimated/ Approved Cost	Expenditure (31-12-2018)	Physical Progress (%)	Remarks
VII.	AJ&K				
29	Construction of guide wall for protection of Khandaq right to Munawar forward situated along right bank of river Munawar Tawi, District Bhimber	<u>108.622</u> 3/5/2017	27.752	-	Start of physical work is pending for want of funds to complete the scheme in one-go.
30	Extension of Existing Flood Protection Structures at Bararkot Left Bank of River Kunhar	<u>15.761</u>	Nil	Nil	PC-I under process of approval
	Sub Total (FATA)	124.383	27.752		
	Grand Total	1,877.559	692.635		

**MAJOR RIVERS FLOW DATA OF MONSOON
SEASON 2018**

Major Rivers Flow Data (July 2018) Sheet 1 of 4

Date	TIME	INDUS			KABUL			INDUS					
		TARBELA		D/S	NOWSHERA		KALABAGH		CHASHMA			TAUNSA	
		Reservoir Level (FT)	U/S		Flow	U/S	D/S	Reservoir Level (FT)	U/S	D/S	U/S	D/S	
01-07-18	0600	1402.28	95700	137200	45800	161200	155300	640.30	171500	180000	192800	167400	
02-07-18	0600	1398.28	108600	141200	47200	172000	166500	641.20	183400	170000	185600	163900	
03-07-18	0600	1395.35	131600	146600	48200	176600	171100	640.90	180300	177000	181500	160300	
04-07-18	0600	1392.36	148400	163700	56700	200900	195400	639.50	191100	196000	177300	158500	
05-07-18	0600	1390.59	154100	162900	61100	210700	205200	641.60	219000	196000	192200	172600	
06-07-18	0600	1390.30	149100	150000	52800	205300	200300	643.80	224700	196000	209500	188200	
07-07-18	0600	1387.82	133100	145200	51200	188100	183100	645.30	214800	190000	204100	183300	
08-07-18	0600	1386.00	115000	123700	45200	170200	165200	644.70	187900	190000	203900	182800	
09-07-18	0600	1386.00	121300	120600	36000	140200	135200	643.60	172800	180000	199100	178600	
10-07-18	0600	1386.00	123500	122800	33700	133200	128200	638.80	143400	180000	193300	177300	
11-07-18	0600	1388.27	150800	138500	36800	142400	137300	638.15	154800	153200	184200	168900	
12-07-18	0600	1392.20	171300	150000	40500	194500	189500	638.15	167100	161600	179400	164500	
13-07-18	0600	1397.40	178500	150000	50200	176000	171000	641.00	205900	180000	165700	158000	
14-07-18	0600	1405.51	212800	140000	57000	177500	172500	641.60	191300	180000	181100	108100	
15-07-18	0600	1413.64	221500	140000	56700	176100	170000	642.80	197700	180000	186600	173200	
16-07-18	0600	1420.17	219000	140000	61600	189600	184500	648.30	191300	180000	184400	171100	
17-07-18	0600	1427.24	220200	140000	64700	203500	197500	643.90	202600	190000	201500	187000	
18-07-18	0600	1434.75	227300	140000	65300	189100	182100	645.60	217900	190000	190500	176800	
19-07-18	0600	1442.02	227000	140000	67700	190800	183700	646.30	206600	190000	199600	185600	
20-07-18	0600	1448.30	207600	140000	64900	198500	191000	647.30	213800	190000	206300	191600	
21-07-18	0600	1455.03	231000	108600	67800	187700	180200	647.90	208400	190000	203300	188800	
22-07-18	0600	1461.88	249600	110200	63400	170500	162500	648.20	203200	190000	200500	181400	
23-07-18	0600	1469.52	259100	100000	62700	179300	171300	647.10	172300	190000	195800	177200	
24-07-18	0600	1477.78	276300	100000	105300	203100	196100	647.30	200100	190000	199100	180200	
25-07-18	0600	1486.86	279600	80000	86800	198700	191700	648.60	225800	190000	199100	180200	
26-07-18	0600	1495.27	271300	80000	68500	139400	132400	648.50	201100	197700	195600	177000	
27-07-18	0600	1503.59	277000	80000	88000	156000	148500	645.00	138800	197000	199900	180900	
28-07-18	0600	1508.59	277600	155300	79700	174100	166600	642.00	169200	197000	200900	175400	
29-07-18	0600	1511.59	256900	182000	74100	262700	255200	645.00	236600	197000	206900	180600	
30-07-18	0600	1515.59	215300	113700	64900	258000	250500	647.80	250000	197000	212000	185100	
31-07-18	0600	1517.44	182000	135000	59000	174400	166900	648.00	226500	216500	206700	180500	

Major Rivers Flow Data (July 2018) Sheet 2 of 4

Date	TIME	INDUS						JHELMUM				
		GUDDU		SUKKAR		KOTRI		Reservoir Level (ft)	MANGLA		RASUL	
		U/S	D/S	U/S	D/S	U/S	D/S		U/S	D/S	U/S	D/S
01-07-18	0600	134700	98200	86200	38200	35000	NIL	1115.40	29100	20000	24200	11900
02-07-18	0600	131400	100000	81600	33700	36600	NIL	1117.05	30600	11700	6400	-
03-07-18	0600	129700	96000	81100	33200	37600	NIL	1117.85	35400	26200	20600	11900
04-07-18	0600	128700	96000	80300	33000	37700	NIL	1119.20	40400	25000	15800	-
05-07-18	0600	128700	96000	79400	33000	38500	NIL	1120.95	47700	25000	14000	-
06-07-18	0600	129800	96100	80500	35100	39200	NIL	1122.60	48500	25000	24100	8000
07-07-18	0600	131200	96400	80100	35100	39200	NIL	1123.70	46500	30800	16100	-
08-07-18	0600	134900	99000	80100	35100	38000	NIL	1122.65	40000	55000	24000	5300
09-07-18	0600	145600	107400	81200	35900	33800	NIL	1121.55	39300	55000	36500	15800
10-07-18	0600	150000	110900	85100	36100	29100	NIL	1120.45	39300	55000	33600	11900
11-07-18	0600	149400	110500	91500	39900	30000	NIL	1119.55	43400	55000	41400	19700
12-07-18	0600	144600	105700	90600	40900	31700	NIL	1119.75	47300	45000	41400	19700
13-07-18	0600	138600	99700	87800	39000	34400	NIL	1119.75	45000	45000	33600	11900
14-07-18	0600	134900	96300	83800	35600	34400	NIL	1121.50	49300	25000	21900	-
15-07-18	0600	130200	93800	79900	33300	34900	NIL	1122.90	40000	20000	17900	-
16-07-18	0600	126600	92500	75900	30000	34900	NIL	1124.10	37100	20000	14900	-
17-07-18	0600	130000	94000	76000	30000	35800	1000	1125.10	34300	20000	15900	-
18-07-18	0600	136200	98200	77200	30100	36000	1000	1126.75	38500	15000	13800	-
19-07-18	0600	143500	104700	80100	32100	35200	1000	1128.40	38500	15000	10800	-
20-07-18	0600	147000	107500	34500	37600	34500	-	1129.65	32800	15000	9600	-
21-07-18	0600	146500	107000	89400	38600	35100	-	1131.10	33400	10000	8200	-
22-07-18	0600	147700	107400	95100	44300	35100	-	1132.50	33400	10000	2700	-
23-07-18	0600	149900	108600	34900	44900	34900	-	1134.65	46000	10000	2800	-
24-07-18	0600	149500	108200	34800	47200	34800	-	1136.95	48500	10000	8800	-
25-07-18	0600	147600	107700	35400	45000	35400	-	1139.45	51800	10000	7000	-
26-07-18	0600	140900	105900	35400	36300	35400	-	1141.50	47500	10000	5000	-
27-07-18	0600	144400	105900	37000	35800	37000	-	1144.00	57200	10000	7600	-
28-07-18	0600	144600	105900	39500	35800	39500	-	1145.90	45900	10000	7600	-
29-07-18	0600	145200	104700	42600	35800	42600	2000	1147.60	42100	10000	6000	-
30-07-18	0600	145200	105200	42700	35800	42700	2000	1148.90	34500	10000	6800	-
31-07-18	0600	152000	112700	42700	39800	42700	1000	1148.95	30900	30000	7000	-

Major Rivers Flow Data (July 2018) Sheet 3 of 4

Date	TIME	CHENAB								RAVI		
		MARALA		KHANKI		QADIRABAD		TRIMMU		PANJNAD		BALLOKI
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S
01-07-18	0600	88100	59700	76400	71000	86400	64400	18900	2200	8300	NIL	32900
02-07-18	0600	72600	43600	52300	46100	60100	38100	16700		8900	NIL	32600
03-07-18	0600	68100	38300	47500	40400	45600	23600	54400	37700	8800	NIL	34200
04-07-18	0600	68000	40000	49100	42200	49400	27400	43200	26500	8800	NIL	45400
05-07-18	0600	60800	32400	43600	36800	53200	31200	35200	20500	7900	NIL	40000
06-07-18	0600	68700	40000	45600	38600	48100	26100	26000	12500	8800	NIL	38200
07-07-18	0600	43400	13500	23800	16600	32700	10700	32300	18800	13100	NIL	35700
08-07-18	0600	49000	17300	11000	3600	26100	4100	29300	15800	16900	3100	34600
09-07-18	0600	53200	21100	11400	3600	30000	8000	27000	13500	16800	2100	34600
10-07-18	0600	68600	36200	24400	16700	36500	14500	18800	5300	14900	-	35100
11-07-18	0600	72800	40000	34600	26800	44200	22200	14900	1400	14300	-	34400
12-07-18	0600	69200	36200	40800	33000	51900	29900	17300	2800	14200	-	35300
13-07-18	0600	69200	36200	37500	29700	51900	29900	30100	15600	15900	1700	35300
14-07-18	0600	88100	55100	50000	42200	60700	38700	38400	23900	10100	-	35300
15-07-18	0600	67600	34400	56300	48400	74400	52400	42400	27900	7900	-	35400
16-07-18	0600	72400	39200	73600	65800	43000	21000	42400	27900	6300	-	37100
17-07-18	0600	83000	49900	51800	44000	63300	41300	40300	25800	9200	-	36300
18-07-18	0600	88400	55400	67700	59800	68200	46200	45000	30500	11600	-	36800
19-07-18	0600	74900	41600	51800	44000	59500	37500	28000	13500	13100	-	36400
20-07-18	0600	88500	55100	58700	50800	43000	21000	34800	20300	17100	-	36400
21-07-18	0600	82400	49500	38700	31000	62000	40000	34800	20300	19200	5100	38000
22-07-18	0600	81400	48500	42800	35200	45600	23600	35700	22200	15400	1200	39100
23-07-18	0600	82900	49500	52700	45000	45700	25000	25900	12400	14500	-	38800
24-07-18	0600	87600	54300	64800	57100	43100	21100	26000	12500	14600	-	37200
25-07-18	0600	89400	56200	81400	73900	68200	46200	20000	6500	14600	-	38600
26-07-18	0600	96200	63000	74200	66700	83000	61000	16200	2700	14600	-	39900
27-07-18	0600	97300	63900	78400	71000	68200	46200	22600	9100	11200	-	40800
28-07-18	0600	80700	47500	73100	65800	79400	57400	35500	22000	11100	-	45600
29-07-18	0600	68600	36500	55400	48400	54500	32500	42700	30700	8300	-	48000
30-07-18	0600	63300	32400	45700	38600	44300	22300	42700	30700	10600	-	53600
31-07-18	0600	57400	26400	36700	29600	31400	94000	45700	33700	11200	-	51400

Major Rivers Flow Data (July 2018) Sheet 4 of 4

Date	TIME	RAVI		SUTLEJ			LINKS/CANAL			SKARDU		
		SIDHNAI	SULEMANKI	ISLAM		C.J	CRBC	Q.B	T.P	Temperature °C		
		U/S	U/S	D/S	U/S	D/S	Flow	Flow	Flow	Flow	Max	Min
01-07-18	0600	13200	14900	5100	1000	NIL	1900	4400	22000	12000	21.1	12.1
02-07-18	0600	13200	14900	4600	1000	NIL	1500	4400	22000	11700	28.4	14.4
03-07-18	0600	13200	14000	3100	1000	NIL	1500	4400	22000	11200	32.7	17.8
04-07-18	0600	17400	14100	3100	1000	NIL	1500	4400	22000	8800	26.7	15.2
05-07-18	0600	17400	16600	8300	1000	NIL	1500	4400	22000	9600	25.3	15.2
06-07-18	0600	15800	15400	6200	-	NIL	1500	4400	22000	9400	23.6	12.4
07-07-18	0600	21400	16200	6300	1000	NIL	1500	4400	22000	8800	28.5	13.6
08-07-18	0600	20400	15600	5100	1300	NIL	1500	4400	22000	7100	31.6	16.2
09-07-18	0600	19100	14500	3600	1300	NIL	1500	4400	22000	5000	33.6	16.4
10-07-18	0600	17100	14300	3100	2300	1000	1000	4300	22000	6000	35.3	16.4
11-07-18	0600	15800	13300	2000	2300	1000	1000	4300	22000	5300	35.6	17.2
12-07-18	0600	15800	13300	2000	2000	NIL	1500	4000	22000	4900	37.6	18.6
13-07-18	0600	16400	12500	1200	1500	NIL	1500	4100	22000	1700	37.2	18.4
14-07-18	0600	16400	12500	1200	1100	NIL	1500	4400	22000	2300	30.5	14.2
15-07-18	0600	15800	12500	1200	1100	NIL	1500	4400	22000	3400	35.2	14.6
16-07-18	0600	15800	12500	1200	1000	NIL	1500	4400	22000	3300	37.3	15.6
17-07-18	0600	16600	12700	1800	1000	NIL	1500	4400	22000	4500	35.5	16.0
18-07-18	0600	16600	12600	1500	1000	NIL	1500	4400	22000	1000	30.4	16.6
19-07-18	0600	16600	12600	1500	1000	NIL	1500	4400	22000	1000	28.7	16.6
20-07-18	0600	17200	12600	1500	1000	NIL	1500	4400	22000	1700	32.3	17.0
21-07-18	0600	17900	13900	2000	1000	NIL	1500	4500	22000	1600	34.1	19.2
22-07-18	0600	16600	14600	2600	1000	NIL	1500	4500	22000	3700	35.7	17.3
23-07-18	0600	15600	14600	3000	1500	NIL	1500	4500	22000	3100	35.6	17.0
24-07-18	0600	15900	14900	3300	2200	NIL	1500	4500	22000	3400	28.7	17.6
25-07-18	0600	16600	14900	3300	1800	NIL	1500	4500	22000	3400	26.2	16.4
26-07-18	0600	16600	14900	3300	1900	NIL	1500	4500	22000	3100	30.5	16.0
27-07-18	0600	15900	15000	3300	2200	NIL	1500	4500	22000	3500	27.1	16.2
28-07-18	0600	16200	15300	3300	1800	NIL	1500	4500	22000	9500	20.6	13.4
29-07-18	0600	15300	15300	3300	2200	NIL	1500	4400	22000	10000	24.2	14.0
30-07-18	0600	17900	15300	3300	2200	NIL	1500	4200	22000	10600	21.7	13.9
31-07-18	0600	21900	15400	3300	1600	NIL	1500	4400	22000	10800	28.6	12.2

Major Rivers Flow Data (August 2018) Sheet 1 of 4

Date	TIME	INDUS		KABUL			INDUS					
		TARBELA		NOWSHERA		KALABAGH		CHASHMA		TAUNSA		
		Reservoir Level (FT)	U/S	D/S	Flow	U/S	D/S	Reservoir Level (FT)	U/S	D/S	U/S	D/S
01-08-18	0600	1518.62	165000	135000	47200	164700	157200	646.70	177300	197000	210200	183100
02-08-18	0600	1519.00	160000	150000	41400	169300	161800	645.60	182500	192000	216200	188700
03-08-18	0600	1519.20	160400	155000	39500	168600	160600	644.00	185800	192000	203400	175800
04-08-18	0600	1519.12	163300	165000	37700	179400	171400	642.70	193700	192000	205600	182500
05-08-18	0600	1519.18	166800	165000	38400	202700	194700	641.60	197200	192000	198600	176400
06-08-18	0600	1519.75	184800	170000	37700	199300	191300	641.10	203400	192000	201100	179300
07-08-18	0600	1521.44	214800	170000	38000	188000	180000	639.90	198300	192000	202000	180800
08-08-18	0600	1524.93	242700	150000	51200	208600	200600	639.20	209800	200000	203600	182400
09-08-18	0600	1529.23	254100	140000	63300	203600	195600	639.00	244200	200000	203600	182300
10-08-18	0600	1531.23	257100	202400	60400	204800	196800	642.00	200800	200000	213400	185400
11-08-18	0600	1533.23	253000	196400	52200	262900	245900	641.60	240100	232800	214600	186600
12-08-18	0600	1535.23	248000	198200	51200	257800	251800	641.00	257800	252300	211400	183400
13-08-18	0600	1537.23	271000	214200	50200	244100	236100	641.00	251000	240000	235400	207300
14-08-18	0600	1539.23	277000	246200	51400	254700	246700	641.00	247700	233800	265400	237400
15-08-18	0600	1541.23	265000	187900	55100	299900	291900	641.00	272500	256500	253300	225200
16-08-18	0600	1543.23	219000	113200	45800	271300	263300	641.00	312900	296900	256600	235600
17-08-18	0600	1545.23	209000	112800	42800	196600	188600	646.70	264700	180000	287200	266100
18-08-18	0600	1547.00	210000	191200	40700	185600	177600	647.00	191000	170000	284200	263100
19-08-18	0600	1548.50	218000	176100	42400	211600	203600	647.40	194300	170000	178900	158400
20-08-18	0600	1550.00	232000	176300	43300	221900	213900	648.00	218400	190000	187900	167400
21-08-18	0600	1550.00	193000	193100	39100	232800	224800	647.50	226600	220900	185000	164300
22-08-18	0600	1550.00	210000	226000	37200	243100	235100	647.00	237000	228500	205000	184500
23-08-18	0600	1550.00	231000	224800	37300	251500	243500	646.50	265600	252800	221500	194000
24-08-18	0600	1550.00	230000	225200	40900	256000	248000	646.00	262000	249300	229500	202400
25-08-18	0600	1550.00	234500	234200	39000	251900	243900	645.50	282100	268000	246900	219400
26-08-18	0600	1550.00	233000	232700	38600	286900	278900	645.00	287400	273400	262600	235000
27-08-18	0600	1550.00	210300	210000	37000	269400	261400	644.50	297700	282800	277400	249800
28-08-18	0600	1550.00	189800	189500	35700	248000	240000	647.00	272300	214200	280500	252700
29-08-18	0600	1550.00	161800	161500	31100	219600	211600	648.50	243000	187000	264600	236800
30-08-18	0600	1550.00	142000	166300	21500	176300	168300	649.00	220200	183700	192000	164200
31-08-18	0600	1550.00	154600	154300	21000	195200	187200	648.20	173100	170000	195600	167900

Major Rivers Flow Data (August 2018) Sheet 2 of 4

Date	TIME	INDUS						JHELUM				
		GUDDU		SUKKAR		KOTRI		Reservoir Level (ft)	MANGLA		RASUL	
		U/S	D/S	U/S	D/S	U/S	D/S		U/S	D/S	U/S	D/S
01-08-18	0600	151600	112700	95100	42400	39300	-	1148.85	28100	30000	28200	11900
02-08-18	0600	152300	112700	100100	45700	37900	-	1149.70	29400	13300	16600	-
03-08-18	0600	152300	113300	100500	46100	38900	1300	1150.60	28400	10000	5700	-
04-08-18	0600	167200	130300	101200	46100	38900	1300	1151.45	28100	10000	2700	-
05-08-18	0600	165900	126900	115100	59600	38900	1300	1152.20	25900	10000	7800	-
06-08-18	0600	163200	126300	116300	60800	40500	2000	1153.00	27000	10000	5800	-
07-08-18	0600	159200	122000	112000	56500	46700	4800	1154.25	36600	10000	5700	-
08-08-18	0600	157400	126100	108000	52500	46700	4800	1157.25	73800	10000	6000	-
09-08-18	0600	157800	124000	112100	56600	46700	4800	1158.40	34500	10000	5600	-
10-08-18	0600	158600	127700	112100	56600	46700	4800	1159.70	37600	10000	5400	-
11-08-18	0600	160200	127700	113100	57500	51600	9800	1160.80	35200	10000	5500	-
12-08-18	0600	159500	127700	114400	58700	53100	11200	1161.75	32300	10000	5400	-
13-08-18	0600	158700	125700	114700	58700	50200	8300	1162.90	37100	10000	5500	-
14-08-18	0600	159500	125700	112700	58700	48700	6900	1164.90	57000	10000	8200	-
15-08-18	0600	162100	128100	113300	58700	50200	8300	1166.35	44100	10000	12300	-
16-08-18	0600	205900	172100	115500	60000	48700	6900	1167.25	31200	10000	7300	-
17-08-18	0600	238800	208300	150500	94800	51600	9800	1168.20	32300	10000	6400	-
18-08-18	0600	241500	212400	186900	131500	51600	11300	1169.00	28800	10000	6400	-
19-08-18	0600	248200	220300	198800	143800	51800	10100	1170.00	33500	10000	6400	-
20-08-18	0600	256000	227300	205400	149800	52300	10500	1170.75	29300	10000	6300	NIL
21-08-18	0600	171600	140600	211600	156000	53000	11300	1171.35	25400	10000	6000	-
22-08-18	0600	166300	133600	172600	117600	56000	14400	1172.10	29300	10000	7400	NIL
23-08-18	0600	170300	137900	119100	63600	80700	39200	1172.80	28000	10000	7000	-
24-08-18	0600	171400	137900	119400	63400	91800	50300	1173.40	25400	10000	7100	NIL
25-08-18	0600	187100	151000	120700	64800	97000	55400	1174.00	25400	10000	5600	-
26-08-18	0600	188400	151000	127500	71500	102400	60700	1174.70	28000	10000	5700	-
27-08-18	0600	217400	180800	131800	75600	80800	39200	1175.30	25400	10000	7700	-
28-08-18	0600	217400	182700	150100	93800	71300	29700	1175.75	21600	10000	5800	-
29-08-18	0600	222900	190700	165300	109100	60800	19100	1176.00	16400	10000	2600	-
30-08-18	0600	239300	206600	185700	129700	60800	19100	1176.30	17700	10000	5700	-
31-08-18	0600	243200	210900	188200	132100	62500	20900	1176.55	16400	10000	2800	-

Major Rivers Flow Data (August 2018) Sheet 3 of 4

Date	TIME	CHENAB								RAVI		
		MARALA		KHANKI		QADIRABAD		TRIMMU		PANJNAD		BALLOKI
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S
01-08-18	0600	63400	30400	35500	27900	40500	18500	30800	18800	16600	3100	46800
02-08-18	0600	59400	26400	37200	29500	40500	18500	26600	14600	23000	9000	42800
03-08-18	0600	59800	26400	29400	21600	31400	9400	18600	6600	28500	14200	42800
04-08-18	0600	58800	25400	29400	21600	20000	-	25900	13900	31200	16600	40000
05-08-18	0600	66900	33500	29400	21600	26100	5400	30900	18900	29900	15000	36600
06-08-18	0600	77000	43500	43500	35700	36600	14600	21400	7900	23800	8700	36600
07-08-18	0600	98100	64900	74800	67000	50700	28700	16300	2800	16800	1700	36800
08-08-18	0600	120300	87200	113400	105600	87800	65800	14000	-	15100	-	36800
09-08-18	0600	117600	85300	83100	75300	81800	59800	15000	-	16800	1700	40100
10-08-18	0600	89800	56200	71700	63900	67000	45000	34000	19500	10900	NIL	50600
11-08-18	0600	87900	54300	63500	55700	53200	31200	57000	43000	10900	-	46000
12-08-18	0600	87800	54300	60600	52900	53200	31200	61400	47400	10000	-	44900
13-08-18	0600	111100	77500	80600	72800	67000	45000	42700	30700	10000	-	40300
14-08-18	0600	177300	143800	184100	176300	194000	172000	38500	26500	10700	-	39200
15-08-18	0600	96300	73900	126500	118800	180000	158000	37600	25600	18900	5100	44600
16-08-18	0600	75700	53300	74900	67100	84300	62300	78900	66900	34600	19700	52000
17-08-18	0600	69100	42600	57300	49300	54600	32300	93700	81700	36700	21600	53100
18-08-18	0600	71300	42600	46700	38600	51800	29800	59800	47800	31700	16900	44500
19-08-18	0600	79600	47900	57400	49300	50600	28600	48900	36900	27100	12700	41300
20-08-18	0600	74300	42600	53800	46100	54300	32300	43600	31600	39500	25100	40100
21-08-18	0600	79600	47900	46400	38600	37800	15800	42000	30000	55200	40400	40400
22-08-18	0600	78400	47900	83000	75300	68000	46000	36000	24200	53300	38800	43800
23-08-18	0600	75100	44500	57100	49300	61900	39900	38000	26000	48400	34400	45000
24-08-18	0600	78500	47900	57400	49300	54300	32300	34000	22000	41300	27100	50800
25-08-18	0600	78600	47900	55800	47700	56800	34800	51400	39500	31000	16500	50200
26-08-18	0600	68000	37200	54200	46100	50600	28600	51200	39200	28400	13600	49100
27-08-18	0600	69000	37200	54300	46100	51900	29900	44800	32800	28500	13600	48000
28-08-18	0600	53800	21900	32000	23800	31400	9400	44800	32800	31900	16900	45000
29-08-18	0600	58400	26500	27800	19600	22000	-	41200	29200	38200	23100	43900
30-08-18	0600	53800	21900	34100	25900	31400	9400	39400	27400	40400	25300	42700
31-08-18	0600	56700	24900	21100	12800	24700	2700	29600	17600	35800	20800	39300

Major Rivers Flow Data (August 2018) Sheet 4 of 4

Date	TIME	RAVI		SUTLEJ			LINKS/CANAL			SKARDU		
		SIDHNAI	SULEMANKI	ISLAM		C.J	CRBC	Q.B	T.P	Temperature °C		
		U/S	U/S	D/S	U/S	D/S	Flow	Flow	Flow	Flow	Max	Min
01-08-18	0600	22500	14700	2600	7600	NIL	1500	4500	22000	11600	31.0	12.0
02-08-18	0600	23700	14700	2600	1900	NIL	3300	4500	22000	12000	30.3	13.8
03-08-18	0600	23700	14300	2300	1900	NIL	10200	4500	22000	11600	33.3	14.2
04-08-18	0600	20200	13300	1300	1600	NIL	11500	4500	20000	7100	35.6	14.0
05-08-18	0600	18200	13300	1300	1600	NIL	11500	4500	20800	6200	36.3	16.2
06-08-18	0600	18200	13400	1300	1200	NIL	11500	4500	22000	5800	38.8	15.2
07-08-18	0600	15600	13800	1300	1200	NIL	11500	4500	22000	5200	38.6	15.0
08-08-18	0600	15100	13400	1000	1200	NIL	10300	4400	22000	5200	32.6	18.0
09-08-18	0600	15100	14400	1700	1200	NIL	6700	4300	22000	5300	32.6	17.0
10-08-18	0600	16000	14100	1700	1200	NIL	6500	4500	22000	12000	27.6	16.0
11-08-18	0600	16000	14300	1700	1200	NIL	6500	4500	22000	12000	32.2	17.2
12-08-18	0600	20000	14400	1700	1200	NIL	6500	4500	22000	12000	35.7	16.4
13-08-18	0600	20600	14500	1700	1000	NIL	6500	4500	22000	12000	34.5	17.0
14-08-18	0600	17300	13800	1000	1000	NIL	9369	4500	22000	12000	29.0	17.0
15-08-18	0600	17300	13900	1000	1000	NIL	11500	4500	22000	12000	28.8	14.4
16-08-18	0600	16000	14100	1400	600	NIL	11500	4500	22000	5000	33.6	15.0
17-08-18	0600	16000	14500	1700	600	NIL	11500	4500	22000	5000	33.7	14.6
18-08-18	0600	19600	14500	1700	1100	NIL	11500	4500	22000	5000	33.6	16.4
19-08-18	0600	22200	16500	3700	1300	NIL	11500	4500	22000	5000	26.3	15.0
20-08-18	0600	23100	20200	7700	1300	NIL	11500	4500	22000	5000	20.3	15.6
21-08-18	0600	20800	17900	5500	1700	NIL	11500	4500	22000	5000	33.7	14.4
22-08-18	0600	16500	14800	2200	2000	NIL	14300	4500	22000	5000	30.0	15.0
23-08-18	0600	16500	14800	2200	2100	NIL	16500	4600	22000	12000	36.4	18.6
24-08-18	0600	17100	15700	2900	2100	NIL	16500	4600	22000	12000	33.8	17.4
25-08-18	0600	17200	15700	2900	2100	NIL	16500	4600	22000	12000	32.6	16.0
26-08-18	0600	18600	15700	2900	2100	NIL	16500	4600	22000	12000	24.8	13.5
27-08-18	0600	20600	14400	1500	1600	NIL	16500	4600	22000	12000	23.7	11.4
28-08-18	0600	21200	14900	2000	1200	NIL	16500	4600	22000	12000	29.6	11.7
29-08-18	0600	21900	14900	2000	1200	NIL	18000	4600	22000	12000	32.6	12.4
30-08-18	0600	20600	14900	2000	1200	NIL	19100	4600	22000	12000	33.4	17.2
31-08-18	0600	19900	14200	1400	1200	NIL	18900	4600	22000	12000	32.6	15.0

Major Rivers Flow Data (September 2018) Sheet 1 of 4

Date	TIME	INDUS			KABUL			INDUS				
		TARBELA		D/S	NOWSHERA		KALABAGH		CHASHMA		TAUNSA	
		Reservoir Level (FT)	U/S		Flow	U/S	D/S	Reservoir Level (FT)	U/S	D/S	U/S	D/S
01-09-18	0600	1550.00	163100	162800	22500	197400	189400	647.50	177900	170000	168200	141600
02-09-18	0600	1550.00	162100	161800	21400	199600	191600	647.00	183000	170000	170200	143500
03-09-18	0600	1550.00	166000	165600	23000	195500	187500	646.60	186700	170000	170200	144000
04-09-18	0600	1550.00	164300	163800	23700	189900	181900	646.50	192000	170000	170200	145000
05-09-18	0600	1550.00	154500	153900	23600	174100	166100	646.30	190400	170000	145600	145000
06-09-18	0600	1550.00	144500	143800	21300	174100	166100	645.90	187200	170000	146500	146500
07-09-18	0600	1550.00	133600	132900	16000	157800	149800	644.20	170700	170000	147800	147800
08-09-18	0600	1549.17	136800	160000	15000	151300	143300	639.10	143200	170000	170800	143000
09-09-18	0600	1548.32	135000	126000	12100	183100	175100	642.70	182800	155000	170800	143000
10-09-18	0600	1546.94	130900	170000	12100	173100	165100	640.50	185300	170000	167500	140000
11-09-18	0600	1545.26	122300	170000	12500	184000	176000	640.30	175400	160000	161000	134600
12-09-18	0600	1543.00	115500	180000	12600	184700	177700	641.80	189500	160000	165300	138200
13-09-18	0600	1540.65	112900	180000	13900	192100	185100	642.60	189400	160000	165700	142000
14-09-18	0600	1538.18	111600	180000	14600	190000	183000	644.40	201800	160000	163300	140000
15-09-18	0600	1536.67	108900	150000	13300	204700	197700	645.60	197500	160000	160000	142200
16-09-18	0600	1534.87	100900	150000	13600	161200	154200	647.20	208000	160000	166000	142200
17-09-18	0600	1532.63	88800	150000	12000	162000	155000	646.20	164200	160000	163300	139900
18-09-18	0600	1529.98	77500	150000	13300	160800	153800	645.80	175300	160000	159800	137000
19-09-18	0600	1527.37	69200	137600	11800	182000	175000	645.10	171500	160000	159800	137000
20-09-18	0600	1524.85	64000	130000	10900	169800	162800	644.30	168100	160000	159800	137000
21-09-18	0600	1522.22	61100	130000	10900	150500	143400	644.70	156600	139000	159800	137000
22-09-18	0600	1519.46	58300	130000	10900	139100	132100	644.40	143100	139000	157500	135000
23-09-18	0600	1516.77	62300	130000	12000	153500	146500	644.50	146000	139000	140600	117400
24-09-18	0600	1513.98	59900	130000	12700	135900	128900	644.50	144500	139000	140600	117400
25-09-18	0600	1511.58	59700	120000	11500	144600	137600	644.40	143200	139000	139600	116600
26-09-18	0600	1509.41	61100	115000	11400	138200	131200	645.00	141800	129000	139600	116600
27-09-18	0600	1507.24	62600	115000	11100	127300	120300	644.60	129400	129000	139600	116600
28-09-18	0600	1505.32	58800	105000	11500	129500	122500	644.90	127900	119000	128800	105900
29-09-18	0600	1503.40	53800	100000	10900	115300	108300	645.20	123300	114000	132600	111700
30-09-18	0600	1501.50	54300	100000	10900	119300	112300	644.80	113900	114000	115900	95200

Major Rivers Flow Data (September 2018) Sheet 2 of 4

Date	TIME	INDUS						JHELM				
		GUDDU		SUKKAR		KOTRI		Reservoir Level (ft)	MANGLA		RASUL	
		U/S	D/S	U/S	D/S	U/S	D/S		U/S	D/S	U/S	D/S
01-09-18	0600	213300	181400	188200	132100	69700	28000	1176.75	15100	10000	5800	NIL
02-09-18	0600	160500	126600	164000	107800	79300	37500	1177.00	16400	10000	2800	NIL
03-09-18	0600	153000	119000	116500	60500	89600	47800	1177.53	16400	10000	2700	NIL
04-09-18	0600	142600	108000	95200	40300	97100	55400	1177.40	13900	10000	2900	NIL
05-09-18	0600	135400	100700	82800	30300	103400	61600	1177.60	15100	10000	2600	NIL
06-09-18	0600	132500	99700	81200	28600	103400	61600	1177.75	13900	10000	2600	NIL
07-09-18	0600	130300	99200	81200	28600	89600	47800	1177.85	12600	10000	2200	NIL
08-09-18	0600	130200	100200	81300	30100	71500	30000	1177.95	12600	10000	1900	NIL
09-09-18	0600	130200	100200	83500	31500	56400	14500	1178.05	12600	10000	2000	NIL
10-09-18	0600	130200	100200	83500	31500	48800	6900	1178.00	11800	13100	2000	NIL
11-09-18	0600	124700	95000	83500	31500	45900	4000	1178.10	14600	12000	7000	NIL
12-09-18	0600	122500	92800	81200	30000	43600	1600	1178.20	14600	12000	5000	NIL
13-09-18	0600	116100	86400	79300	30000	42000	NIL	1178.25	13300	12000	7000	NIL
14-09-18	0600	113800	84100	78600	30100	41300	NIL	1178.40	15900	12000	7000	NIL
15-09-18	0600	116100	86400	75300	30000	39600	NIL	1178.60	17100	12000	7100	NIL
16-09-18	0600	118000	88000	76800	30000	39600	NIL	1178.60	12000	12000	7100	NIL
17-09-18	0600	124500	94800	80400	30500	39600	NIL	1178.00	12600	28000	16900	5300
18-09-18	0600	128800	99100	82100	30700	37700	NIL	1176.75	12800	45000	23500	5300
19-09-18	0600	128800	99100	85100	32400	34900	NIL	1175.50	12800	45000	36200	15800
20-09-18	0600	125400	95800	86000	33900	34900	NIL	1174.15	10300	45000	36800	15800
21-09-18	0600	123200	93500	86000	33900	34300	NIL	1172.90	12800	45000	32900	11900
22-09-18	0600	123200	93500	81400	30700	33800	NIL	1171.55	10300	45000	40700	19700
23-09-18	0600	123200	95100	81300	30700	33800	NIL	1170.20	10300	45000	32900	11900
24-09-18	0600	122600	95100	84500	32400	33800	NIL	1169.40	10700	30000	24400	11900
25-09-18	0600	118600	91100	84500	32400	33800	NIL	1169.15	9100	15000	7500	-
26-09-18	0600	104300	76500	81500	30700	34500	NIL	1168.95	10300	15000	7000	-
27-09-18	0600	99600	71500	72400	27100	34500	NIL	1168.70	9100	15000	12400	5300
28-09-18	0600	99800	73700	71800	30100	35200	NIL	1168.45	9100	15000	12300	5300
29-09-18	0600	99800	73700	70500	30100	35200	NIL	1168.20	9100	15000	11000	-
30-09-18	0600	99800	73700	70400	28000	34500	NIL	1168.00	10300	15000	13000	-

Major Rivers Flow Data (September 2018) Sheet 3 of 4

Date	TIME	CHENAB								RAVI		
		MARALA		KHANKI		QADIRABAD		TRIMMU		PANJNAD		BALLOKI
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S
01-09-18	0600	60500	28600	36200	27900	28200	9400	19200	5200	36800	21700	37100
02-09-18	0600	53000	21100	32000	23800	24700	2700	24100	9100	35800	20800	37100
03-09-18	0600	56700	24900	29900	21600	24700	2700	24100	9100	31800	16800	38900
04-09-18	0600	53000	21100	36200	27900	28700	6700	24100	9100	24300	9300	38900
05-09-18	0600	45400	13500	23500	15200	20000	-	24100	9100	20300	5200	38800
06-09-18	0600	49200	17300	21100	12800	9900	-	20300	5300	17000	1900	36600
07-09-18	0600	45400	13500	13000	5500	6900	-	22200	7200	15200	NIL	30000
08-09-18	0600	56700	24800	22700	15200	10500	-	22000	6000	12600	NIL	29000
09-09-18	0600	49400	17300	33400	25900	25300	4100	20700	4700	12500	NIL	29000
10-09-18	0600	41900	9800	20300	12800	16000	NIL	15500	NIL	12900	NIL	36500
11-09-18	0600	38000	5900	11100	3600	12300	NIL	12400	NIL	13100	NIL	36000
12-09-18	0600	45600	13500	11100	3600	10400	NIL	12500	NIL	13000	NIL	32600
13-09-18	0600	38600	10000	14600	7100	12400	NIL	15300	NIL	10500	NIL	31000
14-09-18	0600	36900	10000	14600	7100	12400	NIL	13100	NIL	10500	NIL	29000
15-09-18	0600	37800	10000	14600	7100	12300	NIL	15100	1400	9800	NIL	29500
16-09-18	0600	29400	10000	14600	7100	13000	NIL	17400	1400	8600	NIL	28000
17-09-18	0600	20000	6000	9300	1800	10300	NIL	18100	NIL	7900	NIL	32000
18-09-18	0600	20000	6000	9300	1800	17700	NIL	16700	NIL	8300	NIL	23500
19-09-18	0600	20500	6000	9300	1800	21600	NIL	16700	NIL	9000	NIL	22500
20-09-18	0600	20000	6000	9300	1800	22000	NIL	16700	NIL	9900	NIL	24000
21-09-18	0600	20000	6000	9200	1700	22000	NIL	16700	NIL	10500	NIL	25000
22-09-18	0600	19200	6000	9200	1700	21000	NIL	19500	2800	10500	NIL	24000
23-09-18	0600	20100	6000	11000	3500	22000	NIL	20800	4100	10400	NIL	21000
24-09-18	0600	91300	78600	33500	25900	22000	NIL	18100	1400	10400	NIL	23500
25-09-18	0600	55600	42000	71600	64100	97600	75600	18100	1400	10200	NIL	24500
26-09-18	0600	37200	23100	40000	31500	41800	19800	18100	1400	11500	NIL	56000
27-09-18	0600	29800	15500	27100	19600	24700	2700	18100	1400	11600	NIL	68000
28-09-18	0600	26100	11800	24700	17200	22000	NIL	33700	19700	11400	NIL	43600
29-09-18	0600	24200	9800	9200	1700	15000	NIL	26600	14900	11900	NIL	36400
30-09-18	0600	24500	10000	12700	5200	13000	NIL	11700	NIL	11300	NIL	30600

Major Rivers Flow Data (September 2018) Sheet 4 of 4

Date	TIME	RAVI		SUTLEJ			LINKS/CANAL			SKARDU		
		SIDHNAI	SULEMANKI	ISLAM		C.J	CRBC	Q.B	T.P	Temperature °C		
		U/S	U/S	D/S	U/S	D/S	Flow	Flow	Flow	Flow	Max	Min
01-09-18	0600	18600	14300	1400	1200	NIL	18800	4600	18800	10800	33.3	18.9
02-09-18	0600	18700	14300	1400	1100	NIL	18800	4600	22000	10900	32.6	13.5
03-09-18	0600	18000	14200	1400	1000	NIL	18800	4600	22000	10400	31.6	16.0
04-09-18	0600	16700	14200	1400	1000	NIL	19000	4600	22000	9300	30.6	14.4
05-09-18	0600	16000	14300	1300	1000	NIL	19100	4600	20000	8700	30.6	17.4
06-09-18	0600	16700	14300	1300	-	NIL	19000	4600	9900	8500	32.7	16.0
07-09-18	0600	16400	14300	1300	1000	NIL	18800	4600	6900	8200	31.6	15.2
08-09-18	0600	16800	14300	1300	1000	NIL	16100	4500	10500	12000	26.6	13.4
09-09-18	0600	16200	13000	NIL	1000	NIL	11600	4100	21300	12000	25.6	11.0
10-09-18	0600	15500	13000	NIL	1000	NIL	12600	4300	16000	11600	27.1	14.5
11-09-18	0600	12500	13600	1000	1000	NIL	12600	4400	12300	10500	24.6	12.4
12-09-18	0600	10300	13600	1000	1000	NIL	12100	4400	10400	11300	27.6	11.0
13-09-18	0600	13000	13600	1000	1000	NIL	16900	4600	12400	10200	30.0	9.4
14-09-18	0600	15500	14200	1300	1000	NIL	17000	4600	12400	10100	29.6	9.2
15-09-18	0600	14000	13500	1000	1000	NIL	17000	4600	12300	10200	23.7	8.0
16-09-18	0600	14400	13500	1000	1000	NIL	17000	4600	13000	10200	17.6	7.6
17-09-18	0600	14000	13500	1000	1000	NIL	17000	4600	10300	10900	21.6	4.2
18-09-18	0600	14000	14200	1400	1000	NIL	17000	4500	17700	11900	22.7	4.0
19-09-18	0600	14000	12100	NIL	1000	NIL	17000	4400	21600	12000	25.8	4.8
20-09-18	0600	13500	10100	NIL	1000	NIL	13800	4400	22000	12000	27.6	6.3
21-09-18	0600	13500	10900	NIL	1000	NIL	8200	4400	22000	12000	28.6	6.0
22-09-18	0600	13500	14500	NIL	1000	NIL	3400	4400	21000	12000	28.0	7.2
23-09-18	0600	14000	10900	NIL	NIL	NIL	1500	4200	22000	12000	29.3	12.3
24-09-18	0600	14000	10900	NIL	NIL	NIL	1500	4000	22000	12000	25.6	6.0
25-09-18	0600	13500	12300	NIL	NIL	NIL	1500	3900	22000	12000	26.6	14.8
26-09-18	0600	13500	14400	1600	NIL	NIL	1500	3900	22000	12000	23.7	8.4
27-09-18	0600	13500	19700	6800	1000	NIL	1500	3900	22000	12000	23.8	7.3
28-09-18	0600	16500	36900	25400	1000	NIL	1500	3800	22000	12000	24.8	12.3
29-09-18	0600	19300	46600	34700	1000	NIL	1500	3700	15000	5000	24.6	10.0
30-09-18	0600	24200	31700	19900	4800	2900	1500	3700	13000	5000	21.6	7.0

Major Rivers Flow Data (October 2018) Sheet 1 of 4

Date	TIME	INDUS			KABUL			INDUS				
		TARBELA		D/S	NEWSHERA	KALABAGH		CHASHMA			TAUNSA	
		Reservoir Level (FT)	U/S		Flow	U/S	D/S	Reservoir Level (FT)	U/S	D/S	U/S	D/S
01-10-18	0600	1499.45	51300	100000	10600	130200	123200	644.20	110800	113000	111700	94000
02-10-18	0600	1497.25	49900	100000	7400	121500	114500	643.70	112400	113000	109100	91800
03-10-18	0600	1495.00	48700	100000	7500	117900	110900	643.10	111600	113000	109100	91700
04-10-18	0600	1493.27	45800	85000	7800	118600	111600	642.30	110200	113000	109200	91800
05-10-18	0600	1491.50	44800	85000	3400	107300	100300	641.00	106300	86000	91700	7400
06-10-18	0600	1489.85	42700	80000	6900	115600	108600	642.40	103900	86000	91700	7300
07-10-18	0600	1488.05	40800	80000	6900	101600	94600	642.80	94100	86000	91700	7300
08-10-18	0600	1486.37	43400	80000	8000	97800	90800	643.10	93200	86000	68400	5900
09-10-18	0600	1484.96	39400	70000	7900	10000	93500	642.80	86800	86000	68400	5900
10-10-18	0600	1483.96	37800	60000	8800	94300	87800	643.70	10000	86000	68400	5900
11-10-18	0600	1483.35	36900	50000	9800	82900	77400	644.60	79500	65000	82800	68400
12-10-18	0600	1482.76	37200	50000	8400	70900	66900	645.00	73700	65000	83000	68500
13-10-18	0600	1482.52	35400	40000	7200	69400	65400	645.20	62500	56000	66700	57500
14-10-18	0600	1482.45	33900	35000	7500	65600	61600	645.20	59700	56000	66700	57500
15-10-18	0600	1482.34	33100	35000	6900	57900	53900	644.10	45700	56000	60600	60600

Major Rivers Flow Data (October 2018) Sheet 2 of 4

Date	TIME	INDUS						JHELUM				
		GUDDU		SUKKAR		KOTRI		Reservoir Level (ft)	MANGLA		RASUL	
		U/S	D/S	U/S	D/S	U/S	D/S		U/S	D/S	U/S	D/S
01-10-18	0600	94500	69700	70400	28000	34500	1167.75	9100	15000	9000	-	
02-10-18	0600	90300	66700	67400	27000	33200	1166.50	10600	40000	10000	-	
03-10-18	0600	86100	64700	64400	26000	28300	1165.15	8200	40000	33300	15800	
04-10-18	0600	82700	62700	62700	25600	24200	1163.65	9700	45000	35800	15800	
05-10-18	0600	80200	62700	61100	25300	18300	1162.00	6200	45000	32900	11900	
06-10-18	0600	80000	66500	61100	25300	18300	1160.50	4700	40000	36400	15800	
07-10-18	0600	78900	66500	61900	25500	18300	1159.90	8100	22000	13600	-	
08-10-18	0600	76600	66500	63500	26500	17500	1159.40	11400	22000	11600	-	
09-10-18	0600	76600	66500	65200	27200	17500	1158.70	7100	22000	25000	11900	
10-10-18	0600	72000	61900	65300	27200	17400	1158.10	9200	22000	25100	11900	
11-10-18	0600	61200	51100	61100	25200	17400	1157.65	10400	20000	18600	5300	
12-10-18	0600	57300	47200	55000	23300	17400	1157.25	11500	20000	13100	-	
13-10-18	0600	59300	49200	49300	20000	17400	1156.80	10400	20000	13100	-	
14-10-18	0600	58000	47300	46000	19000	17400	1156.30	9400	20000	18500	5300	
15-10-18	0600	56700	46000	45000	18700	17400	1155.75	8300	20000	13100	-	

Major Rivers Flow Data (October 2018) Sheet 3 of 4

Date	TIME	CHENAB								RAVI		
		MARALA		KHANKI		QADIRABAD		TRIMMU		PANJNAD		BALLOKI
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S
01-10-18	0600	20500	6000	11000	3500	16000	NIL	11400	NIL	10600	NIL	30900
02-10-18	0600	20100	6000	9200	1700	13000	NIL	9200	NIL	13600	NIL	33200
03-10-18	0600	18500	6000	9200	1700	17700	NIL	7500	NIL	14400	NIL	28400
04-10-18	0600	18000	6000	10100	2600	18600	NIL	5700	NIL	12300	NIL	29900
05-10-18	0600	19300	6000	10100	2600	20800	-	6700		11500	-	27100
06-10-18	0600	18700	6000	10100	2600	20000	-	7200		9600	-	27100
07-10-18	0600	17600	6000	7500	-	16000	-	12900		10200	-	24700
08-10-18	0600	17400	6000	9200	1700	14000	-	15200		10200	-	22500
09-10-18	0600	16100	6000	8200	1700	14000	-	19500	2800	10200	-	17000
10-10-18	0600	16400	6000	9000	2500	15500	-	16700		9300	-	14000
11-10-18	0600	15800	6000	10300	4200	15100	-	15100	-	9100		16500
12-10-18	0600	16000	6000	9000	2500	15500		15500	8700	9300		15000
13-10-18	0600	15800	6000	9000	2500	14800		14800	8400	7400		15000
14-10-18	0600	15800	6000	9000	2500	15900		15900	8100	7700		14000
15-10-18	0600	14500	6000	8200	1800	14000		14000	5700	6200		16000

Major Rivers Flow Data (October 2018) Sheet 4 of 4

<i>Date</i>	<i>TIME</i>	<i>RAVI</i>		<i>SUTLEJ</i>			<i>LINKS/CANAL</i>			<i>SKARDU</i>	
		<i>SIDHNAI</i>	<i>SULEMANKI</i>	<i>ISLAM</i>		<i>C.J</i>	<i>CRBC</i>	<i>Q.B</i>	<i>T.P</i>	<i>Temperature °C</i>	
		<i>U/S</i>	<i>U/S</i>	<i>D/S</i>	<i>U/S</i>	<i>D/S</i>	<i>Flow</i>	<i>Flow</i>	<i>Flow</i>	<i>Flow</i>	<i>Max</i>
01-10-18	0600	27800	15900	13000	11100	1500	3700	16000	5000	22.6	4.8
02-10-18	0600	27700	15600	17200	15300	1500	3700	13000	7200	25.7	5.4
03-10-18	0600	21000	9000	18500	16500	1500	3800	17700	7300	24.7	6.7
04-10-18	0600	23100	11100	12600	10200	1500	4000	18100	7400	22.3	5.8
05-10-18	0600	21100	9100	10000	10000	1500	4000	20800	7400	23.7	10.2
06-10-18	0600	18000	6000	9400	9400	1000	4000	2000	7300	21.1	8.9
07-10-18	0600	16400	4200	9400	9400		4000	16000	7300		
08-10-18	0600	15500	3400	5000	5000		4000	14000	5900	21.3	6.0
09-10-18	0600	14600	2500	2800	2800		4000	14000	5900	22.2	6.0
10-10-18	0600	12300	2200	2000	2000		3800	15500	5900	20.3	4.2
11-10-18	0600	10000		1200	-		3700	15100	5900	14.7	4.4
12-10-18	0600	9700		1000	-		3700	15500	5900	15.2	5.0
13-10-18	0600	9200		1000	-		3700	14800	1000	16.1	6.7
14-10-18	0600	8700		1000	-		3700	15900	1000	16.7	6.1
15-10-18	0600	8700		1000	-		3700	14000	-	15.6	5.0

**MONTHLY RAINFALL DATA
(JULY-SEPTEMBER 2018)
(SOURCE: PMD)**

