

# FLOOD MANAGEMENT WING/ FFC



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

## 1. FEDERAL FLOOD COMMISSION/ FLOOD WING

#### 3.1 Floods in General Perspective

#### 3.1.1 Causes of Floods: Broad-spectrum

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, 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 owing 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 is 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.

#### 3.1.2 Pakistan's Flood Context and Control Objectives

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 populations with monetary loss in billions of rupees. Major direct flood damages are caused to agricultural lands, standing crops, urban and rural populations, 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 around 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 settlements, 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 has been taken up by the Punjab & Sindh province. The construction of new Khanki Barrage on River Chenab, Rehabilitation of Jinnah & Taunsa Barrages on River Indus, Sulemanki Barrage on River Sutlej, Balloki Barrage over Ravi River and Trimmu and Panjnad Barrages over Chenab River have been completed. Remolding works on Guddu & Sukkur Barrages across River Indus is in progress.

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. 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 floods, flood protection structures in the form of Spurs, Studs and Flood Protection Walls etc. have been constructed in critical reaches. These structures 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, Khurram 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.

## Balochistan

- 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, AJ&K and Merged Area of Khyber Pakhtunkhwa/ Ex-FATA)

- The bed slopes of rivers and nullahs in Gilgit-Baltistan, Merged Area KHYBER PAKHTUNKHWA (Ex- 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.

#### 3.1.3 Flood Protection and Irrigation Infrastructure 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.

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 = 5.827 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 3.1.** 

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Figure 3.1: Schematic Diagram of Indus Basin Irrigation System

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". According to IRSA record, the average annual surface water availability from Western and Eastern Rivers is 145.03 MAF (Western Rivers: 138.50 MAF & Eastern Rivers: 6.53 MAF), whereas the maximum inflows recorded was 183.45 MAF (in year 1978-79) and minimum inflows were 99.05 MAF (in year 2001-2002) during the post Tarbela period.

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 are given in **Table 3.1**.

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.	6. Left Bank Canal Area Water Board 07						
	Sub-Total (Sindh)	261					
Khyber I	Pakhtunkhwa						
1.	North Irrigation Zone	439					
2.	South Irrigation Zone	345					
3.	Merged Area	209					
	Sub-Total (KHYBER PAKHTUNKHWA)	993					
Balochis	stan						
1.	North Irrigation Zone	159					
2.	South Irrigation Zone	96					
3.	Canal Irrigation Zone	05					
	Sub-Total (Balochistan)	260					
	Total (In four Provinces)	2,699					
Gilgit-Ba	ltistan						
1.	Gilgit	02					
2.	Hunza/Nagar	08					
3.	Skardu	04					

## Table 3.1: Existing Flood Protection Infrastructure in PIDs, Pakistan

Sr. No.	Zone/Region/ Agency/District	No. of Protection Works
4.	Ghizar	04
5.	Astore	02
6.	Ghanche	09
7.	Diamer	01
	Sub-Total (G-B)	30
AJ&K		
8.	Bagh	03
9.	Bhimber	06
10.	Kotli & Mirpur	01
11.	Muzaffarabad	02
	Sub-Total (AJ&K)	13

#### 3.1.4 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 has increased the risk of GLOFs in Pakistan; Shishper glacier's bursting is one example. 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 2022 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.

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 (Khyber Pakhtunkhwa), South Eastern Punjab and Central Sindh.

#### 3.1.5 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, 2017, 2019, 2020 & 2022. The 2010 floods and 2022 floods have been the worst ever in the country. The floods of various magnitudes affected vast areas in the four provinces including Gilgit-Baltistan, Merged Area, Khyber Pakhtunkhwa (Ex-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.

NDMA's Report dated 18<sup>th</sup> November 2022 states that almost 897,014 homes were fully destroyed and a further 1.392 million partially damaged. Furthermore, livelihoods are also heavily impacted by the flooding, which has killed more than 1,164,270 livestock – a critical source of sustenance and livelihoods for many families. A report from the United Nations Office for the Coordination of Humanitarian Affairs, published on August 30, 2022 indicates that around 2 million acres of crops and orchards have also been affected.

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 one of 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 Km<sup>2</sup> was affected.

The floods of Monsoon 2022 are said to have surpassed the 2010 floods as this caused a humanitarian catastrophe with over 33 million people affected and 1739 deaths (*source: NDMA sitrep dated 18<sup>th</sup> November 2022*). There has also been a substantial impact on livestock, homes and other infrastructure across Sindh, Khyber Pakhtunkhwa, Southern Punjab and Eastern Balochistan.

The major historical flood events and their damages are given in **Table 3.3** on the ensuing page.

#### 3.1.6 Traditional & Innovative Approaches 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 approaches to Integrated Flood Risk Management (IFRM). Based on this, 4<sup>th</sup> Flood Protection Plan of the country (NFPP-IV) is being updated with support from ADB.

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	5,134	474	9,719	41,472
/	1975	684	126	8,628	34,931
8	1976	3,485	425	18,390	81,920
9	1977	338	848	2,185	4,657
10	1978	2,227	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	3,010	1,008	13,208	38,758
16	1994	843	431	1,622	5,568
17	1995	376	591	6,852	16,686
18	2010	<b>10,056</b> @ 1US\$= PKR 86	1,985	17,553	160,000
19	2011	<b>3,730</b> @ 1US\$= PKR 94	516	38,700	27,581
20	2012	<b>2,640</b> @ 1US\$= PKR 95	571	14,159	4,746
21	2013	<b>2,000</b> @ 1US\$= PKR 98	333	8,297	4,483
22	2014	<b>440</b> @ 1US\$= Rs 101	367	4,065	9,779
23	2015	<b>170</b> 1US\$= PKR 105.00	238	4,634	2,877
24	2016	6 1US\$= PKR 104.81	153	43	-
25	2017	-	172	-	-
26	2018	-	88	-	-
27	2019	-	235	-	-
28	2020	-	409	-	-
29	2021	-	198	-	-
30	2022	1US\$= PKR 225	1,739	0,031	05,000*
Т	otal	68,225	15,199	203,704	701,558

**Table 3.2:** Major Flood Events Witnessed in Pakistan

\* PDNA Report, M/o PD&SI ^ Union Councils (UC's): Source NDMA

<sup>#</sup> United Nations Satellite Centre: 2022 Floods Imagery Analysis from 1.7.2022 to 31.8.2022

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

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.

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. Traditional flood management interventions are briefly described below:

## i. Source Control to Reduce Runoff

Permeable pavements, afforestation artificial recharge;

#### ii. Storage of Runoff

Detention Basins, check dams and small/medium/large reservoirs etc.;

#### iii. <u>Capacity enhancement of Headwork/Barrages across Rivers</u>

Remodeling of Barrages/Headworks for enhancing their discharge capacities besides, provision of Bypass/Escape channels, wherever feasible;

#### iv. Separation of Rivers and Population

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

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

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, trans-boundary 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 program/ 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.

#### 3.1.7 Challenges in 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 behavior 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 bank s 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. 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.

### 3.1.8 Impact of Rapid Urbanization on Flood Management

The 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. The urban population projected to reach 64% in Asia by 2050 (currently at 48%).

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. Total volume of water discharged during a flood tends to be more in urban streams as compared to rural areas streams.

#### 3.1.9 Urban Floods in Pakistan: Causes, Impact & Control

Flooding in urban areas can be caused by flash floods, or coastal floods, or river floods, but there is also a specific flood type that is called urban flooding. Urban flooding is specific in the areas that lack drainage of storm water. Urban flooding is specific in the areas that lack drainage of storm water. High intensity rainfall can cause flooding, when the city drainage system does not have the adequate capacity to drain away the runoff generated through concentrated rains. Urban floods are a great disturbance for daily life in the city. During periods of urban flooding, streets can become fast moving rivers, while basements can become fatal traps as they fill with water.

Urban floods are being experienced in Pakistan in different cities, especially in monsoon season, having high population density (Karachi, Lahore, Faisalabad, Multan, Hyderabad, etc.) with unplanned, clogged, encroached and undersized drainage systems. Urban flooding is a relatively serious problem in the city, especially in the dense parts of the city. The Karachi's vulnerability to the urban flooding is due to population growth, blocking of drainage channels, inappropriate land use and urbanization.

Karachi has many large and small drains, but most of them are chocked or encroached. Urban flooding takes place due to the insufficient and encroached storm water drainage system, unplanned urbanization and impact of climate change. The climate vulnerability has contributed to the unpredictability of precipitation in many parts of the world and also to frequent urban flooding in Karachi, which is not only capital of Sindh province of Pakistan but the country's biggest city in terms of both population and area. Karachi is most populous city of Pakistan with population of 14.9 million (according to 2017 census). Karachi is hub of governance, education, business, industry, transport, finance and banking. The urban flooding in Pakistan usually occurs due to the following reasons:

- High intensity of rainfall and uneven rainfall (due to climate change)
- Population growth/ unplanned housing
- Inadequate sewerage/Storm water drains system.
- Encroachments in the drain way
- Inadequate cleaning of Drains/Nullahs
- Mismanagement at city/provincial government level
- Little height from sea level (In case of Karachi it is only 1.5 meters above mean sea level)

Urban Floods results in accumulation of storm water on streets, markets, houses, hospitals, school roads, railway tracks and in few cases even at airports. Because of the poor storm water drainage capacity. These result in traffic jams, electricity failure, telecommunication network stops working ambulances carrying get stuck on roads traffic problems and over all city life almost stops or hampered. Urban flooding also results into spread of infectious diseases, loss of precious human life, loss of property, disturbed economic activity and stress on National Economy. Karachi is backbone of Pakistan's economy contributing 42 per cent of GDP, 70 per cent of income tax revenue and 62 per cent of sales tax revenue. Karachi adds Rupees 16 billion to GDP a day.

Based on the review of available literature, the following recommendations may be helpful made to minimize the damages to human lives and public and private properties in Karachi due to urban flooding:

- i) Flood hazard map of Karachi needs to be prepared with respect to the drainage system and different nullahs on the basis of degree of hazards.
- ii) Once hazard mapping is available early warning system needs to be provided on the different mullahs keeping in view the degree of danger so that necessary evacuation may be carried out in case of emergency situation.
- iii) Cleaning of different nullahs/storm drains may be carried out well before the onset of monsoon season so that blockage in these nullahs/storm drains can be avoided.
- iv) Government of Sindh may carry out necessary legislation to stop further dumping of garbage into these nullahs by the local inhabitants.
- v) Removal of encroachments in these Nullahs needs to be carried out on top priority.
- vi) Carryout mass campaign among the public to raise the awareness of the flood hazards and its consequences.
- vii) Government of Sindh needs to invest in the rehabilitation of storm drains and carry out proper maintenance of the system.

### 3.2 FFC – History, Organogram, Functions and Achievements

#### 3.2.1 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.

#### 3.2.2 Organogram

CEA & CFFC heads the FFC/ National Flood Management Wing as Chairperson. He is assisted by two senior officers i.e. Member Technical (BS-21) and Chief Engineer (Floods) BS-20. The Organogram of FFC showing gazetted staff strength is given in **Figure 3.2.** 



Figure 3.2: Organogram of FFC

## 3.2.3 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. FFC 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.

## 3.2.4 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 details related to flood projects executed under 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)

#### Normal/ Emergent Flood Program

Number of schemes executed in the country	170
Expenditure incurred	Rs 805.33 Million

Source of funding	GOP (100%)
Flood Protection Sector Project-I (FPSP-I)	
Expenditure incurred Number of schemes executed in the four provinces	Rs 4,735.29 Million 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).

#### Prime Minister's River Management Programme (1994-96)

Expenditure Incurred	Rs 613.39 Million
Number of schemes executed	10
Source of funding	GOP (100%)
Flood Damage Restoration Project (1988-FDRP)	
Expenditure Incurred Number of structures restored all over country Source of funding	Rs 1,874.00 Million 2,028 GOP (10%), IDA & ADB (90%)
Flood Damage Restoration Project (1992)	
Expenditure Incurred	Rs 6,888.36 Million
Number of structures restored all over country including AJ&K	1,980
Source of funding	GOP (20%), IDA, ADB & KfW (90%)
3. National Flood Protection Plan-III (1998-2008)	
Normal/ Emergent Flood Programme	
Expenditure Incurred Number of schemes executed in all over the country	Rs 4,192.35 Million 362
Source of funding	GOP (100%)

<u>Special Grant through President Directive (2000-02)</u>	
Expenditure incurred	Rs 92.035 Million
Number of schemes executed in Gilgit-Baltistan	21
Source of funding	GOP (100%)
Flood Protection Sector Project-II (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/1<sup>st</sup> 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.

#### 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 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 & TMA/Rescue-1122-Rawalpindi respectively;

- Executive Warning Control Room in Rawalpindi Fire Brigade;
- Nine (9) No. Warning Posts at various locations.

## 3.2.5 National Flood Protection Plan – IV (NFPP-IV)

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 NFPP-IV 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 billion 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 31<sup>st</sup> 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".

#### **Meetings 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 1<sup>st</sup> June 2017 to review priority of projects for implementation under 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 28<sup>th</sup> July 2017. FFC conveyed to consultants detailed comments on draft umbrella PC-I on 17<sup>th</sup>August 2017. A meeting of consultants & FFC was organized on 12<sup>th</sup>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 15<sup>th</sup> December 2017 subject to certain observations. The updated umbrella PC-I was submitted by the consultants to FFC on 28<sup>th</sup> February 2018, which was circulated among the Irrigation Departments of the four provinces for getting its clearance from PDWP.

#### Clearance by PDWPs of Punjab, Sindh, Khyber Pakhtunkhwa 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 6<sup>th</sup> April 2018, 8<sup>th</sup> May 2018, 12<sup>th</sup> June 2018 and 10<sup>th</sup> August 2018 respectively. The finalized version of umbrella PC-I was submitted to Ministry of Water Resources on 16<sup>th</sup> November 2018. Ministry of Water Resources had submitted the same to Ministry of Planning, Development & Reforms on 11<sup>th</sup> January 2019.

## Flood Protection Sector Project-III (FPSP-III)

The Umbrella PC-I was considered in the Pre-CDWP meeting held on 4<sup>th</sup> April 2019 under the Chairmanship of Member (Infrastructure), Planning Commission, wherein it was agreed in principle to process the Umbrella PC-I for approval of CDWP/ECNEC. However, it was highlighted during the meeting that projects like GLOF-I & GLOF-II, Project of Flood Forecasting and Warning System, besides, other projects had either been executed by NDMA, PMD and MoCC or under process of approval for which PD&R Division had received the project documents for approval of CDWP/ECNEC. Later on Ministry of Planning, Development & Special Initiatives M/o PD&SI) returned the Umbrella PC-I in July 2019 with the comments that neither scope of the project was firmed up nor fiscal space available to take up the project. In light of M/o PD&SI letter, Ministry of Water Resources also advised that keeping in view the financial constraints, FFC may pick only top priority/emergent nature works at this stage in consultation with all stakeholders and formulate an Umbrella PC-I with firm scope of work and realistic cost estimates, so that implementation of NFPP-IV may be materialized.

The strategy for reformulation of Umbrella PC-I for Flood Protection Sector Project-III (FPSP-III) and to explore source of funding for FPSP-III was discussed with all stakeholders in the meeting of FFC held on 20<sup>th</sup> August 2019 and 14<sup>th</sup> November 2019 in office of CEA & CFFC, Islamabad. It was agreed that the overall cost of the Umbrella PC-I of FPSP-III containing priority sub-projects of NFPP-IV should be around Rs 96.00 Billion. After detailed discussions and deliberations, the investment plan of FPSP-III in the sum of Rs 95.980 Billion **(Table 3.3)** based upon the proposals received from Irrigation Departments Government of Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan & Federal Line Agencies (Merged Area, Khyber Pakhtunkhwa, G-B, AJ&K, NDMA, PMD, WAPDA and MoCC) was unanimously agreed. In order to process the issue on fast track basis, as a 1<sup>st</sup> step it was decided to prepare and process Concept Clearance Paper (CCP) of FPSP-III through MoWR for approval of CDWP and for approaching external donors through EAD.

Sr. No.	Province/Line Agency	Proposed Estimate (Rs billion)	
1.	Punjab	23.040	
2.	Sindh	16.348	
3.	Khyber Pakhtunkhwa	11.400	
4.	Balochistan	7.769	
5.	FATA (Merged Area Secretariat)	6.000	
6.	Gilgit-Baltistan	6.996	
7.	AJ&K	4.500	
8.	NDMA	0.962	
9.	Ministry of Climate Change	6.000	
10.	PMD	4.505	
11.	WAPDA (H&WM Directorate)	6.000	
12.	FFC (Technical Studies & Construction	2.460	
	Supervision through consultants)		
	Total:	95.980	

## Table-3.3: Investment Plan of FPSP-III (Umbrella PC-I of 2020)

CCP for FPSP-III based on NFPP-IV (Cost of Rs 95.980 Billion) was forwarded to MoWR for further processing on 6<sup>th</sup> December 2019. Side-by-side Umbrella PC-I of the project was prepared through in-house capacity. The CCP of FPSP-III was approved by the CDWP/CCC in its meeting held on 3<sup>rd</sup> March 2020. Sequel to that Ministry of Water Resources forwarded the case for approaching prospective donor for FPSP-III financing to EAD. In the meanwhile, the Umbrella PC-I of FPSP-III was submitted to M/o PD & SI enroute MoWR on 23<sup>rd</sup> June 2020 for approval of CDWP/ECNEC.

The umbrella PC-I of FPSP-III was considered in the Pre-CDWP meeting held on 9<sup>th</sup> September 2020 and recommended for consideration in CDWP. It was considered in the CDWP meeting held on 12<sup>th</sup> October 2020 and CDWP approved the Umbrella PC-I at an estimated cost of Rs 95,980 Million, including FEC Component of Rs 6,905 Million, with a condition to confirm financing from donors before consideration of the project by ECNEC. In this regard, MoWR was requested for taking-up the issue of external financing of FPSP-III with NDRMF/ADB through EAD, as NDRMF has been put in place through MoU between ADB and EAD, GoP for the purpose of implementation of National Disaster Management Plan (NDMP) of which NFPP-IV covers more than 75% portion.

Subsequently, EAD was requested enroute MoWR for approaching prospective foreign donors to implement FPSP-III. EAD in response conveyed that Umbrella PC-I could not be shared with donors being only composed of selected list of structural and non-structural interventions. So far external financing arrangements for FPSP-III are not available/ forthcoming through EAD, which is a main condition of CDWP for Project consideration by ECNEC. Accordingly, a Ready-to-Implementation portfolio of sub-projects out of approved FPSP-III PC-I costing Rs. 44.880 billion was prepared in consultation with all the stakeholders and forwarded to EAD through Ministry of Water Resources for exploring external funding.

## Need for Preparation of Updated FPSP-III

- In view of devastating 2022-rains/ floods experienced by the country, it became essential to review and update the National Flood Protection Plan (NFPP-IV), to incorporate protection measures against ever-erratic torrential and pluvial floods experienced during 2022. In a meeting chaired by the Prime Minister of Pakistan on 29<sup>th</sup> August 2022, the Prime Minister directed that <u>"Flood Protection Plan 2017 to be updated and protection measures against flash floods and hill torrents to be included in the Plan".</u>
- In compliance to the Prime Minister's directive, CDWP re-considered the already processed Umbrella PC-I of FPSP-III in its meeting held on 14<sup>th</sup> September 2022 and decided to also update it by including fresh proposals based on lessons learnt from 2022-Floods, specifically in the context of flash floods, hill torrents and drainage system.

With reference to above, it is stated that NFPP-IV is being updated by M/o PD&SI through ADB financing. M/s Deltares of the Netherlands is doing the updation work.

## Current Status regarding Updated FPSP-III

• Regarding FPSP-III, it is stated that the updated Umbrella PC-I costing **Rs 194.625 billion** was submitted to PD&SI Division on **December 16, 2022** enroute MoWR for the approval of CDWP & ECNEC and for the arrangement of finances.

- PD&SI Division has desired a "<u>No-Duplication Certificate</u>" from all Executing Agencies, to be made part of PC-I. Needful is being done (<u>Requisite Certificates</u> have been received from WAPDA, PCRWR, PMD and Irrigation Departments of <u>Governments of Sindh and AJ&K</u>; follow up underway for obtaining the same, also from Governments of Punjab, Khyber Pakhtunkhwa and Balochistan etc.)
- Structural Interventions, proposed under FPSP-III, include construction of flood embankments/dikes, spurs, retaining walls, flood diversion/dispersal structures, small/ medium dams for conservation of flood water, strengthening/remodeling of flood embankments/dikes etc. & improvement of drainage network in Sindh. These interventions will be implemented mainly through Irrigation Departments of four provinces, Federal Line Departments (G- B, AJ&K and Merged Areas).
- Non-Structural Interventions mainly comprise off Improvement works of Flood Forecasting & Early Warning System of PMD including installation of Automatic Weather Stations (AWS) etc. & and establishment of Regional FF&W Centers. Likewise, Installation of Flood Telemetry Network & watershed management interventions by WAPDA along main, secondary & tertiary rivers and construction of ecosystem-based interventions by MoCC through Recharge Pakistan Project.
- Summary of updated FPSP-III project and anticipated benefits of the FPSP-III (derived from initial Ready-to-Implement sub-project proposals submitted by the PIDs/FLAs) are given in **Table 3.4.**

## 3.2.6 Normal/Emergent Flood Programme

Federal Flood Commission is the federal coordinating body for 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, approval of DDWP/CDWP and release of funds by Planning Commission/Finance Division to the executing agencies.

The award of contract, execution and disbursement is the exclusive responsibility of Provincial Irrigation Departments and Federal Line Agencies. The urgent nature flood protection works are proposed by the Provincial Irrigation Departments and Federal Line Agencies for execution under Normal/Emergent Flood Programme.

Around 373 number flood project costing Rs 9.420 billion have been approved for implementation through Normal/Emergent Flood Programme during the period 2007-08 to 2021-22. 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.

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 3.5**.

## Table-3.4: Summary of Interventions in Updated Umbrella PC-I of FPSP-III

(Rs Million)

Sr. No.	Description	No. of Sub- Projects	Estimated Cost	Tentative key benefits to be achieved/ Assets to be protected from future floods
a.	Punjab	12	29,708.25	Around 160,000 population, 5,000 houses, 12 Basic Health Unit (BHU), 20 No. Irrigation Channels, 30 No. schools, 10 No. roads and 31000 acres of lands
b.	Sindh	40	50,570.59	Around 2,507,800 population, 65,500 household, 685,000 acres of agricultural lands
C.	Khyber Pakhtunkhwa	31	14,157.20	Settlements along Rivers Swat, Panjkora, Kabul and their tributaries/ other rivers and
d.	Merged Area	25	1,206.80	hill torrents like Tochi Rivers etc. and around 24,699 acres agricultural lands
e.	Balochistan	29	44,289.41	Around 22,850 population, 3,811 farm families, 5,762 houses, 12,910 acre agricultural lands, 1,500 livestock and 223 No. Tube Well
f.	Gilgit-Baltistan	10	8,197.51	Around 1,200,000 population, 93,466 acre agricultural lands and 4500 houses
g.	Azad Jammu & Kashmir (AJ&K)	4	11,052.59	Conservation 55,345 Acre feet (68.25 million m <sup>3</sup> ) of flood water for direct irrigation and drinking purposes benefiting about 19,224 acres of fertile cultivable land, Supply of safe drinking water of 0.521 MGD to 52,015 people, production of 1,539 tons of fish annually, hydropower generation of 566,800 KW, Protection of 200 acres valuable agriculture land from floods and Protection of 1,000 households
	Sub-Total (A)	151	159,182.35	
h.	Water & Power Development Authority (WAPDA)	05	15,318.743	457 Telemetry Station on country wide basis, improved data sets for making more accurate flood forecasts, conducting climate studies, timely flood early warnings etc.
i.	Pakistan Meteorological Department (PMD)	02	5,025.390	Improved weather forecast, riverine and flash flood forecast, Institutional weather early warning capabilities strengthening and increased satisfaction of end-users.
j.	Recharge Pakistan Project (MoWR + MoCC)	01	6,000.000	More than 10 million people will directly benefit, while 20 million people across 50 vulnerable districts of Pakistan will be the indirect beneficiaries.
k.	LiDAR Survey of flood plain areas of Indus River/its	01	779.900	Capture high resolution images alongwith accurate terrain information/ DEM i.e. base data for any type of flood modeling software and similar others.
I.	HillTorrentManagementStudiesupdation&	04	457.590	Improving Climate Resilience in Gilgit-Baltistan, Improving Climate Change Adaptation Capacity of Local Communities in Thar Desert etc.
m.	Federal Flood Commission	-	7,861.030	Project Coordination & Management Unit, office renovation (FFC's office building), Project Supervisory Consultants, and other key projects/studies on Urban flood control/ Rainwater Harvesting projects
Sub-Total (B)		13	35,593.450	
Grand Total (A+B)		179	194,625.821	

Table 3.5: Status of Budget Demanded and Allocated for Normal/ Er	nergent
Flood Programme during 2010-11 to 2021-22	

Sr.	Financial	Funds	Budget Allocation under PSDP		Funds Released
No.	Year	Demanded*	Original	Revised	
1.	2010-11	3,500.00	740.798	735.752	276.714
2.	2011-12	4,000.000	894.000	844.194	567.095
3.	2012-13	4,000.000	900.000	597.483	419.325
4.	2013-14	4,500.000	1,000.000	1,000.000	855.533
5.	2014-15	5,000.000	1,000.000	1,000.000	898.477
6.	2015-16	5,500.000	1,000.000	964.430	964.430
7.	2016-17	5,515.000	500.000	500.000	267.500
8.	2017-18	11,223.516	500.000	500.000	244.010
9.	2018-19	10,000.00	1,000.000	1,000.000	610.000
10.	2019-20	10,000.00	500.000	500.000	500.000
11.	2020-21	10,000.00	1500.000	0.000	0.000
12.	2021-22	10,000.00	1500.000	720.368	720.368
Total		83,236.516	11,034.798	8,362.227	6,323.452

\* Funds demanded by PID'S & FLA'S for execution of flood protection works

An amount of Rs. 1500.00 million was allocated under PSDP (2021-22) for Normal/ Emergent Flood Programme. Detailed list of schemes to be executed under Normal/ Emergent Flood Programme during Financial Years (2021-22) is attached as Appendix-I.

## 3.2.7 Summary of Investment on Flood Projects (GOP Grants/ Foreign Aid)

The summary of investment on flood projects through GOP grants & foreign aids coordinated by FFC since 1978-79 to June 2021 is given in **Table 3.6**.

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
	Sub-Total (NFPP-I)		311	1,730
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
	Sub-Total (NFPP-II)		436	6,153
3.	NFPP-III (1998-2008)			
i.	Normal/Emergent Flood Programme	Countrywide	362	4,192.348

## Table 3.6: Summary of Federal Investment on Flood Protection Works

Sr. No.	Flood Plans/ Programs	Location	No. of Schemes	Expenditure (Rs Million)	
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	
Sub-Total (NFPP-III)			485	8,797	
4.	Normal/Emergent Flood Programme				
i	Normal/Emergent Flood Programme (2008-09 to 2021-22)	All over country	373	9,420	
	Sub-Total (N/EFP)			9,420	
	Total (1+2+3+4)	1588	26,100		
5.	Flood Damages 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	
Grand Total			4,008	8,762	

## 3.3 Institutional Flood Management Mechanism

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

- Irrigation Departments of the four Provinces (Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan);
- Irrigation & Water Management Department, Government of GB,
- Irrigation & Small Dams Directorate, Government of AJ&K.
- PMD/Flood Forecasting Division, Lahore.
- Water and Power Development Authority (WAPDA).
- Office of the Pakistan Commissioner for Indus Waters (O/o PCIW).
- Federal Flood Commission (FFC).
- National Disaster Management Authority (NDMA).
- Pakistan Army
- National Highway Authority (NHA)/ Provincial Communication & Highway Departments
- Pakistan Railways
- Provincial Disaster Management Authorities, GB-DMA and SDMA including District Administrations/ DDMAs

Major functions of the above organizations are briefly described hereinafter:

## 3.3.1 **Provincial Irrigation Departments (PIDs)**

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

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

#### 3.3.2 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;
- ii. 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;
- iv. Coordination between FFD Lahore and WAPDA has considerably improved after the 1992-flood disaster;
- v. 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.

## 3.3.3 Provincial Disaster Management Authorities (PDMAs)

- i. 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;
- ii. 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;
- iii. 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 DDMAs regarding actions to be taken in response to disaster; and promote general education, awareness and community training etc. pertaining to all disasters including floods;
- iv. 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.

## 3.3.4 Pak Army

- i. Pak Army's Corps of Engineers under the command and control of Engineerin-Chief (*E-N-C*) provide necessary help to the civil authorities to carry out rescue and relief operations during floods;
- ii. 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;
- iv. Pre-flood phase is the flood preparatory phase during which the adequacy and serviceability of the flood fighting equipment is ensured;
- v. 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;
- vi. 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;
- vii. 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;
- viii. 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;
- ix. 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;
- x. 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;
- xi. A post flood coordination meeting is held under the Chairmanship of Engineerin-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.

## 3.3.5 Office of Pakistan Commissioner for Indus Waters (O/o PCIW)

- i. 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;
- iii. 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;
- iv. 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;

- v. The Pakistan Commissioner for Indus Waters receives the Chenab River and Eastern Rivers (Ravi & Sutlej) data normally once in a day;
- vi. The data is then passed on to the FFD, Lahore for preparation and issuance of flood forecast to concerned organizations;
- vii. Frequency of data reception is increased to six hourly and even to hourly in case of severe flood situation;
- viii. 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;
- ix. 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).

## 3.3.6 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.

#### 3.3.7 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.

#### 3.3.8 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.
- For that purpose, Pre-Monsoon 2022 meeting of Federal Flood Commission was held on 15<sup>th</sup> March 2022 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 2021 flood activities and preparatory works for Monsoon Season 2022. Accordingly, necessary directions regarding pre-emptive measures for Monsoon Season 2022 were issued to concerned organizations;
- 57<sup>th</sup> Annual meeting of FFC was organized on 7<sup>th</sup> June 2022 under the Chairmanship of Chief Engineering Advisor/ Chairman Federal Flood Commission, 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 2022.
- Moreover, FFC organized a special meeting of stakeholders on 15<sup>th</sup> June 2022, keeping in view PMD's 2022 Monsoon Seasonal Weather Outlook. The purpose of the meeting was to review the precautionary steps taken in the Provinces & Federal Line Agencies to combat 2022 Monsoon including their present state of preparedness.
- A follow up meeting was held on 30<sup>th</sup> June 2022 to deliberate on the preparatory arrangements made over and above those already reported by the Provinces/ Federal Line Agencies (FLAs) in the context of combating any flooding situation during Monsoon Season (MS) 2022.
- A special meeting of FFC was convened on 7<sup>th</sup> July 2022 in order to deliberate on the data sharing mechanism of Karot HPP with Mangla Dam Organization (MDO).
- An emergency meeting regarding Flood Management during the Monsoon-2022 was held on 22<sup>nd</sup> August 2022.

 Monsoon Season 2022 Review meeting of Federal Flood Commission was held on 1<sup>st</sup> September 2022.

#### Role of FFC during Monsoon Season

- Flood Communication Cell established in FFC started working on round the clock basis with effect from 15<sup>th</sup> June 2022 and worked on 24-hour basis during the entire Monsoon Season (15<sup>th</sup> June 15<sup>th</sup> October 2022) 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 Reports (DFSR) 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.;
- In addition to DFSRs, eleven (11) Press Releases, five (05) Weather Advisories, four (04) Significant Flood Warnings and two (02) GLOF Alerts were issued by Flood Communication Cell of FFC;
- 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 1500 million** allocated under PSDP (2021-22) 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. Four meetings of Scrutinizing Committee of FFC were organized on 28<sup>th</sup> February 2022, 18<sup>th</sup> March 2022, 4<sup>th</sup> November 2022, and 1<sup>st</sup> December 2022, wherein flood protection schemes were technically examined and recommended to Ministry of Water Resources for approval of DDWP.
- Two (02) meetings were organized by FFC for review of progress on implementation of flood projects under GOP funded Normal/Emergent Flood Programme.
- 14<sup>th</sup> Progress Review meeting of Federal Flood Commission was organized on 24<sup>th</sup> October 2022 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.
- Post Monsoon 2022 meeting of Federal Flood Commission (FFC) was held on 22<sup>nd</sup> November 2022, 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.

• Site inspections of 12 No. flood protection schemes of Normal/Emergent Flood Programme were carried out by FFC's Monitoring Teams throughout the country.

#### 3.3.9 Flood Warning Dissemination System

- Monsoon Season normally starts in 1<sup>st</sup> week of July (sometimes, it starts little early) and ends in last week of September (sometimes prolongs up to mid-October).
- Flood Warning Centers of all flood management related agencies start functioning from 15<sup>th</sup> June every year for collecting weather & flood flow data and keep continue upto 15<sup>th</sup> 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.

#### 3.4 Flood Preparedness & Contingency Planning for Monsoon Season 2022

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 the annual practice, FFC holds meetings prior to start of Monsoon Season every year. As stated above, 57<sup>th</sup> Annual Meeting of FFC was organized on 7<sup>th</sup> June 2022 to review the arrangements made by the concerned organizations for flood management during Monsoon Season 2022. The contingency planning measures done by FFC for Monsoon Season 2022 hare been briefly mentioned under 3.3.8 above.

Further details with reference to FFC's coordination meetings held with federal and provincial stakeholder departments on flood preparedness are explained in the subsequent paragraphs.

## 3.4.1 13<sup>th</sup> Meeting of FFC to Review Progress on Honourable Supreme Court's Directions regarding Constitution Petition No. 62 of 2010

13<sup>th</sup> meeting of Federal Flood Commission (FFC) to review progress regarding Directions of Honourable Supreme Court of Pakistan related to Constitution Petition No. 62 of 2010, filed by Ms. Marvi Memon versus Federation of Pakistan was held on **20<sup>th</sup> January 2022**.

Following decisions were made in the meeting:

- i. Installation of state of the art Weather Radars at Mangla, Lahore and Sialkot would be given top priority.
- ii. PMD would make utmost efforts to further improve its coordination mechanism with WMO & SAARC countries for sharing the information regarding Early Weather Forecast and issuance of Flood Warning.
- iii. PMD would submit a status report regarding its Flood Forecasting & Early Warning System (FEWS) position in 2010, improvement made till now and

Future Plans for further improvement within 30 days to FFC for consideration in the next Progress Review Meeting.

- iv. PID Punjab & Sindh to share comprehensive report on all Barrages on regular basis indicating date of start & completion and activities carried out/being carried out on the projects till completion of projects.
- v. All existing/ designated breaching sections be revisited by Punjab Irrigation Department for their operationality and need keeping in view the present site conditions besides identification of new breaching sections, if needed, at vulnerable locations as highlighted by Flood Inquiry Commission. The report may be submitted to FFC within 60 days for consideration in the next Progress Review Meeting.
- vi. Pak Railways would send the PC-I of Left Guide Bund of Shershah Railway Bridge to Punjab Irrigation Department through its administrative Secretary and also share the same with FFC for consideration of Scrutinizing Committee.
- vii. PID, Khyber Pakhtunkhwa to furnish details of O&M funds demanded / required, allocated, released & utilized during the financial years (2010-11 2019-20) and status of maintenance of flood protection infrastructure to FFC at the earliest.
- viii. NHA to provide to FFC detailed updated progress report regarding 57 vulnerable sites identified by Consultants M/S NESPAK containing the sub- project wise recommendations and their status of implementation alongwith brief details of the scope and obligation of each sub-project.
- ix. Irrigation Departments of Sindh, Balochistan, GB and AJ&K to vigorously pursue their cases with concerned authorities for early approval of River Act and submit latest status to FFC.
- x. Irrigation Departments of the Punjab, Sindh, Khyber Pakhtunkhwa & Balochistan, GB-PWD and Agriculture, Livestock, Irrigation & ESMA, Government of AJ&K would share with SUPARCO under intimation of FFC, the details of encroachments, besides, those encroachments already removed on prescribed format already circulated among concerned organizations at the earliest.
- xi. PDMAs, GBDMA & SDMA will take steps to remove encroachments in floodplains/ waterways along major and other rivers including hill torrents with the coordination of concerned District Administrations and submit report to FFC at the earliest.
- xii. Upon receipt of information from Irrigation Departments, SUPARCO will carry out the verification of encroachments removed and those existing and submit report to FFC.
- xiii. WAPDA to keep on providing progress on Munda/ Mohmand Dam Project to FFC on regular basis.
- xiv. Forest Departments of four Provinces and Federally Administered Areas including Watershed Management Authorities of Mangla & Tarbela Dams Projects (WAPDA), will keep up their efforts and would regularly 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.

- xv. Irrigation Departments of Punjab, Khyber Pakhtunkhwa & Balochistan and Forest Department of Sindh Province to submit their views/ comments on PC-II for formulation of National Watershed Management Plan to FFC at the earliest.
- xvi. PID, Punjab will provide to FFC on regular basis the updated progress on Construction of Hydro Power Station along right side of Taunsa Barrage.
- xvii. WASA, in consultation with RDA, to share progress on construction of Lai Expressway with FFC on regular basis.
- xviii. PID, Punjab to share updated status regarding Model Study of River Channelization for Ravi River Front Urban Project on regular basis.
- xix. PID, Balochistan & G-B to share details about critical locations (including their number, nature of criticality/vulnerability) requiring attention and funds needed etc. to be shared with FFC by PIDs/FLAs.
- xx. KMC & KDA to keep on sharing the progress regarding rehabilitation/upgradation of storm drainage system of the city on regular basis until completion of the job.
- xxi. PID, Sindh to keep on sharing latest updates to FFC on regular basis regarding Long term rehabilitation/ up-gradation works of LBOD and its allied components i.e. Dhora Poran water drains to Shakoor Dhund for further action.
- xxii. WAPDA to furnish latest status of the approval of remaining PC-I of the project to FFC within a fortnight.
- xxiii. WAPDA and PID Sindh to keep on sharing the progress about Rainee Canal on regular basis to FFC.

#### 3.4.2 4<sup>th</sup> Progress Review Meeting regarding Normal/ Emergent Flood Programme for Financial Year (2021-22) held on February 15, 2022

4<sup>th</sup> Progress Review Meeting regarding Normal/Emergent Flood Programme for Financial Year (2021-22) was held on **February 15**, **2022**.

Following decisions were made in the meeting:

- i. PIDs & FLAs to submit request for obtaining extension in execution period of all those flood protection schemes of previous years, which could not be completed within the target period given in the approved PC-Is on the prescribed proforma of Planning Commission at the earliest, for obtaining approval from Ministry of Water Resources.
- ii. PID Punjab and Khyber Pakhtunkhwa to complete the ongoing schemes at the earliest possible time and completion reports (on prescribed PC-IV proforma) may be submitted to FFC soon after completion of works for taking further action in the matter.
- iii. PIDs & FLAs to submit to Federal Flood Commission, the utilization account of funds released during previous five (5) years (2015-16 to 2019-20) without further delay, for taking further action in the matter.
- iv. The utilization of funds of Rs. 248.978 million is still pending by PID Punjab. If PID Punjab cannot utilize the available balance of outstanding amount, then the funds would be adjusted through federal adjuster after the approval of Competent Forum.

- v. FFC to write letter to Finance Department, Government of Khyber Pakhtunkhwa for the revalidation of funds amounting to Rs. 47.500 million.
- vi. FFC to prepare and submit position paper for the CDWP through MoWR highlighting the issue of non-utilization of released funds during previous financial years by PID Punjab for its settlement.
- vii. PID Balochistan to refund the un-spent funds of Rs. 5.854 million to the federal government, if it is unable to utilize the said funds on implementation of approved schemes, taken up under Normal/ Emergent Flood Programme.
- viii. PIDs & FLAs to strictly follow the implementation schedule of Normal/ Emergent Flood Programme, which was approved by ECNEC on 27th July 2004, as given below;

Sr. No.	Activity	Scheduled time	
i.	Finalization of priority works in consultation with the Provinces/ Federal line Agencies and Pak Army after allocation of funds under PSDP.	End of August and as a special case by end of September	
iii.	Preparation of PC-Is of schemes their clearance by PDWPs, Scrutinizing Committee of Federal Flood Commission and approval from DDWP/ CDWP	Before/ By 31 <sup>st</sup> October and exceptional cases by 30 <sup>th</sup> November each year	
iv.	Execution of works	October/ November to April-May each year	

- ix. FFC will submit to MoWR the proposal for re-appropriation of Rs. 403.773 million (as per distribution given in Para-13 above) from PID Punjab share for approval of competent authority.
- x. Meanwhile, five (5) No. schemes (Khyber Pakhtunkhwa=3 under one PC-I, Balochistan = 1 & Gilgit-Baltistan = 1) would be processed on immediate basis for consideration of Scrutinizing Committee of FFC and DDWP of Ministry of Water Resources so that the same could be approved and started as early as possible.
- xi. PID Sindh, Khyber Pakhtunkhwa & Balochistan and GB-PWD will ensure in written that they will complete their schemes (taken up through saving account) before 30th June 2022.
- xii. PIDs & FLAs to submit demand for release of budget allocated under PSDP (2021-22) alongwith other necessary documents to FFC without further delay for further processing of the case.
- xiii. PIDs & FLAs to submit to FFC Project Completion Reports (PCRs) of flood protection schemes carried out during (2007-08) to (2019-20) under Normal/ Emergent Flood Programme on prescribed PC-IV Proforma (in triplicate) alongwith as built drawings, X-sections & coloured site pictures for further action.

## 3.4.3 Preparatory Meeting of FFC held on 15<sup>th</sup> March 2022

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, a preparatory meeting of Federal Flood Commission was held on **15<sup>th</sup> March 2022** in order to review the progress on post 2021 flood activities and preparatory works for Monsoon Season 2022. Accordingly, following necessary directions regarding pre-emptive measures for Monsoon Season 2022 were issued to PIDs/Federal Line Agencies, WAPDA, PMD & other concerned agencies etc.:

- i. **Provincial Irrigation Departments & Federal Line Agencies** to ensure completion of all approved and ongoing flood protection schemes taken up under Provincial ADP and Normal/ Emergent Flood Programme, besides, rehabilitation 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 2022 Monsoon Season.
- ii. Provincial Irrigation Departments of Sindh, Balochistan, G-B & AJ&K to pursue 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 regular basis. PIDs/FLAs to ensure the approval of River Act and its enactment before 30<sup>th</sup> June 2022.
- iii. PIDs & FLAs to ensure removal of encroachments from flood plains/ High Risk Zones, waterways of major and other rivers including Hill Torrents/ Flood Flow generating nullahs, 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 Monsoon Season 2022.
- iv. PIDs & FLAs to initiate the case for opening a separate Assignment Account for implementation of Normal/ Emergent Flood Programme for smooth transfer of funds to the Project Authorities. Efforts may be made to open the accounts by/ before 30<sup>th</sup> June 2022.
- PIDs to expedite efforts with respect to Revision in Flood Limits of their respective Barrages/ Head Works/ Bridges falling in their jurisdictions in view of changing ground realities. The exercise may be completed before 30<sup>th</sup> June 2022.
- vi. **PID Khyber Pakhtunkhwa** to share revised/ updated limits of their rivers with all the stakeholders including FFC, PMD & PID Punjab.
- vii. PID, Punjab to conduct study on need of existing as well as additional needed (at critical locations) Breaching Sections in Punjab on fast track basis. The exercise may be completed before 30<sup>th</sup> June 2022.
- viii. **Irrigation & Agriculture Department, Government of AJ&K** to complete the rehabilitation works and submit status report before 30th June 2022.
- ix. **PMD** to ensure procurement & installation of the Weather Radar at D.I. Khan as per approved Implementation Plan.
- x. Mangla Dam Organization (MDO) would prepare draft Contingency Plan by 31<sup>st</sup> March 2022 for discussion in the special meeting with regards to safe passage of surplus flood water through Emergency Spillway of Barakas Nullah in case of emergency situation.
- xi. Based on Contingency Plan prepared by **MDO**, a special meeting on Barakas Nullah would be held around 10<sup>th</sup> April 2022.
- xii. **Rawalpindi District Administration** to ensure removal of encroachments from the banks/ bed of Lai Nullah at the earliest.
- xiii. **Pak Railways** to ensure the execution of Left Guide Bund of Shershah Railway Bridge across River Chenab in District Multan at the earliest.
- xiv. **PID, Punjab and NHA** to facilitate Pak Railways in design work/ preparation of PC-I. Pak Railways to ensure execution of work before 30<sup>th</sup> June 2022.
- xv. **WAPDA** to take action on the decisions reflected in the minutes of the 2<sup>nd</sup> meeting of High Level Barakas Nullah Committee without any loss of time.
- xvi. **WAPDA** to ensure that the 2<sup>nd</sup> Revised PC-I of Mangla Dam Raising Project got approved by/ before 31<sup>st</sup> March 2022.
- xvii. **Provincial Governments** to provide list of encroachments removed alongwith proper coordinates to SUPARCO for analysis & verification of encroachments removed from the waterways & flood plains of rivers.
- xviii. **PCIW Office** to take up the agenda of timely provision of advance flood flows information of River Chenab and Eastern Rivers with the ICIW in the next Permanent Indus Commission meeting.
- xix. **PCIW office** to make all the necessary arrangements for gathering information of River Chenab and Eastern Rivers from India as per practice in vogue and share the same with PMD/ FFD, Lahore
- xx. **PMD** to submit its PC-Is under Flood Protection Sector Project -III (FPSP-III) to FFC at the earliest.

### 3.4.4 Flood Communication Cell of FFC

The Flood Communication Cell of Federal Flood Commission started functioning on round-the-clock basis from 15<sup>th</sup> June 2022 till end Monsoon Season (15<sup>th</sup> October 2022) 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 of Monsoon Season 2022.

### 3.4.5 57<sup>th</sup> Annual Meeting of FFC (07<sup>th</sup>June 2022)

The 57<sup>th</sup>Annual Meeting of Federal Flood Commission was held on **07<sup>th</sup> June 2022** under the Chairmanship of CEA & CFFC Islamabad, in order to review the status of preparedness of the Provinces & Federal Line Agencies for Monsoon Season 2022. The following directions were given to PIDs/ Federal Line Agencies, WAPDA, WASA & PMD etc.:

- i. **Federal Flood Commission** to write D.O. letters to Chief Secretaries of Sindh, Balochistan, G-B and AJ& K for early approval and enforcement of Flood Plain Management/ River Act ensuring removal of existing settlements in river flood plains/ water ways and placing restrictions on future encroachments.
- ii. Federal Flood Commission to write D.O. letters to Chief Executive (IESCO, LESCO and KESC) on power supply issue of PMD, Islamabad, FFD, Lahore and PMD Regional Met. Centre, Karachi.

#### iii. Provincial Irrigation Departments (PIDs) & Federal Line Agencies (FLAs-GB, AJ&K, Merged Area):

- (a) To ensure completion of all ongoing flood protection schemes taken-up under Provincial ADP & Federal PSDP, besides, strengthening/ rehabilitation works of all critical reaches including Operation & Maintenance (O&M) works related to Barrages/ Head-works/ Bridges at the earliest.
- (b) To ensure early submission of their respective priority lists and PC-Is of need based flood protection projects proposed under Normal/ Emergent Flood Programme of PSDP (2022-23) to FFC within July 2022 (not beyond July 2022) so that their technical clearance from Scrutinizing Committee of FFC is completed well within November 2022 for their final approval of DDWP/ CDWP and issuance of Administrative Approval.
- (c) To remain vigilant and ensure Round-the-Clock patrolling of flood protection infrastructure, especially vulnerable sections of embankments as identified by the PIDs, besides, operation of dams and Barrages/ Headworks as per existing SOPs.
- (d) To aggressively follow the case with concerned quarters for early approval of River Flood Plains Management Act and its enactment and preparation of necessary regulatory framework for removal of existing encroachments and restricting new settlements in the waterways/ flood plains of major & other rivers.
- (e) For all those barrages & head-works of Punjab, which have been rehabilitated with increased design capacities, Punjab Irrigation Department to circulate the revised design capacities of its barrages to all the stakeholders including FFC.
- (f) PID Punjab to carry out an in-house technical study to review the existing Flood Classification of Eastern Rivers in the Punjab and update. Efforts be made to complete the entire exercise at the earliest since Monsoon Season 2022 is approaching fast, and the compliance status be shared with all the stakeholders including FFC.
- (g) PID Punjab to take up a desk study on need of existing as well as additional (at critical locations) Breaching Sections in Punjab on fast track basis. The feasibility study is to be finalized in consultation with Pak Railways and NHA in the wake of improvement in barrage capacity and construction of new communication lines. Efforts be made to complete the entire exercise at the earliest since Monsoon Season 2022 is approaching fast, and the compliance status be shared with all the stakeholders including FFC.
- (h) PID Khyber Pakhtunkhwa to share revised/ updated limits of rivers in Khyber Pakhtunkhwa with all the stakeholders including FFC, PMD & PID Punjab.
- (i) PIDs and FLAs (GB, AJ&K, PMD, WAPDA, NDMA, MoCC etc.) to submit their respective final lists of sub-projects under Ready-to-

Implement Portfolio of FPSP-III at the earliest preferably within 25<sup>th</sup> June 2022 to FFC.

(j) PIDs and FLAs (GB, AJ&K, PMD, WAPDA, NDMA, MoCC etc.) to submit PC-Is of the sub-projects under Sr. No. 1 above by 15<sup>th</sup>July 2022, to FFC for further processing.

#### iv. **PMD:**

- (a) To ensure completion of all essential repairs/maintenance of equipment relating to Flood Forecasting & Warning System.
- (b) To formally share its viewpoint on keeping in view the D.I. Khan Weather Radar Project present pace of progress.
- (c) 100 percent functionality of all existing weather radars shall be ensured by PMD.
- (d) To ensure effective use of FEWS computer model and the IFAS model towards better and precise runoff information, flood forecasting.
- (e) FFD, Lahore, to ensure its best efforts for an early issuance of daily Bulletins (A&B) preferably by 0930 hours daily morning during the Monsoon Season 2022.
- (f) For all purposes, only FFD, Lahore/PMD-Islamabad shall give official point of view, update, assessment etc. on past, existing and future meteorological conditions and the likely impacts.
- (g) To submit duly corrected PC-Is of its four (04) projects under FPSP-III to FFC besides on NDRMF Format to FFC latest by July 15, 2022 for further action.
- v. <u>Pakistan Railways</u> to ensure the approval and subsequent execution of Left Guide Bund of Shershah Railway Bridge across River Chenab in District Multan at the earliest.

### vi. PDMAs/ SDMA & GB-DMA

- (a) To ensure removal of encroachments from flood plains/waterways causing hindrance in flood flows with the help of concerned districts administrations. The compliance report be submitted to FFC on regular basis till completion of the task.
- (b) To submit to FFC hard & soft copies of the relevant Contingency Plans prepared for Monsoon Season 2022 for official use and uploading on its website.
- (c) To ensure proper and effective coordination with concerned district administrations and WASAs/ Municipal Corporations in order to ensure

that all necessary arrangements were put in place for effective management of Urban Floods, Flash Floods & GLOFs etc.

- (d) PDMA Khyber Pakhtunkhwa will inform FFC in writing whether they are interested in implementation of some components from its Early Warning System Proposal through NDRMF facility of US\$ 3.5 million or not. If yes, requisite PC-I including on NDRMF format shall be submitted by PDMA-Khyber Pakhtunkhwa to FFC within June 25, 2022 for further action.
- (e) PDMA-Balochistan and PDMA Sindh to share details of equipment proposed for procurement possibly through NDRMF.

#### vii. PID Punjab including NHA, Pak Railways to ensure:

- (a) Complete clearance/ cleaning of the silted up bays of Barrages/ Bridges.
- (b) Arrangements of explosive and related/ required material at sites of predetermined breaching sections.
- (c) Arrangement of stone reserve stock/ flood fighting material at all critical reaches of flood embankments based on the sites identified as a result of pre-flood inspections carried out before the start of Monsoon Season 2022.
- viii. <u>PCIW</u>:
  - (a) To ensure continuity of all necessary arrangements for obtaining reservoirs/rivers flows data and other information from Indian Counterpart (ICIW), as well as through its own efforts on River Chenab and Eastern Rivers during Monsoon Season 2022 and its timely transmission to all stakeholders especially to FFD, Lahore for preparation of daily flood forecast including significant flood forecast in case of any high flows from upstream riparian in river Chenab and eastern rivers.
  - (b) O/o PCIW shall exercise all possible efforts to ensure availability of authentic, reliable and real time cross border data (River Chenab and Eastern Rivers) to FFD, Lahore.

#### ix. WAPDA:

- (a) To expedite action on inclusion of Barakas Nullah (BN) Rehabilitation Works in 2<sup>nd</sup> Revised PC-I of Mangla Dam Raising Project (MDRP) and its approval from concerned fora at the earliest so that implementation is commenced accordingly.
- (b) To operate the Tarbela Dam as per SOPs, based on the latest Periodic Inspection, for filling of reservoir beyond elevation 1510 feet during Monsoon-2022.
- (c) To ensure conducting mock exercise at Mangla Dam as per approved SOPs as and when the desired level of 1220 SPD is achieved.

- (d) To ensure that Contingency Plan prepared in consultation with HQ Engineers 1 Corps (Mangla Garrison) regarding Emergency Spillway/ Barakas Nullah is implemented for safe passage of surplus water.
- (e) To ensure 100% workability of existing flood telemetry system on a countrywide basis ensuring availability of related information to FFD/PMD on a real time basis for precise forecast generation and dissemination.
- (f) To ensure the activation and operation of Flood Management Committee (FMC) in line with its ToRs.
- (g) To ensure an early submission of its all PC-Is to FFC under FPSP-III Ready-to-Implement Portfolio, preferably within early July 2022 besides submission of their details on NDRMF format already shared by FFC with WAPDA.
- x. <u>SUPARCO</u> to share its Flood Watch Report/ Rivers monitoring report with PCIW, PMD/ FFD, Lahore, FFC and other concerned organizations on daily basis for effective use in flood management activities. Event based outcomes of any of the major/extreme flood event shall be shared with FFC for incorporation in FFC's daily reports and for further coordination with relevant department(s)/agency/ies for early restoration/rehabilitation of damages.
- xi. Karachi Water & Sewerage Board (KW&SB), (WASA) MCs of all major cities-Punjab (Lahore, Sialkot, Gujranwala, Faisalabad, Sargodha, Multan, Rawalpindi etc.), Sindh (Karachi, Hyderabad, Sukkur, Thatta, Jacobabad, Shikarpur, Kashmore etc.), Khyber Pakhtunkhwa (Peshawar, Mardan, D.I. Khan, Nowshera, Charsadda etc.), Balochistan (Quetta, sibi, Nasirabad, Jaffarabad, Dera Allah Yar etc.).
  - a) To ensure regular cleaning and clearance of all main sewer lines, storm drains etc. within the respective city by removal of debris, solid waste etc. for unhindered flow of rain/storm water for ease of civic life and to avoid urban flooding/drainage issues.
  - b) Installing sizeable number of dewatering pumps, flood fighting machinery etc. fully operational to combed rain induced urban flooding.
- xii. <u>WASA Rawalpindi</u> to complete all necessary desilting works of critical sections of Lai Nullah by 30<sup>th</sup> June 2022 and submit report to FFC by July 10, 2022.
- xiii. <u>477 Army Survey Group</u> to share its proposal on river Chenab alongwith recommendations for implementation and use of LiDAR for effective flood risk management under the overall umbrella of NFPP-IV.

#### 3.4.6 FFC's Special Meeting on Pre-Monsoon Rains (15<sup>th</sup> June 2022)

Keeping in view PMD's 2022 Monsoon Seasonal Weather Outlook, dated **7**<sup>th</sup> **June 2022**, a meeting was held on **15**<sup>th</sup> **June 2022** in the Committee Room of WAPDA's Mega Hydel Complex, Islamabad. The purpose of the meeting was to review the precautionary steps taken in the Provinces & Federal Line Agencies to combat 2022 Monsoon including their present state of preparedness. Secretary, Ministry of Water Resources chaired the meeting and gave following directions to the stakeholders:

- (i) Ministry of Water Resources (MoWR) will write D.O letters to Power Division, Ministry of Energy for provision of uninterrupted power supply to PMD's at its HQ Islamabad, FFD, Lahore and Regional Center, Karachi during the entire Monsoon Season-2022 to avoid any untoward situation which may develop potentially due to non-availability of Radar's inputs in PMD's forecasts owing to interruptions in power supply.
- (ii) MoWR will approach Ministry of PD&SI for an early approval of 2<sup>nd</sup> Revised PC-I of Mangla Dam Raising Project (MDRP) including rehabilitation works of Barakas Nullah for their early implementation. MoWR will also approach Government of the Punjab, Military Operation Directorate for effective enforcement of Contingency Plan in the absence of surplus discharge of flood water through Barakas Nullah.
- (iii) Provincial Irrigation Departments to ensure the availability and use of District Level Submergence/ Inundation Maps during the upcoming Monsoon Season 2022 besides adding the vulnerable points lying in the jurisdiction of the respective provinces.
- (iv) **MoWR** will approach Aviation Division for up-gradation of Sialkot Weather Radar on priority and backup power supply arrangements for PMD's Forecasting centers for uninterrupted supply during Monsoon Season.
- (v) Provinces/ Federal Line Agencies (FLAs) shall ensure removal of encroachments from the floodplains using available legal framework of Irrigation and Drainage Act 1877 until approval and enactment of their individual River Acts. Provinces to consider use of LiDAR facilities of Pak Army for survey of river floodplains.
- (vi) Provinces/ FLAs, PDMAs/ DDMAs to give due consideration to the issue of combating urban flooding while preparing the Contingency Plan for Monsoon Season-2022.
- (vii) **MoWR** will approach Chief Secretary AJ&K for arrangement of funds from ADP for restoration of flood protection works at Bararkot which was executed through Federal PSDP.
- (viii) **MoWR** will approach National Disaster Risk Management Fund (NDRMF) for the approval of pending flood related projects including their financing.
- (ix) **WASA, Rawalpindi** should ensure to earmark adequate funds for O&M of Flood Early Warning System of Lai Nullah installed through JICA under Grantin-Aid.
- (x) Joint Secretary (Water), Ministry of Water Resources, CEA/ CFFC, representatives of WAPDA & GHQ will visit the Control Room of NDMA to determine as to how that facility can be better linked with the FFC to manage floods.
- (xi) MoWR will approach Ministry of Communication for taking necessary actions regarding vulnerable points/ locations on the NHA bridge sites on major rivers for safe passage of floods.
- (xii) **MoWR** to approach Ministry of Railways for the provision of funds to purchase explosives meant for activation of pre-determined breaching sections at vulnerable locations of Pak. Railway bridges in case of emergency.
- (xiii) **MoWR/FFC** will organize another meeting within next 15 days (if needed) for further deliberations on the preparatory arrangements made by the Provinces/

FLAs in the context of combating any flooding situation during Monsoon Season-2022. Higher level participations from the provinces is much desired and hence expected for precise and accurate decisions.

### 3.4.7 FFC's Pre-Monsoon Rains Follow-up Meeting (30<sup>th</sup> June 2022)

FFC organized a follow up meeting of stakeholders on **30<sup>th</sup> June 2022** to deliberate on the preparatory arrangements made over and above those already reported by the Provinces/ Federal Line Agencies (FLAs) during 57<sup>th</sup> meeting of FFC (June 07, 2022) and June 15, 2022 meeting of Ministry of Water Resources in the context of combating any flooding situation during Monsoon Season (MS) 2022. Following decisions were made:

 PIDs/FLAs/NDMA/PMDA/DDMAs to ensure the compliance of decisions taken in the 57<sup>th</sup> Annual meeting of FFC held on 7<sup>th</sup> June 2022 for better management of Monsoon Season-2022.

### ii. WAPDA

- a) To operate the Tarbela Dam as per SOPs, for filling of reservoir beyond elevation 1510 feet during Monsoon-2022.
- b) To ensure conducting mock exercise at Mangla Dam as per approved SOPs as and when the desired level of 1220 SPD is achieved.
- c) To ensure that Contingency Plan prepared in consultation with HQ Engineers 1 Corps (Mangla Garrison) regarding Emergency Spillway/Barakas Nullah is implemented for safe passage of surplus water during Monsoon-2022.
- d) To ensure the activation and operation of Flood Management Committee (FMC) in line with its ToRs as per approved SOPs.
- e) To share on Top Priority basis latest status with FFC regarding data sharing mechanism of those stations of Mangla Dam Project which have been submerged as a consequence of construction of Karot & Gulper Hydropower Projects and for which the existing stations (Azad Pattan) and (Kotli) have been shifted to Tain Dhalkot Bridge and Talhair Bridge respectively.
- iii. **PID Punjab** to share the compliance status regarding review of existing flood classification of eastern rivers with all the stakeholders including FFC.
- iv. **PID Sindh** to share the progress on Gujjar Nullah desilting alongwith works on Malir & Korangee Nullahs.
- v. **PID Sindh** to consider the establishment/ formation of a Regulatory Framework for monitoring of nullahs in Karachi.
- vi. **PID Khyber Pakhtunkhwa** to share revised/ updated flood limits of rivers in Khyber Pakhtunkhwa with all the stakeholders including FFC, PMD & PID Punjab.
- vii. **PID Sindh & Balochistan, GB-PWD and Irrigation and Small Dams of AJ&K** to aggressively pursue their case with concerned quarters for early approval and enactment of River Act.
- viii. **O/o PCIW** will exercise all possible efforts for obtaining cross border reservoirs/ rivers flows data (River Chenab and Eastern Rivers) for onward

transmission to FFD, Lahore for flood forecast generation besides to all other related stakeholders.

- ix. PIDs and FLAs (GB, AJ&K, PMD, WAPDA, NDMA, MoCC etc.) to submit their respective final lists of sub-projects under Ready-to-Implement Portfolio of FPSP-III and their PC-Is within 15<sup>th</sup> July 2022, to FFC for further necessary action.
- x. **WASA, Rawalpindi** to ensure early completion of dredging work on eleven (11) nullahs/ tributaries of Lai Nullah under intimation to all concerned including FFC.
- xi. O/o CEA/ CFFC to look into the possibility of linkage of Flood Communication Cell of FFC with Control Room of NDMA besides with WAPDA, PMD/FFD, PIDs, PDMAs etc. for better coordination particularly during monsoon season in general round the year. For an early action, FFC to look into the possibility of revamping its Flood Communication Cell (FCC) through some support of donors (ADB etc.) by Technical Assistance arrangements.
- xii. **Dam management authorities of Khanpur, Rawal & Simly Dams** to share SOPs regarding flood management including sharing of data during entire monsoon season on daily basis with all concerned stakeholders including FFC.

### 3.4.8 FFC's Special Meeting on Karot HPP (07th July 2022)

A special meeting of FFC was convened on **July 07, 2022** in the WAPDA's Mega Hydel Complex, Islamabad in order to deliberate on the data sharing mechanism of Karot HPP with Mangla Dam Organization (MDO) and miscellaneous Flood Management related issues in the context of combating any flooding situation during Monsoon. After detailed discussions, a comprehensive Cooperation Mechanism for Data Sharing between Karot HPP and MDO-WAPDA regarding Flood Management at Mangla Dam was agreed during the meeting, as explained in ensuing paragraphs.

### <u>Cooperation Mechanism for Data Sharing between Karot HPP and MDO-WAPDA</u> <u>Regarding Flood Management at Mangla Dam</u>

Regular data sharing between KHPP and Mangla Dam Organization (MDO) is essential for national cause of flood mitigation to save lives and properties downstream of Mangla Dam as per following:

- i) Regarding sharing of data following timings were agreed between KHPP and WAPDA:
  - In normal situation throughout the year, data will be shared two times daily (i.e. at 0600 Hrs in the morning and at 1800 Hrs in the evening) by KHPP with Mangla Dam Project.
  - During Flood in Monsoon Season (minimum outflows from KHPP > 2100 Cusecs or 75,000 Cusecs)/ Emergency Situation hourly inflow, outflow and level data of KHPP will be shared by KHPP with WAPDA-Mangla Dam Project authority till end of Emergency Situation, in addition to similar situation any time during the currency of the year.
  - The data may be served at following simple format:

Date:	05.07.2022
Time:	0600 Hrs
Reservoir Level:	ft and m
Tail Water Level:	ft and m
Inflow:	cfs and m <sup>3</sup> /s
Outflow:	cfs and m <sup>3</sup> /s

- ii) Data will be shared through easy to use platforms such as:
  - Whatsapp Groups
  - Landline Numbers
  - Wireless
  - Email Mode
  - Website
- iii) Both sides have nominated and shared details of focal persons and contact numbers of control rooms for better coordination by Karot HPP and MDO as below:

### Mangla Dam Project

Mr. Abdul Majid Ch. Project	Superintending Engineer (Hydrology) WAPDA Mangla Dam			
Contact No.	0544-671354, 0343-0590519			
Mr. Kelash Kumar	Junior Engineer (Hydrology) WAPDA Mangla Dam Project			
Contact No.	0544-671353, 0333-7127099			
Control Room Numbers 0544-639005, 0544-639209, 0544-671353				
Karot Hydropower Plant Project				

# Mr. Aftab AlamSr. Manager (Safety), Karot Power Co. Ltd.Contact No.0317-5777265, 0345-9486677Mr. ZulqarnainOperation Engineer (Karot HPP)Contact No.0342-4576636

Control Room No. 0310-5666605

- iv) KHPP will share all the documents (in English Language) related to releases/hydrology of the KHPP. These documents need to cover all aspects of KHPP that may affect Mangla Dam Project in any way and will be shared well within July-2022.
- v) KHPP will issue Spillway Operation Warning to Mangla Dam Project Authority as per Sr. No. (ii) Above, for releases beyond normal KHPP power station releases/unit generation flow. The Warning will contain time and quantum of water to be released towards Mangla Dam Project.
- vi) Dam Safety Organization of WAPDA and Dam Safety Council, O/o CEA/CFFC-MoWR may offer their technical reviews for annual and periodic inspection of KHPP to ensure its safety as per guidelines of International Commission on Large Dams (ICOLD) as per reports/program provided by KHPP.
- vii) WAPDA-Mangla Dam Project authority will share available data of Chattar Klass Flood Warning Station with KHPP which includes the flows from Neelum Jhelum

Hydropower Project, to facilitate KHPP with respect to hydrological perspective and inflow warning from Jhelum River as per availability with WAPDA with special consideration of KHPP data requirements.

### 3.4.9 Meeting regarding Finalization of Portfolio of Ready-To-Implement Sub-Projects out of FPSP-III for Financing through NDRMF (July 22, 2022)

A joint meeting of Federal Flood Commission, National Disaster Risk Management Fund (NDRMF), and relevant stakeholders i.e. Provincial Irrigation Departments of the Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan & FLAs (PMD & WAPDA) was held on **22<sup>nd</sup> July 2022**. The purpose of the meeting was to finalize the portfolio of Ready-to-Implement sub-projects under Flood Protection Sector Project-III (FPSP- III) for financing through NDRMF.

After detailed discussion the following decisions were taken:

- i. PIDs (Punjab & Sindh) and PMD will submit remaining PC-Is of Ready-to-Implement sub-projects of FPSP-III within 15<sup>th</sup> August 2022.
- PID Balochistan &FLA (Merged Area Khyber Pakhtunkhwa) will submit list alongwith PC-Is of Ready-to-Implement sub-projects of FPSP-III preferably by 15<sup>th</sup> August 2022.
- iii. WAPDA will submit PC-I for Flood Telemetry Network to FFC & NDRMF within one week's time for technical scrutiny.
- iv. NDRMF will share schedule for joint field investigation/technical appraisal within one week's time to FFC so that further process be taken accordingly.

### 3.4.10 Meeting on Flood Management for Monsoon 2022 held on August 15, 2022 in PMD Headquarters, Islamabad (15<sup>th</sup> August 2022)

An urgent meeting of relevant stakeholders was held on **15<sup>th</sup> August 2022** in Pakistan Meteorological Department (PMD) Headquarters, Islamabad jointly chaired by Chief Engineering Advisor/ Chairman Federal Flood Commission and Director General, PMD. After detailed discussion following were mutually agreed:

- (i) For efficient operation of reservoirs, manipulation of extra discharge via offtaking canals be considered to avoid flood synchronization in the Indus River System.
- (ii) Keeping in view the SOPs of Tarbela Dam, filling of Tarbela dam reservoir is the responsibility of Tarbela Dam Management Committee. The issue shall be discussed with GM-Tarbela for their information and consideration viz-a-viz the approved SOPs.
- (iii) PMD to provide 10-dayadvance weather forecast for Tarbela upstream, for Hill Torrent areas of D.G. Khan & Rajanpur District of Punjab and for the Indian side for future flood management purposes.
- (iv) PID Punjab &PDMA Punjab to exercise maximum vigilance to ensure safe passage of river flood flows and the safety of communities, public & private property including irrigation and flood protection infrastructure etc. Additionally:
  - a) All concerned Chief Engineers of Irrigation Department, Government of the Punjab shall take necessary precautionary measures for safe

passage of flood flows in line with contingency plans of their respective irrigation zones in view of PMD's forecast as well as releases of flood flows from Indian side.

b) PDMA Punjab including all related DDMAs will ensure all necessary precautionary measures well in time with respect to their contingency plans prepared to avoid loss of precious human lives and damages to public & private properties.

### 3.4.11 FFC's Special Meeting on Flood Management during Monsoon-2022 (22<sup>nd</sup> August 2022)

A special meeting of FFC regarding Flood Management during the Monsoon-2022 was held on **22<sup>nd</sup> August 2022** in the Committee Room of O/o CEA/ CFFC, Islamabad under the chairmanship of Chief Engineering Adviser & Chairman, Federal Flood Commission. Following decisions were taken:

- (i) PMD to issue Exclusive Weather & Flood Forecast for catchments of River Indus (upstream Tarbela) and River Kabul to FFC, IRSA & WAPDA (Tarbela & Chashma Management authorities) for 24 hours, 72 hours and for 7-days (August 31, 2022) for better management of flood flows at Tarbela Dam to avoid any situation at Taunsa.
- (ii) PIDs/ FLAs to ensure round-the-clock patrolling of all embankments and vulnerable locations during the rest of the period of the current Monsoon in order to save human lives and public & private properties from flood flows.
- (iii) PIDs/ FLAs to ensure effective implementation of Contingency Plan regarding flood fighting during rest of current Monsoon Season.
- (iv) For regulations of high flows in eastern rivers and in River Chenab, Punjab Irrigation Department shall use off-taking canals from the respective barrages so that the main thrust including synchronizations of flood peaks could be avoided at Guddu Barrage.
- (v) PID Punjab to share the details of study in progress on management of D.G. Khan hill torrents with FFC.
- (vi) PIDs/ FLAs to submit details of damages to irrigation, flood protection infrastructure and restoration cost and plans to FFC on an immediate basis for the appraisal of higher authorities.
- (vii) Tarbela Dam Authorities, WAPDA, should do close liaison with PMD and IRSA for better management of flood flows and regulation of the reservoir in accordance with the SOPs.
- (viii) WAPDA will start work on the restoration of CRBC immediately under intimation to all concerned including FFC.
- (ix) Tarbela Dam Authorities, WAPDA, will continue to operate the reservoir as per existing SOPs ensuring maximum possible flood mitigation through routing of inflows coming into the reservoir. Further Tarbela Dam Management to take utmost care, exercise extra vigilance in reservoir operation, and ensure realistic dam regulation with a view to manage high flows from Kabul and to reduce inflows at Taunsa.
- (x) Pakistan Meteorological Department will provide more accurate and precise forecasting for catchments areas of Kabul, Indus and D.G Khan hill torrents and will also strengthen quantitative forecasting of flood flows for hill torrent areas of D.G Khan.

- (xi) PCIW ensure close liaison with the ICIW and shall immediately transmit flood flows/ data to the concerned quarters more accurately and precisely.
- (xii) IRSA and WAPDA to utilize maximum indents from River Indus and ensure maximum storage in Mangla Dam.

### 3.4.12 1<sup>st</sup> Meeting of Technical Committee on MoWR related SDG Indicators

The 1<sup>st</sup> meeting of the Technical Committee on Water Sector related SDG Indicators was held on **22<sup>nd</sup> August 2022.** Following decisions were made:

- (i) O/o CEA/CFFC will take up the matter with the Pakistan Water Partnership (PWP) with regard to ascertain the necessity for carrying out again a "National Survey on SDG Indicator 6.5:1: PWP will review and submit their Feedback/ Work Plan with regard to arranging obligatory stakeholder Consultation in this regard".
- (ii) O/o PCIW will act as Focal Point organization on SDG Indicator 6.5.2 to review drat input already prepared by O/o CEA/CFFC on SDG-Indicator 6.5.2 and submit to O/O CEA/CFFC the final report, at the earliest for further action.
- (iii) Agriculture Department, Government Sindh shall be the Focal Point on SDG Indicator 6.4.1 to coordinate with concerned organizations, review the methodology set by FAO regarding reporting implementation status of SDG Indicator 6.4.1 and submit to O/o CEA/CFFC. "Workable Action Plan with timelines" for evaluation and finalization of baseline regarding implementation of this SDG indicator in Pakistan.
- (iv) WAPDA shall act as Focal Point on SDG Indicator 6.4.2 to review the methodology set by FAO regarding reporting the implementation status of SDG Indicator 6.4.2 and submit a "Workable Action Plan with timelines" in order to evaluate and finalize baseline with regard to implementation status of this SDG indicator in Pakistan.
- (v) PCRWR shall be the Focal Point on SDGs Indicators 6.3.2 & 6.6.1 to review the methodology set by-UNEP regarding reporting the implementation status of SDGs Indicators 6.3.2 & 6.6.1 and submit to O/o CEA/CFFC a "Workable Action Plan with timelines" with timelines, to evaluate and finalize the baselines of these SDG Indicators will be in Pakistan.
- (vi) O/o CEA/CFFC (National Focal Point) will maintain a close liaison with the Federal SDGs Unit of PD&SI Division regarding accomplishment of the task for determining baselines i.e. implementation status of water sector related SDG Indicators in Pakistan.
- (vii) Ministry of Climate Change, Irrigation and Public Health Engineering Departments Govt. of Khyber Pakhtunkhwa, Agriculture & Public Health Engineering Departments of Sindh and Public Health Engineering Department of Balochistan including WAPDA & Public Health Department, Government of Punjab, will nominate suitable officer well versed with the SDGs to act as "Nominative Member" of the Committee: contact details of the nominated officer will be submitted to O/o CEA/CFFC within a week time.

### 3.4.13 FFC's July-August 2022 Monsoon Review Meeting

The Monsoon Season 2022 (July-August period) review meeting of Federal Flood Commission was held on 1<sup>st</sup> September 2022. Decisions made in the meeting are as follow:

- i. **PMD** to issue precise Weather & Flood Forecast for catchments of River Indus (upstream Tarbela) and River Kabul, besides overall forecast on countrywide basis during rest of the current Monsoon Season for better management of flood flows keeping in view the present Water Level in Tarbela Dam.
- ii. **PIDs/ FLAs** to continue round-the-clock patrolling of all embankments and vulnerable locations during the rest of the period of the current Monsoon in order to save human lives and public & private properties from flood flows.
- iii. **PIDs/ FLAs** to ensure effective implementation of Contingency Plan on flood fighting during rest of current Monsoon Season.
- iv. PIDs/ FLAs to share details of damages to Irrigation derange and flood protection infrastructure caused due to rains/ floods during current Monsoon Season along with coordinates with FFC and share their restoration / rehabilitation plans.
- v. **SUPARCO** will verify the damages caused to the Irrigation, Drainage and Flood Protection Infrastructure based on the coordinates provided by the PIDs/FLAs.
- vi. **PID Punjab** to share the details of studies carried out for flood management of D.G. Khan & Rajanpur hill torrents with FFC, besides the projects in hand for implementation (on-going & in the pipeline).
- vii. **PID Sindh** to ensure early plugging of breaches occurred in Qadirpur Loop Bund, FP Bund and Suprio Bund.
- viii. **Tarbela Dam Authorities, WAPDA**, to continue exercising close liaison with PMD and IRSA for better management of flood flows and regulation of the reservoir in accordance with the SOPs during rest of current Monsoon Season.
- ix. **PMD** to issue quantitative forecast of flood flows for hill torrent of D.G Khan, in case any weather situation develops, during the rest of current Monsoon Season.
- x. **PCIW** to ensure close liaison with the ICIW and shall immediately transmit flood flows/ data to the concerned quarters more accurately and precisely.

### 3.4.14 1<sup>st</sup> Progress Review Meeting for GOP funded Normal/Emergent Flood Programme during Financial Year (2022-23) held on September 01, 2022

Decisions made in the meeting are as under:

- (i) PIDs & FLAs to ensure that the schemes taken-up for implementation under Normal/ Emergent Flood Programme of current financial year (2022-23) are meant for the benefit of community and not for an individual family. The reference of NFPP-IV, if any, must be mentioned in the PC-I besides, reason of selection be given in PC-I, in case it is not recommended under NFPP-IV.
- (ii) PIDs & FLAs should submit coloured pictures of all proposed sites indicating the abadies, private & public property to be protected in the PC-Is of schemes

being implemented under Normal/ Emergent Flood Programme of current financial year (2021-22) for further processing.

- PIDs & FLAs to strictly follow the implementation schedule of flood protection works approved by ECNEC on 27<sup>th</sup> July 2004, reminded time and again.
- (iv) PIDs & FLAs to submit PC-1s of prioritized schemes duly cleared by the respective Provincial DWPs to Federal Flood Commission (FFC) before 15<sup>th</sup> September 2022 for further processing of technical clearance from the Scrutinizing Committee (SC) of FFC and approval from the DDWP of Ministry of Water Resources.
- (v) PIDs & FLAs to submit request for obtaining extension of execution period of all those flood protection schemes of previous years, which could not be completed within the target period given in the approved PC-Is on the prescribed proforma of Planning Commission by/ before 15<sup>th</sup> September 2022, for obtaining approval from Ministry of Water Resources.
- (vi) PIDs & FLAs to submit demand proforma for release of 1<sup>st</sup> installment of budget allocated under PSDP (2022-23) alongwith other necessary documents to FFC by/before 15<sup>th</sup> September 2022 for further processing of the case.
- (vii) PIDs & FLAs to submit in writing about the damage occurred to the on-going/ completed structures during monsoon season 2022. It must be noted that any damage, if occurred to the ongoing structures during monsoon season would be restored by PIDs & FLAs through their own resources and the restoration expenditure would not be charged to the capital cost of the projects.
- (viii) PIDs & FLAs to submit physical & financial progress report of all on- going/new schemes taken under Normal/ Emergent Flood Programme upto 5<sup>th</sup> of each following month on the prescribed proforma of Planning Commission regularly till completion of the scheme.
- (ix) PIDs & FLAs to submit to Federal Flood Commission, the utilization account of funds released during previous years (2015-16 to 2021-22) without further delay, for taking further action in the matter.

## 3.4.15 1<sup>st</sup> Meeting of the Prime Minister's Coordination Committee for monitoring Flood Relief Efforts in Sindh

In wake of devastating 2022 floods, the honorable Prime Minister was pleased to constitute Provincial Coordination Committees for monitoring of relief efforts in the flood affected areas by NDMA and other federal agencies in particular, the provision of tents, food bags, drinking water, mosquito nets and medical supplies to the flood affected population. The Committee constituted **for Sindh Province**, was headed by the Federal Minister for Water Resources.

The 1<sup>st</sup> meeting of the Committee was held on September 05, 2022 under the chairmanship of the Federal Minister for Water Resources/ Convener of the Committee. Recommendations made by the Committee/decisions taken are as follows:

- (i) NDMA will provide district-wise detail of flood relief items/services provided to flood affected populations in Sindh province.
- (ii) Flood emergency should be declared in Sindh.

- (iii) Immediate measures should be taken to drain the vast inundated lands in flood affected areas of Sindh.
- (iv) NDMA in close coordination with the PDMA-Sindh and all concerned District Administrations will carry out aerial spray for control of mosquito growth and associated risk of malaria in flood affected communities of the Sindh provinces.
- (v) Necessary directions shall be given by the Government of Sindh to the Commissioners and the Deputy Commissioners to hold meetings on every alternate day with the elected representatives of the flood affected areas to apprise them ground situation and deliberate on future course.
- (vi) Teams of senior ministers be formed to approach international fraternity and sensitize them to come forward for contributing in relief activities as the flood devastation in Pakistan is owed to climate change which is a consequence of large-scale and persistent carbon emissions by the developed world to the detriment of nations like Pakistan.
- (vii) Next meeting of the Committee will be held on Thursday, September 08, 2022 in the Committee Room of the Chief Secretary, Sindh, Sindh Secretariat Building, Karachi.
- (viii) Chairman Federal Flood Commission shall be the focal person for coordinating the implementation of Committee's recommendations and liaison among the Members of the Committee and other concerned agencies.

### 3.4.16 2<sup>nd</sup> Meeting of the Prime Minister's Coordination Committee for monitoring Flood Relief Efforts in Sindh

The said meeting concerning Sindh Province was held on **September 08, 2022** in the Committee Room of the office of Chief Secretary, Sindh, Sindh Secretariat Building, Karachi. Federal Minister for Water Resources chaired the meeting being Convener of the Committee. After detailed deliberations, Committee recommended as under:

- (i) Irrigation Department, Government of Sindh will mobilize necessary resources to drain out water from inundated areas on immediate basis.
- (ii) As a long term measures, Irrigation Department, Government of Sindh will prepare a study proposal for comprehensive re-modeling of already constructed drains (MNV, RBOD-I, RBOD-II and RBOD-III) keeping in view the exceptional rainfall of 2022 and potential for conservation of torrential flows from the Kirther range and Balochistan. It would be presented to the federal cabinet for its consideration.
- (iii) NDMA/ PDMA-Sindh to arrange additional tents/ tarpaulins for displaced persons on war footing basis.
- (iv) BISP to revisit the Poverty Index from existing threshold score of 19% and preferably extend it upto 29% so that maximum number of affected people of calamity hit districts could avail the relief announced by the Federal Government i.e. Rs. 25,000 per household.
- (v) NHA will expedite rehabilitation work on all flood damaged highways including N-5 so that flood relief could reach all flood affected villages/Talukas.

- (vi) Health Department, Government of Sindh in collaboration with NDMA/ PDMA Sindh shall arrange at least 50 Dengue spray guns for each district for carrying out anti-mosquitoes spray in order to avoid the outbreak of water borne diseases. Mobile teams containing ambulance equipped with Doctors/ Para-Medical Staff/ necessary medicines will also be deployed in the calamity hit districts.
- (vii) Department of Live Stock, Government of Sindh shall start immediately relief activities to save the livestock in calamity hit districts on war footing basis.
- (viii) Government of Sindh shall arrange an early approval of Provincial River Act from provincial cabinet and ensure its enforcement for removal of encroachments from drains, flood plains and local nullahs etc.
- (ix) Chief Secretary, Sindh shall issue necessary directions to all Commissioners/ Deputy Commissioners to convene coordination meetings on daily basis on flood relief activities in close coordination with the public representatives of the area including Committee Members. Meetings to be followed up/ preceded by field visit to the flood affected areas by the Committee Members residing in close vicinity.
- (x) In order to monitor the implementation of Committee's recommendations at micro level, O/o Chief Secretary, Sindh shall be the Provincial Focal Point to coordinate with all Provincial Line Departments, Committee Members and Focal Person at Federal Government level for better coordination. For this purpose, next/ follow up meeting of the Committee will be organized by O/o Chief Secretary, Sindh on Thursday, September 15, 2022 in the Committee Room of the Chief Secretary, Sindh, Sindh Secretariat Building, Karachi.
- (xi) Representative from Engr. 5-Corps, Pak Army will also be invited in next meeting of the Committee to brief about the real-time facts regarding rescue and relief operations.

### 3.4.17 3<sup>rd</sup> Meeting of the Prime Minister's Coordination Committee for monitoring Flood Relief Efforts in Sindh

The said meeting concerning Sindh Province was held on **September 16, 2022** in the Committee Room of O/o Chief Secretary, Sindh, Sindh Secretariat Building, Karachi. Honorable Federal Minister for Water Resources presided over the meeting being Convener of the Committee. After detailed deliberations, Committee recommended as under:

- (i) NDMA & PDMA-Sindh shall define their district-wise specific roles with regard to ensure full scale relief operation so that duplication of efforts could be avoided and relief items could reach the affected population still waiting for the relief assistance. Defined roles shall be apprised to Committee in its next meeting.
- (ii) All Commissioners of respective Divisions of Sindh Government shall attend next meeting of the Committee and make presentation about the assessment of flood damages and relief operations as well as the detail of funds allocated, received, utilized and unutilized.
- (iii) Irrigation Department, Government of Sindh will prepare district-wise Plan with timelines, to drain out flood water from inundated areas and ensure the drainage of water on immediate basis. A committee comprising of (i) Chief Engineer, Sukkur, (ii) Chief Engineer, Drainage and (iii) Chief Engineer, Kotri shall exclusively prepare a Plan to drain out lands from their respective areas, in particular from KN Shah and ensure its implementation on war footing basis.

- (iv) Health Department, Government of Sindh shall expedite actions to eradicate mosquito growth in calamity hit districts, in particular, procurement of 50 antimosquitoes spray guns for each district in order to avoid the outbreak of water borne diseases.
- (v) Chief Secretary, Sindh shall issue necessary directions to all Commissioners/ Deputy Commissioners to approach INGOs/ NGOs interested/ involved in reconstruction of damaged houses in affected areas and assist them in identification of areas where they can build houses for displaced families.
- (vi) BISP, NHA and NDMA shall submit to O/o CEA/CFFC (Focal Point) the compliance status of the Committee's recommendations issued in its previous meetings (1<sup>st</sup> & 2<sup>nd</sup> meetings respectively held on September 05 & 08, 2022) as well as of this 3<sup>rd</sup> meeting held on September 16, 2022, within September 21, 2022 for consideration by the Committee in its next meeting.
- (vii) O/o Chief Secretary, Sindh, being the Provincial Coordination Point, shall submit to O/o CEA/CFFC (Focal Point Federal) the consolidated compliance status of the Committee's recommendations related to respective Provincial Line Departments within September 21, 2022 for consideration by the Committee in its next meeting.
- (viii) Next/ 4<sup>th</sup> meeting of the Committee shall be held on Friday, September 23, 2022 in the Committee Room of O/o the Chief Secretary, Sindh, Sindh Secretariat Building, Karachi.
- (ix) Secretary, Home Department Sindh/ IG Police Sindh shall also attend next meeting of the Committee to brief about the measures carried out for control of social crimes in flood affected areas.

### 3.4.18 4<sup>th</sup> Meeting of the Prime Minister's Coordination Committee for monitoring Flood Relief Efforts in Sindh

The said meeting concerning Sindh Province was held on **September 23, 2022** in the Committee Room of O/o Chief Secretary, Sindh, Sindh Secretariat Building, Karachi. Honorable Federal Minister for Water Resources chaired the meeting being Convener of the Committee. After detailed deliberations, Committee recommended as under:

- (i) NDMA shall expedite process for procurement of additional tents & tarpaulins to be made available expeditiously for displaced persons in Sindh; rescue and relief operations in Districts Khairpur and Larkana shall exclusively be taken up by NDMA.
- (ii) NDMA/ PDMA-Sindh to ensure improving the composition/number of ration bags to cover needs of affected family for relatively longer time; funds required for provision of improved food baskets/ration bags shall be shared by the Government of Pakistan and Government of Sindh on 50:50 basis. Apropos, Government of Sindh shall process a Summary for the Federal Government for arranging 50% of total funds required for providing cooked food/ration bags to affected families in Sindh province.
- (iii) Sindh Irrigation Department shall prepare the project proposal on early basis for purchase of new pumping stations/ complete overhaul of old pumps for immediate drainage of flood water. A separate proposal for procurement of dredgers shall also be prepared by Government of Sindh for possible funding through federal PSDP.

- (iv) Sindh Irrigation Department shall also ensure removal of dead animals floating in canals, drains and rivers and those stranded in the gates of hydraulic structures, within a week time.
- (v) Secretary, Public Health Engineering Department, in close coordination with Local Government & Irrigation Departments of Sindh Government shall make a Joint Action Plan to drain out the flood water from inundated cities; besides removal of dead animals floating in inundated lands/cities shall also be ensured within a week time.
- (vi) Government of Sindh, in coordination with NESPAK and concerned Provincial line departments, to carry out a due diligence/assessment study to confirm the time required to evacuate the flood water and the sufficiency of existing pumps used by Irrigation Department Sindh and inter alia recommend measures for drainage of stagnant flood water from inundated cities/lands at a large scale.
- (vii) Secretary, Agriculture & Livestock Department, Sindh shall process a Summary for Federal Government for arranging 50% of total funds (Rs 66 billion) required for providing seed free of cost to farmers in Sindh province.
- (viii) Secretary Health Department, Sindh will expedite process for procurement of anti-malaria and other necessary medicines from international market; the Committee shall be apprised about the same in its next meeting.
- (ix) NHA, BISP, IG Police Sindh and all concerned Departments of Sindh Government shall present to the Committee the updated status of compliance of the Committee's recommendations made earlier during in its previous meetings held on September 05, 08 & 16, 2022 respectively.
- (x) Next/ 5th meeting of the Committee shall be held on Friday, September 30, 2022 in the Committee Room of O/o the Chief Secretary, Sindh, Sindh Secretariat Building, Karachi.
- (xi) NGOs/INGOs showing inclination towards providing much needed relief and damage restoration/reconstruction shall be invited in the next meeting of the Committee to make short presentation about their flood relief and rescue/reconstruction efforts.

### 3.4.19 5<sup>th</sup> Meeting of the Prime Minister's Coordination Committee for monitoring Flood Relief Efforts in Sindh

The said meeting concerning Sindh Province was held on **September 30, 2022** in the Committee Room of O/o Chief Secretary, Sindh, Sindh Secretariat Building, Karachi. Honorable Federal Minister for Water Resources chaired the meeting being Convener of the Committee.

After detailed deliberations, Committee recommended as under:

(i) Irrigation Department, Government of Sindh will prepare weekly drainage plans regarding complete drainage of flood water from inundated areas connected/ not connected with drainage network; same to be presented to Committee in its next meeting. The Committee shall also be briefed in the next meeting about the formulation of a study proposal for comprehensive re- modeling of Sindh's drainage network required for holistic management of water logging, torrential flash flooding & pluvial floods as experienced in 2022. For that, all areas including Badin, Sujawal, Jhuddo, KN Shah, Khairpur, Qambar Shahdadkot, Dadu & Sehwan etc. shall also be included. This shall be recommended to the Federal Government for financing out of PSDP.

- (ii) PDMA-Sindh to procure mobile/truck mounted dewatering pumps to expedite ongoing drainage of flood water from inundated areas/ cities not connected with the existing drains.
- (iii) NDMA will expedite the process of procurement of additional tents and other relief items through international manufacturers and provide the adequate share to PDMA-Sindh for distribution among affected population.
- (iv) Government of Sindh will waive off toll tax being charged from Trucks of NGOs/INGOs carrying ration bags, cooked food and other flood relief items to calamity hit areas; matter will also be taken up with NHA to provide requisite relief on national highways.
- (v) Works and Services Department, Government of Sindh will prepare details related to structural damages assessed so far and present before the Committee their plan for implementation of 2022 flood damages restoration and rehabilitation works.
- (vi) Planning & Development Department, Government of Sindh will ensure that future development schemes are properly designed duly incorporating the DRR elements and that their technical specifications are strictly followed up during the course of their implementation on ground.
- (vii) Livestock Department, Government of Sindh to carry out necessary relief measures including up-scaling of the incentives given to livestock farmers in calamity hit areas. The Committee shall be apprised about the same in its next meeting.
- (viii) Government of Sindh will issue necessary directions to concerned Commissioner/ District Commissioners asking them to coordinate with NGOs/INGOs working in their respective areas and provide them necessary support regarding arrangement of safe and cheaper transport for distribution of ration bags and cooked food among the affected people.
- (ix) Health Department, Government of Sindh will nominate a focal person to coordinate with all INGO/NGOs who were providing medical services to affected population so as to assist them with every possible support regarding availability of doctors and medicines etc. Representatives from Liaqat Memorial hospital, Indus hospital and SIUT may also be invited to virtually participate in the next meeting of the Committee w.r.t possible support they could extend to INGO/NGOs providing medical services as flood relief.
- (x) O/o the Chief Minister, Sindh will issue certificate of appreciation to all those NGOs/ INGOs who had given exemplary relief support to the flood affected population in Sindh.
- (xi) With regard to the request of one of the NGOs (Faizan Global Relief Foundation) to support in construction of 10,000 houses for the affected population, the process shall include giving an advertisement in the daily newspapers and the Deputy Commissioners shall indicate the places/ sites where these can be built to avoid doubling. Information Department, Government of Sindh will advertise the Government campaign in print media regarding reconstruction of damaged houses whereby the affected household/ families will be asked to submit the application to concerned Deputy Commissioners.
- (xii) Next/ 6<sup>th</sup> meeting of the Committee shall be held on Friday, October 07, 2022 at 1030 hours in the Committee Room of O/o Chief Secretary Sindh, Sindh Secretariat, Karachi.

## 3.4.20 6<sup>th</sup> Meeting of the Prime Minister's Coordination Committee for monitoring Flood Relief Efforts in Sindh

The said meeting concerning Sindh Province was held on **October 19, 2022** in the Committee Room of O/o Chief Secretary, Sindh, Sindh Secretariat Building, Karachi. Honorable Federal Minister for Water Resources chaired the meeting being Convener of the Committee. After detailed deliberations, Committee recommended as under:

- NDMA/PDMA-Sindh will provide updated status in terms of demand versus supply regarding flood relief items/ provided to flood affected populations in Sindh province.
- (ii) Chief Secretary, Sindh to present comprehensive sector-wise regarding flood relief and restoration works/ services already provided and yet required to be provided to residents of flood affected areas.
- (iii) Irrigation Department, Government of Sindh will present updated districtwise status with regard to drainage of flood water from left and right side of Indus River.
- (iv) Government of Sindh to issue necessary directions to Deputy Commissioners asking them to visit frequently their respective flood affected areas in order to better coordinate the flow of correct information on ground (including the exact number of people who have returned back to their homes and whom require reconstruction of their houses etc.) in order to improve further ongoing relief operations.
- (v) O/o Chief Secretary, Sindh shall follow up the matter with FBR regarding issuance of NOC for NGOs/ INGOs willing to provide free of cost clean drinking water to the flood affected population in Sindh province.
- (vi) NHA will mobilize all possible resources to expedite their ongoing flood damages restoration and rehabilitation works in the Sindh province; Chairman NHA to personally attend next meeting of the Committee and present comprehensive status of ongoing rehabilitation works in Sindh province including roads namely (i) Halai- Moro Road, (ii) Sehwan- Mehr Road and (iii) Larkana- Khairpur Road.
- (vii) All concerned Federal & Provincial Departments shall submit to O/o CEA/CFFC (Focal Point) compliance status of decisions taken/ recommendations earlier made by the Committee in its previous meetings (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, & 5<sup>th</sup> meetings) respectively held on September 05,08, 16, 23 & 30, 2022, in annotated form at the earliest, for onward submission to the Prime Minister's office through O/o Minister for Water Resources.
- (viii) Next/ 7<sup>th</sup> Meeting of the Committee shall be held in physical mode in Committee Room of O/o Chief Secretary Sindh, 7<sup>th</sup> Flood of Sindh Secretariat Building No. 1 at Karachi. Date and time shall be intimated in the due course of time.
- (ix) CEO, SEPCO shall attend next meeting of the Committee to brief about the issues related to load shedding carried out in flood affected areas of Sindh province.

### 3.4.21 14<sup>th</sup> Progress Review Meeting of FFC on Supreme Court Recommendations

The 14<sup>th</sup> Progress Review meeting of Federal Flood Commission was held on 24<sup>th</sup> October 2022 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.

- i. Installation of state of the art Weather Radars at Mangla, Lahore and Sialkot would be given top priority.
- ii. PMD would make utmost efforts to further improve its coordination mechanism with WMO, SAARC countries and other multilateral fora for sharing the information regarding Early Weather Forecast and issuance of Flood Warning.
- iii. PMD would submit a status report regarding its Flood Forecasting & Early Warning System (FF&WS) capability in 2010, improvement made till now and Future Plans for further improvement at the earliest to FFC.
- iv. PID Punjab & Sindh to share comprehensive report on improvement of all Barrages on regular basis indicating date of start & completion and activities carried out/being carried out on the projects till completion of projects.
- v. Punjab Irrigation Department to hold a high level meeting of Chief Engineers in order to review the operationality of the existing/ designated breaching sections and reassess their need keeping in view the recent enhancements made in the capacities of the barrages. The report/ decisions may be submitted to FFC at the earliest for consideration in the next Progress Review Meeting.
- vi. Pak Railways to share the latest status of the PC-I of Left Guide Bund of Shershah Railway Bridge with FFC.
- vii. NHA to provide to FFC detailed updated progress report regarding 57 vulnerable sites identified by the Consultants M/S NESPAK containing the sub-project wise recommendations and their status of implementation alongwith brief details of the scope and obligation of each sub-project.
- viii. NHA to provide to FFC detailed updated progress report regarding damages occurred, new vulnerable points identified during 2022 floods and the plans for their restoration.
  - ix. NHA, in future, would consult the Provincial Irrigation Departments while constructing roads or any bridge/ intervention across the river so that any flood flow generated could pass through the NHA structures without damaging/ jeopardizing them.
  - x. Irrigation Departments of Sindh, Balochistan, GB and AJ&K to vigorously pursue their cases with concerned authorities for early approval of River Act and submit latest status to FFC.

- xi. Irrigation Departments of the Punjab, Sindh, Khyber Pakhtunkhwa & Balochistan, GB-PWD and Agriculture, Livestock, Irrigation & ESMA, Government of AJ&K would share with SUPARCO under intimation of FFC, the details of encroachments, besides, those encroachments already removed on prescribed format already circulated among concerned organizations at the earliest.
- xii. PDMAs, GBDMA & SDMA will take steps to remove encroachments in floodplains/ waterways along major and other rivers including hill torrents with the coordination of concerned District Administrations and submit report to FFC at the earliest.
- xiii. Upon receipt of information from Irrigation Departments, SUPARCO will carry out the verification of encroachments removed and those existing and submit report to FFC.
- xiv. WAPDA to keep on providing progress on Munda/ Mohmand Dam Project to FFC on regular basis.
- xv. WAPDA and PID, Khyber Pakhtunkhwa to have further coordination for expeditious completion of Munda Headworks.
- xvi. Forest Departments of four Provinces and Federally Administered Areas including Watershed Management Authorities of Mangla & Tarbela Dams Projects (WAPDA), will keep up their efforts and would regularly submit to FFC detailed progress made on watershed management/ a 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.
- xvii. Irrigation Departments of Khyber Pakhtunkhwa & Balochistan and Forest Department of Sindh Province to submit their views/ comments on PC-II for formulation of National Watershed Management Plan to FFC at the earliest.
- xviii. PID, Punjab will provide to FFC on regular basis the updated status/ progress on Construction of Hydro Power Station along right side of Taunsa Barrage.
- xix. WASA, in consultation with RDA, to share progress on construction of Lai Expressway with FFC on regular basis.
- xx. PID, Punjab to share updated status regarding Model Study of River Channelization for Ravi River Front Urban Project on regular basis.
- xxi. WAPDA and Provincial Irrigation Departments of Sindh & Balochistan to share latest report about the length of the drainage project (RBOD) under their control with FFC at the earliest.
- xxii. PID, Balochistan & G-B to share details about critical locations (including their number, nature of criticality/vulnerability) requiring attention and funds needed etc. to be shared with FFC by PIDs/FLAs.
- xxiii. KMC & KDA to keep on sharing the progress regarding rehabilitation/upgradation of storm drainage system of the city on regular basis until completion of the job.
- xxiv. PID, Sindh to keep on sharing latest updates to FFC on regular basis regarding Long term rehabilitation/ up-gradation works of LBOD and its allied components i.e. Dhora Poran water drains to Shakoor Dhund for further action.

### 3.4.22 Post Monsoon 2022 Meeting of FFC (22<sup>nd</sup> November 2022)

The Post Monsoon Meeting of Federal Flood Commission was held on **22**<sup>nd</sup> **November 2022** in the Committee Room of office of CEA & CFFC Islamabad, in order to review the status of preparedness and lessons learnt by the Provinces & Federal Line Agencies during Monsoon Season 2022. The following directions were given to PIDs/ Federal Line Agencies, WAPDA, WASA & PMD etc. as a way forward for Monsoon 2023:

- (i) For future meetings of FFC, all the members of FFC including MoWR are requested to ensure their participation particularly NDMA, PID Sindh and Khyber Pakhtunkhwa.
- (ii) Provincial Irrigation Departments & Federal Line Agencies (PIDs & FLAs) to ensure completion of all approved and ongoing flood protection schemes taken up under Provincial ADP and Normal/ Emergent Flood Programme, besides, rehabilitation 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 2023 Monsoon Season. Detail of all those projects, be shared with FFC.
- (iii) <u>PIDs & FLAs</u> to ensure removal of encroachments from flood plains/ High Risk Zones, waterways of major and other rivers including Hill Torrents/ Flood Flow generating nullahs, 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 Monsoon Season 2023.
- (iv) **<u>PIDs & FLAs</u>** to ensure rehabilitations of breaches and damaged flood protection infrastructure well before the next year Monsoon-2023
- (v) <u>PIDs</u> to expedite efforts with respect to Revision in Flood Limits of their respective Barrages/ Head Works/ Bridges falling in their jurisdictions in view of changing ground realities. The exercise may be completed before 30<sup>th</sup> June 2023.
- (vi) **<u>PID Punjab</u>** to expedite the working on the Revised Flood Limits of eastern rivers in entire jurisdiction of Punjab keeping in view the new tool and technique under intimation to all relevant stakeholders including FFC.
- (vii) <u>PID, Punjab</u> to conduct study on need of existing as well as additional needed (at critical locations) Breaching Sections in Punjab on fast track basis. The exercise may be completed before 30<sup>th</sup> June 2023.
- (viii) **PMD** to ensure procurement & installation of the Weather Radars at Sialkot and Sukkur as per approved Implementation Plan.
- (ix) <u>**Deputy Commissioner, Rawalpindi**</u> to ensure removal of encroachments from the banks/ bed of Lai Nullah at the earliest.
- (x) <u>**RDA, Rawalpindi**</u> to expedite work on Lai Expressway project to resolve the flooding problem in Rawalpindi city. The progress on Lai Expressway project may also be shared with FFC on regular basis.
- (xi) **Pak Railways** to ensure the execution of Left Guide Bund of Shershah Railway Bridge across River Chenab in District Multan at the earliest.
- (xii) **Provincial Governments** to provide list of encroachments removed alongwith proper coordinates to SUPARCO for analysis & verification of encroachments removed from the waterways & flood plains of rivers.

- (xiii) <u>PCIW</u> to ensure to make necessary alternate arrangements for obtaining reservoirs/ rivers flow data and other information of Chenab and Eastern Rivers, in case ICIW does not agree to provide the same during Monsoon Season 2023.
- (xiv) **<u>PID Balochistan</u>** to share the details of seven indicative sites in Quetta Valley with PMD for installation of rain gauges there.
- (xv) <u>WAPDA</u> would prepare initial draft working paper for flood management SOPs for Tarbela Dam and share the same with the stakeholders for further deliberations.

### 3.4.23 2<sup>nd</sup> Meeting of Technical Committee of MoWR on Water sector related SDG Indicators (29<sup>th</sup> November 2022)

The 2<sup>nd</sup> meeting of the Technical Committee on Water Sector related SDG Indicators was held on 29<sup>th</sup> November 2022. Following key decisions were made:

- (i) Pakistan Water Partnership (PWP) shall remain in close contact with Global Water Partnership (GWP) regarding holding of the next Stakeholders Workshop for carrying out again national survey to report Pakistan's progress on SDG 6.5.1 Indicator. In this respect, PWP in coordination with O/o CEA/CFFC will ensure representation of all stakeholder departments at national and provincial level, in particular all members of the Committee during the workshop, besides representatives from private sector, academia (experts from different universities), industry, civil society, public representatives and development partners etc.
- (ii) O/o PCIW will expedite ongoing consultative process regarding review of the draft input already prepared and shared by O/o CEA/CFFC on SDG-Indicator 6.5.2. Thereafter, the final report to be submitted to O/o CEA/CFFC within 1<sup>st</sup> week of January 2023 for its consideration by the Committee in its next meeting.
- (iii) PCRWR shall prepare comprehensive national progress report on SDGs Indicator 6.3.2 on the format/ guidelines prescribed by UNEP and present the finalized updated report to O/o CEA/CFFC within 1<sup>st</sup> week of January 2023 for its consideration by the Committee in its next meeting.
- (iv) PCRWR shall also prepare updated draft progress report on SDGs Indicator 6.6.1 on the format/ guidelines prescribed by UNEP and present the same for consideration of the Committee during in its next meeting.
- (v) Agriculture Department, Government of Sindh shall propose composition and TORs regarding establishment of a Sub-Committee w.r.t collection of data and compiling the overall progress regarding implementation of SDG Indicator 6.4.1 in Pakistan.
- (vi) WAPDA shall organize stakeholders' workshop with regard to collection of data, compilation and finalizing the baseline of SDG Indicator 6.4.2 with regard to its implementation in Pakistan. Timelines and other necessary arrangements for the Workshop would be presented during the next meeting of the Committee.
- (vii) O/o CEA/CFFC shall invite Representatives from all concerned UN organizations (UNEP, FAO and UNESCO) in the next meeting of Technical Committee, in order to provide necessary guidance w.r.t reporting of the progress on their relevant SDG Indicators.

#### 3.4.24 Meeting Regarding Preparation of National Master Plan for Flood Telemetry held on 7<sup>th</sup> December 2022

A joint consultative meeting of WAPDA, FFC, PMD, AB and Provincial Irrigation Department Sindh and Irrigation and Small Dams AJ&K was held on **7<sup>th</sup> December 2022.** After detailed discussion, following decisions were taken:

- Irrigation Department, Government of Sindh, to submit list including coordinates of locations of additional telemetry stations proposed based on experience of 2022-floods to FFC within a week time for inclusion in the Final Master Plan document by the ADB Consultants.
- (ii) ADB Consultants to finalize add submit the Final Master Plan duly incorporating the suggestions of PMD, AJ&K, PID Sindh & WAPDA and to submit to FFC immediately.
- (iii) WAPDA to submit PC-I of the Phase-I of the Flood Telemetry Project at the earliest to FFC for its inclusion in the updated Umbrella PC-I of FPSP-III.
- (iv) Each province to submit commitment of bearing the operation & maintenance cost of the respective interventions duly approved from their concerned provincial cabinets.

### 3.4.25 Miscellaneous Activities of FFC during 2022

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

- i. Scrutinizing Committee meeting of Federal Flood Commission held on **28<sup>th</sup> February 2022**.
- ii. Meeting on National Master Plan for Flood Telemetry Network held on 17<sup>th</sup> March 2022.
- iii. Scrutinizing Committee Meeting of FFC held on 18<sup>th</sup> March 2022.
- iv. Meeting of Inquiry Committee Constituted for Inquiry in Light of Directives of DAC Meeting regarding IR PARA No. 4 KFW Grant No. BMZ 2013 977 44 Pakistan held on 28<sup>th</sup> March 2022.
- v. One-Day Stakeholders Workshop on Implementation Modalities of National Master Plan for Flood ADB Workshop held on 31<sup>st</sup> March 2022.
- vi. Meeting with NITB and Google for artificial intelligence system through Google for Flood Alerts held on **30**<sup>th</sup> August 2022.
- vii. Meeting with Chinese Expert Delegation Visit in Pakistan held on **30**<sup>th</sup> **September 2022.**
- viii. Meeting of JICA Head Quarter South Asia Disaster Management Advisory Mission held on 31<sup>st</sup> October 2022.
- ix. Scrutinizing Committee Meeting of FFC held on 4<sup>th</sup> November 2022.
- x. Meeting with JICA HQ. South Asia Disaster Management Mission for Pakistan held on 7<sup>th</sup> November 2022.
- xi. Meeting of JICA HQ. South Asia Disaster management Mission for Pakistan held on 11<sup>th</sup> November 2022.

- xii. Flood Stakeholders Workshop on River on Bank Protection, Reinforcement and Maintenance based on Post Floods held on 21<sup>st</sup> November 2022.
- xiii. Scrutinizing Committee Meeting of FFC held on 1<sup>st</sup> December 2022.
- xiv. 1<sup>st</sup> Workshop on Climate Change Adaptation: Related Measurement Reporting and Evaluation (MRE) Guidelines-Stakeholders Consultation held on 2<sup>nd</sup> December 2022.
- xv. Meeting with Visiting Dutch Team on Disaster Risk Reduction (DRR) held on 13<sup>th</sup> December 2022.
- xvi. Meeting with the UNEP High Level Mission to Pakistan (13<sup>th</sup> 16<sup>th</sup> December 2022)
- xvii. Dutch Team on Disaster Risk Reduction (DRR) De-Briefing Session held on 16<sup>th</sup> December 2022.
- xviii. Meeting with IUCN Team was held on 19<sup>th</sup> December 2022 to hear from IUCN about its past work undertaken in the overall realm of integrated water/ flood management.
- xix. Meeting with PCRWR Team was held on 26<sup>th</sup> December 2022 regarding specific research conducted for future flood management.

### 2022 Rains/ Floods in Pakistan



District Jafarabad (Balochistan)



District Dadu (Sindh)



District Rajanpur (Punjab)



District Swat (Khyber Pakhtunkhwa)



Munda Headworks before 2022 Floods



Munda Head Works collapse during 2022 Floods

### 3.5 Climatically Invigorated 2022 Rains/ Floods

Pakistan has been subjected to regular flooding throughout history. In the last 80 years, the frequency of disastrous flood events in the region has been more than one in four years. Owing to the climate change, Westerly Wave has altogether altered the monsoon rainfall pattern in the country and caused Low Pressure areas developed in southern parts resulting in to heavier than unusual rainfall during Monsoon Season 2022 in particular in Sindh and Balochistan.

The country has observed changing weather patterns, including variations in precipitation and temperatures, increased frequency and severity of tropical storms and coastal rains, glacial melt, glacial lake outburst flooding, sea level rise, loss of biodiversity, desertification, and droughts. The plains of Punjab and Sindh have experienced extended and frequent riverine floods and heat waves, affecting economic and human development.

Between June and August 2022, torrential rains and a combination of riverine, urban, and torrential flash flooding led to an unprecedented 2022 flood disaster in Pakistan. It resulted in damages on large scale. According to NDMA, around 33 million people have been affected by the 2022-floods, including nearly 8 million displaced. The floods have taken the lives of more than 1,739 people, one-third of which were children. 90 districts were declared as "calamity hit," during 2022 monsoon accounting for more than half of all districts in the country. The majority were in the provinces of Balochistan, Sindh, and Khyber Pakhtunkhwa.

As per Post Disaster Need Assessment (PDNA) Report of GoP dated October 28, 2022, total damage is estimated at PKR 3.2 trillion (US\$14.9 billion), total loss at PKR 3.3 trillion (US\$15.2 billion), and total reconstruction/ rehabilitation needs at PKR 3.5 trillion (US\$16.3 billion). Out of the 25 poorest districts in the country, 19 were calamity-affected. Preliminary estimates suggest that as a direct consequence of the floods, the national poverty rate will increase from 3.7-4.0 % pushing between 8.4 to 9.1 million people into poverty.

### 3.5.1 Rainfall Analysis for Monsoon Season 2022

In the summer of 2022, the country experienced its wettest August since 1961. Sindh and Balochistan provinces experienced unprecedented rainfall, surpassing average monthly totals by six and seven times, respectively.

#### PMD's Outlook for Monsoon 2023:

According to Pakistan Meteorological Department (PMD) Seasonal Outlook for Monsoon 2022 for Pakistan issued on 7<sup>th</sup> June 2022, the following weather situation was predicted:

- Overall, a tendency for nearly normal precipitation is predicted over most parts of the country during forecast season (May-July 2022) with mostly below normal during May while normal to slightly above normal during June and July.
- Northern Punjab, Kashmir and the adjoining areas of Khyber Pakhtunkhwa and Gilgit Baltistan may get slightly above normal precipitation.
- Nearly normal precipitation is expected over rest of the country; Area weighted normal rainfall of Pakistan during July to September is **140.8 mm**.

Keeping in view the atmospheric conditions observed in June 2022, PMD's updated the seasonal forecast issued on July 04, 2022, is described as under: -

- Overall, a tendency for **above normal precipitation** is likely over the country during forecast season (July-August-September).
- First half of the monsoon from 1st July to Mid-August is likely to be wetter than last half (mid-August to end of September).
- Monsoon rainfall is expected to be 'Above Normal' over Punjab and Sindh whereas slightly above normal rainfall is expected over remaining parts of the country. Temperature would be above-normal during the monsoon season.

Based on above, forecasted impacts were as under: -

- Potential for Riverine Floods Possibility of extreme hydro-meteorological events over catchment areas cannot be ruled out, that may generate riverine floods in the major rivers.
- High probability of Urban Flooding in metropolis cities and flash flooding in hilly areas
- Heavy rainfall events may trigger flash flooding in hilly areas and urban flooding in plain areas i.e. major cities of Sindh, Punjab, AJ&K and Khyber Pakhtunkhwa during the season.
- Above-normal Temperature in high altitudes are likely to increase rate of snowmelt in the Northern Areas subsequently increasing the chances of base flow in the Upper Indus basin.
- Sufficient water availability for irrigation and power sectors will be a good impact.

#### Actually observed Weather/ Rainfall Situation:

PMD forecasted (about 40%) **Above-Normal** rainfall all over the country during 2022 Monsoon Season, however, cumulative rainfall received was around 175% above normal. Province-wise detail is given in **Table 3.7.** 

Province/ Regain	(mm)	(%age above Normal)
Sindh	703.1 mm	426% above normal
Balochistan	320.7 mm	450% above normal
Punjab	393.5 mm	70% above normal
Khyber Pakhtunkhwa	341.1 mm	33% above normal
Islamabad	1,199.46 mm	17% less than normal
Gilgit-Baltistan	81.1 mm	104% above normal
Azad Jammu & Kashmir	382.6 mm	2% less than normal
_	Sindh Balochistan Punjab Khyber Pakhtunkhwa Islamabad Gilgit-Baltistan Azad Jammu & Kashmir	Province/ Regain(mm)Sindh703.1 mmBalochistan320.7 mmPunjab393.5 mmKhyber Pakhtunkhwa341.1 mmIslamabad1,199.46 mmGilgit-Baltistan81.1 mmAzad Jammu & Kashmir382.6 mm

#### Table 3.7: Province-wise Rainfall actually observed across the Country

Source: PMD

Pre-monsoon rainfalls started on 13<sup>th</sup> June 2022 and lasted till 25<sup>th</sup> June 2022. This was followed by the below given four (04) major rainfall spells during the monsoon season 2022:

- i) 1<sup>st</sup> Spell (**29<sup>th</sup> June 9<sup>th</sup> July 2022**);
- ii) 2<sup>nd</sup>Spell (**23<sup>rd</sup> 28<sup>th</sup> July, 2022**);
- iii) 3<sup>rd</sup> Spell (5<sup>th</sup> 13<sup>th</sup> August 2022); &
- iv) 4<sup>th</sup> Spell (23<sup>th</sup> 26<sup>th</sup> August 2022)

Cumulative Rainfall actually observed has been shown in Figure 3.3.





Similar maps showing rainfall spells occurring during the four (04) individual monsoonal rainfall spells (i.e. Spell No. 1 from 29<sup>th</sup> June to 9<sup>th</sup> July 2022, Spell No. 2 from 23<sup>rd</sup> July to 28<sup>th</sup> July, 2022, Spell No. 3 from 5<sup>th</sup> August to 13<sup>th</sup> August 2022 and Monsoon Spell No 4 starting from 23<sup>th</sup> August and ending on 26<sup>th</sup> August 2022) are shown in **Figure 3.4**.



### Figure 3.4: Rainfall Observed during the four different Monsoon Spells

According to PMD, number of cities has observed excessive rainfall. A comparison of few cities which observed extra ordinary/ exceptionally high rainfall in Monsoon Season 2022 as compared to previous record, is given in **Table 3.8**:

### Table 3.8: Stations/ Regions that experienced Above-Normal Rainfall

Sr. No.	Name of Stations	Name of Province /Region	July-Sep 2022 Rainfall (mm)	Annual 2022 Rainfall (mm)	Annual Average Rainfall (mm)	2022 Rains % above Average
1.	Padidan	Sindh	1,764	1806.82	108	1633 %
2.	Moinjo Daro	Sindh	990.5	1029.82	100.1	989 %
3.	Larkana	Sindh	893.4	956.82	127.4	701 %
4.	Jacobabad	Sindh	783.1	833.04	110	711 %
5.	Chhor	Sindh	781.9	810.4	74.5	1049 %
6.	Rohri	Sindh	652	718	105.8	616 %
7.	Sh. Benazir Abad	Sindh	648	703.12	135	480 %
8.	Sukkur	Sindh	552.53	696.52	87.6	630 %
9.	Badin	Sindh	665.33	668.3	16.9	3936 %
10.	Kalaat	Balochistan	501	638.2	12.93	3874 %
11.	Lasbela	Balochistan	538.22	606.1	69	780 %
12.	Khanpur	Punjab	490.21	535.83	21.6	2269 %
13.	Hyderabad	Sindh	492.04	512.01	177.9	276 %
14.	Khuzdar	Balochistan	464.61	644.4	13.29	3495 %
15.	Karachi A/P	Sindh	519.74	572.95	205	253 %
16.	Sibbi	Balochistan	406.01	472.04	13.7	2963 %
17.	Barkhan	Balochistan	471.01	648	13	3623 %
18.	Quetta (Samungli)	Balochistan	271.07	376	56.7	478 %
19.	Panjgur	Balochistan	255	281	115	221 %
20.	Bahawalnagar	Punjab	353.05	362	45	784 %
21.	Bahawalpur (City)	Punjab	303.57	391.02	143	212 %
22.	Dir	Khyber Pakhtunkhwa	520.52	1016	127.01	409 %
23.	Ormara	Balochistan	243	340.01	76.2	318 %
24.	Zhob	Balochistan	311	424	13.47	2308 %

Source: PMD

A bar chart indicating difference in rainfall in July-September 2022 and average rainfall has been shown in **Figure 3.5**: -



#### Figure 3.5: Bar Chart showing Cities with Exceptional High Rainfall in 2022

### 3.5.2 Hydraulic Characteristics of 2022 Floods

Traditionally, monsoon rains occur mostly in the catchments of Jhelum, Chenab, Ravi, Beas and Sutlej. Occasionally, these currents cross Himalaya and cause precipitation in the upper watersheds of Indus River like occurred in year 2010. However, during 2022, monsoon rain initially impacted southern parts of the country (Balochistan, Sindh and their urban centers). Thereafter Heavy to Very Heavy Rains occurred in Southern Punjab particularly in the Koh-e-Suleiman Range, generating record floods in hill torrents of D.G. Khan and Rajanpur Districts. Finally, Monsoon rains caused 'High to Very High Floods' particularly in Swat and Panjkora Rivers of Kabul Basin as well as in local tributaries of Indus River upstream of Tarbela.

The country received unprecedentedly abnormal rains from July – August 2022, especially in the lower half of the country in Sindh & Balochistan Province (Refer **Figure 3.3**), which generated High Flows in various hill torrents on a countrywide basis. The hill torrents of Kirthar Range in Sindh affected the Districts of Larkana, Sukkur, Kandhkot, Jacobabad and Dadu. Extreme hydro-meteorological events

(torrential rainfall) generated flash floods in hill torrent areas of Punjab (D.G. Khan District), Balochistan (Districts Lasbela, Barkhan), Khyber Pakhtunkhwa (Swat, Bahrain & Kalam etc.), Azad Jammu & Kashmir, Gilgit-Baltistan and urban flooding in major cities of Pakistan (refer again **Table 3.8** given above).

In Balochistan, significant increase in monthly rainfall, considerably higher than Annual Average/ Normal Rainfall was observed at Kalat, Barkhan, Quetta, Sibbi, and Khuzdar besides Ormara. Climate driven and intensified rainfall/ flooding brought massive devastation to these areas, which were previously secured from the brunt of the severe monsoon.

In Punjab, Floods 2022 affected the districts DG Khan, Rajanpur, Muzaffargarh, Mianwali, Sialkot and Layyah. Worst-hit areas in Punjab Province were DG Khan & Rajanpur area including the cities namely Taunsa Sharif, DG Khan, Fazilpur and Rojhan. Hill torrent structures of D.G Khan Canal and its system, and drainage network overtopped from numerous spots leaving behind massive destruction to the infrastructure and public and private properties. CRBC main canal system was badly affected due to Vehova and Sanghar Hill Torrents, Kachhi Canal, D.G. Khan Canal. Existing drains were breached by Sori Lund, Vidore, Sakhi Sarwar and Mithawan Hill Torrents, besides, structures on the Hill torrents were also damaged badly.

Heavy to Very-Heavy Rains in southern Punjab particularly in the Koh-e-Suleiman Range, generated record floods in the 13 major hill torrents of D.G. Khan and Rajanpur Districts which brought large scale destruction in D.G. Khan Division. The flood situation is given in **Table-3.9**:

D.G. Khan Hill Torrent Region		Rajanpur Hill Torrent Region		
Gauge Station	Flood Peak observed	Gauge Station	Flood Peak observed	
Kaura	105,668 @ 26.8.2022	Kaha	108,941 @ 14.8.2022	
Vehova	154,362 @ 14.8.2022	Chachar	75,900 @ 21.8.2022	
Sanghar	268,149 @ 14.8.2022	Sori Janubi	17,000 @ 4.8.2022	
Sori Lund	135,544 @ 21.8.2022	Pitok	5,000@ 25.8.2022	
Vidor	174,360 @ 21.8.2022	Sori Shomali	7,150 @ 2.8.2010	
Sakhi Sarwar	32,643 @ 4.8.2010	Zandi	9,000 @ 25.8.2022	
Mithawan	61,905 @ 8.8.2010	-	-	

### Table 3.9: 2022-Floods in major Hill Torrents of D.G. Khan and Rajanpur

Source: PID Punjab

Recurring flash flood events were experienced in entire GB (Districts Ghizer, Diamer, Ghanche, Gilgit, Hunza, Kharmang, Nagar, Shigar, Skardu and Astore) badly affected public & private infrastructure mainly including Power Houses, Roads, bridges, Drinking Water Supply & Irrigation Channels etc. From 1<sup>st</sup> July to 12<sup>th</sup> July, normal flows were observed in the rivers of the Indus basin. However, due to continuously higher temperatures at Skardu later and heavy rainfall in G-B increased flows were subsequently observed in the River Indus. Due to heavy rainfall in the catchment areas of **River Kabul** (a tributary of River Indus downstream Tarbela), it

Calchiment aleas of **River Rabul** (a tributary of River findus downstream

remained in "High Flood" at Warsak on 27<sup>th</sup> August 2022 (peak discharge of 139,086 cusecs) and Very High Flood at Nowshera on 28<sup>th</sup> August 2022 (peak discharge of **336,461 cusecs**). Moreover, **River Swat** (tributary of Kabul River) experienced in Very High Flood stage at Khawazakhela (246,392 cusecs), Chakdara Bridge (275,215 cusecs), Munda Headworks (260,000 cusecs) & Charsadda Road (220,000 cusecs) on 26<sup>th</sup> August 2022.

Due to heavy torrential rainfall and cloud bursts in the upper catchments of Swat River on August 25-26, 2022, unprecedented and exceptionally high floods were generated in Swat River and its tributaries i.e. Barwai Khwar, Haronai Khwar, Chail Khwar, Ushu Matiltan River, Gabral River etc. Swat River experienced historic flood of **246,392 cusec viz-a-viz 175,546 cusec in 2010** which is **53%** higher than previously highest recorded flood and devastated the infrastructures, built-up areas and agricultural lands on both banks. The flood caused havoc and severely devastated/ swept away the public & private infrastructure and agriculture lands in villages namely Lalkoo, Sakhra, Darmai, Nowkhara, Kalakot, Drushkhela, Bamakhela, Sulatan, Mandaldag, Rodingar, Gwalerai, Barthana, Chuprial, Shokhdara, Kharerai, Utror, Gabral, Behrain, Madyan, Asala, Gashkorr etc.

The swollen **Kabul & Swat Rivers** brought destruction of catastrophic proportions in the Kalam, Swat, Upper Dir, Kohistan, Charsadda and Nowshera, sweeping away hotels & homes and submerging several areas. **Munda Headworks** on the Swat River in Khyber Pakhtunkhwa sustained serious damage by 2022 devastating floods; middle three bays got washed away/ completely destroyed including the bridge deck, piers, and hoisting mechanisms etc.

Heavy contribution of torrential flood flows from D.G. Khan (including Rajanpur) hill torrents generated "High Flood" in River Indus at **Taunsa Barrage** which received peak discharge (outflow) of **622,000 cusecs** on 30<sup>th</sup> August 2022. The control structures downstream Taunsa at river Indus i.e. Guddu & Sukkur Barrages also experienced High Flood at Guddu & Sukkur Barrages. **Guddu** Barrage achieved peak discharge of **576,000 cusecs** on 23<sup>rd</sup> August 2022 whereas the **Sukkur** had peak discharge of **580,000 cusecs** on 25<sup>th</sup> August 2022. The Indus at **Kotri** touched high Flood on 10<sup>th</sup> September 2022 with peak discharge (outflow) of **600,000 cusecs**.

Flood situation was encountered at S.M Bund in Hala Division at Shank of T-Head Spur @ Mile 135/7 (Bhanote), S.M Bund Mile 12/2 to 12/3 (Bakhri Site) Rohri Division Kandiaro, Qadirpur Shank Bund at 1/7+100 downstream Guddu Barrage in jurisdiction of Ghotki Feeder Canal Area Water Board. To combat the situation, the emergent work of Dumping Stone Boulders was started immediately and further Flood Fighting arrangements viz: Heavy machinery including Excavators, Bulldozers, Dumpers, Tractors etc. deployed & Patrolling arrangements including stocking of stone boulders at site were carried out to curb further erosion and control the situation.

During Monsoon season 2022, heavy to very heavy monsoon rains in Balochistan Province activated local Nullahs/Hill Torrents which caused flash floods. As a result, the flood water level raised beyond the maximum level of **FP Bund** which caused breaches at various location. Breaches also occurred along **Suprio Bund**. Flood water also entered in the pocket between FP Bund, MNV and other compartment between MNV and Suprio Bund affecting all drainage system in the area. Due to very heavy rainfalls in Larkana Division, all the drains were flowing over their

maximum gauge which caused pluvial flooding. Manchar Lake attained very high level of 123.0 ft and at that stage River Indus was not accepting the desired water from Manchar, hence, relief cuts were made in Manchar to control the excessive flood situation.

### 3.5.3 Attenuation of Torrential & Pluvial Flood in Sindh through Manchar & other Irrigation & Flood Protection Network

Manchar Lake is the largest natural freshwater lake in Pakistan and is one of South Asia's largest lakes. It is located west of the Indus River, in Jamshoro District and Dadu District, Sindh - 18 km away from Sehwan Sharif. In the 2010 Pakistan floods, the lake overflowed due to a high inflow of water. During the 2022 Pakistan floods, it again overflowed. Controlled/ Relief Cuts were made into the lake embankment to facilitate drainage and protect the cities of Sehwan, Dadu, Mehar and the town of Bhan Saeedabad from flooding.

Manchar Lake is connected with Hamal Lake by the Main Nara Valley Drain built in 1921. The average depth is only 2.5 to 3.75 meters. It is 6 meters lower than the bed of the Indus, and sometimes catches floodwater from the river, while in winter when the river is low, water flows from the lake into the Indus. Manchar Lake collects water from numerous small streams in the Kirthar Mountains, and then empties into the Indus River through Aral Wah.

Surface runoff generated from torrential flows in Balochistan flowed along FP Bund and Drains such as RBOD & MNV in Sindh province. Flood water entered in the pocket between FP Bund and MNV drain and other compartment between MNV drain and Suprio Bund which ultimately affected all drainage system in the area. Due to very heavy rainfall in Larkana Division, all the drains were flowing above their maximum gauges and chocked due to inadequate drainage capacity due to flat slope (1 foot per 03 miles i.e. 01 meter per 10 KM).

To stimulate drainage from the area, several relief cuts were provided and to avoid afflux and spreading water in larger area. After Manchar Lake attained ever Maximum Level of R.L. 123 feet on 4<sup>th</sup> September 2022, relief/ controlled cuts in the Manchar Lake Bank at RD 14 & RD 52 were also made to save Sehwan Sharif & Dadu city. This was followed by four (4) Relief Cuts made in Larkana-Sehwan (LS) Bund:

- 1<sup>st</sup> Cut at Mile 95/6 (8<sup>th</sup> September 2022);
- 2<sup>nd</sup> Cut at Mile 99/2 (9<sup>th</sup> September 2022);
- 3<sup>rd</sup> Cut made at Mile 97/2 (10<sup>th</sup> September 2022); &
- 4<sup>th</sup> Cut made at Mile 96/0 (12<sup>th</sup> September 2022)

After evacuation of flood water, all the breaches and relief/controlled cuts were plugged by the Irrigation Department, Government of Sindh. The flood water level raised beyond the top level of FP Bund which caused breaches at many locations. The detail of main breaches which occurred in the flood protection and irrigation infrastructure are given in Table 3.10.
## Table 3.10: Major Breaches caused in FP Bund & Suprio Bund in Sindh

Sr. #	Name of Bund	Date	Time	Breach RD
1.	FP Bund	25.08.2022	07:30 PM	340
2.	FP Bund (Balochistan)	26.08.2022	03:00 PM	169
3.	FP Bund	27.08.2022	06:00 AM	432
4.	FP Bund	27.08.2022	02:00 PM	476
5.	FP Bund	28.08.2022	05:30 AM	200
6.	Suprio Bund	28.08.2022	10:00 PM	52
7.	Suprio Bund	29.08.2022	06:00 AM	12
8.	Suprio Bund	29.08.2022	10:00 AM	28
9.	Suprio Bund	30.08.2022	02:00 AM	82
10.	Suprio Bund	30.08.2022	05:00 AM	42
11.	Manchar Bund	04.09.2022	11:00 AM	14
12.	Manchar Bund	05.09.2022 02:00 AM		52
13.	MNV Drain	04.09.2022	06:00 AM	2,318
14.	MNV Drain	05.09.2022	07:00 AM	8,068
15.	LS Bund	08.09.2022	08:00 PM	95/6
16.	L/S Bund	09.09.2022	08:00 AM	99/2
17.	LS Bund	10.09.2022	06:00 AM	97/2
18.	L/S Bund	12.09.2022	09:30 PM	96/0

In addition to above, several relief cuts were made in the irrigation infrastructure to drain out the rain water from cities, towns and fields. Irrigation and canal network in Sindh sustained 5,412 natural/ controlled breaches because of 2022 floods. Subsequently, after dewatering/ evacuation of flood water, all the breaches and controlled cuts were plugged by Irrigation Department, Government of Sindh.

## 3.5.4 Flood Routing through Major Reservoirs during Monsoon 2023

The water level at Tarbela Dam initially remained down upto 30<sup>th</sup> June 2022; however, afterwards, it started increasing gradually and the Tarbela attained its maximum conservation level (MCL) of 1550 feet on 20<sup>th</sup> August 2022. The outflows at Tarbela Dam were adjusted with the view to avoid peak at Khairabad (junction point of rivers Indus & Kabul). Around 57,000 cusecs were discharged into the Ghazi Barotha Power Channel. Adjustments in water levels of **Tarbela Reservoir** helped in reducing inflows at Khairabad near to 600,000 cusecs; otherwise Khairabad could have received upto 700,000 cusecs or even more. River Indus at Khairabad (junction point after merging river Kabul in the Indus) experienced a peak discharge of 602,400 cusecs on 27<sup>th</sup> August 2022.

Graphical demonstration of flood routing done at **Tarbela Dam** during High Flows in Indus & Kabul from August 25-30, 2022 seen in **Figure 3.5**.



Figure 3.6: Flood Routing through Tarbela Dam during High Flows in Indus & Kabul from August 25-30, 2022

FFC also effectively ensured Flood Routing through Chashma Reservoir during the period from August 26-30, 2022 in order to absorb upstream flood peaks. **Chashma reservoir** was emptied on August 26, 2022 and operated with minimum possible water levels during last week of August 2022 in order to ensure minimum possible amount of downstream flows towards Sindh province where torrential flash floods and pluvial flooding had already struck the communities at large. In parallel, FFC also strictly advised all concerned organizations including field formations of Irrigation Departments Punjab and Sindh to remain on "High Alert" and ensure unhalted flood fighting as and when needed owing to intense pressure of flood water on existing flood protection infrastructure that may cause breaches in the flood protection bunds. Reservoir Level variations from August 25-30, 2022 regarding Flood Routing done through **Chashma Reservoir** are demonstrated in **Figure 3.7**.



Figure 3.7: Flood Routing through Chashma Reservoir during High Flows in Indus & Kabul from August 25-30, 2022

**Mangla Dam** storage remained much below the expectation of IRSA due to less rainfall in its catchment upstream during the monsoon season 2022. Mangla Dam Authorities managed to also retain inflows at Mangla Reservoir which could reach at EI: 1193.10 feet against its MCL of 1242.00 feet on 16<sup>th</sup> August 2022 at 1800 hours. Filling of Reservoir helped to retained inflows upstream. Water level variations at Mangla Dam from August 25, 2022 to August 30, 2022 are illustrated in **Figure 3.8**.



Figure 3.8: Retention of Inflows at Mangla Dam during August 25-30, 2022

## 3.5.5 Flood Position in Indus River Tributaries

**River Chenab** attained peak discharge of 210,936 cusecs (High Flood) at Marala Barrage on 28<sup>th</sup> July 2022. On 12<sup>th</sup> August 2022, the Chenab flowed with peak discharge of 210,945 cusecs (High Flood stage) at Khanki and peak discharge of 202,000 cusecs (High Flood stage) at Qadirabad. The Chenab at Trimmu & Panjnad flowed in normal condition with peak discharge of 112,891 cusecs & 112,564 cusecs respectively. Other main Rivers (**Rivers Jhelum & Sutlej**) had been flowing in Normal Flow Conditions. **Ravi River** flowed in Low Flood at Jassar on 16<sup>th</sup> August 2022; however, it remained in Normal Flow conditions at Sulemanki and Islam.

## 3.5.6 Escapages below Kotri during 2022 Monsoon

Escapages below Kotri Barrage observed during the Monsoon Season 2022 are given in **Table 3.11** 

Month	Releases in MAF
April	0.008
Мау	0.01
June	0.01
July	1.99
August	13.95
September	22.35
Total	38.315 MAF (including Flows from Manchar Lake)
Source: IRSA	·

## Table 3.11: Downstream Kotri Escapages Kharif 2022 (April-September 2022)

Hill torrents generated about 9 MAF of water during monsoon season 2022. Detail is given below:

- $\rightarrow$  1.691 MAF from Tarbela-Chashma Reach
- $\rightarrow$  4.618 MAF from Chashma -Taunsa Reach
- $\rightarrow$  0.702 MAF from Taunsa-Guddu Reach
- $\rightarrow$  0.874 MAF from Guddu-Sukkur Reach
- → 1.083 MAF from Sukkur-Kotri Reach

## Total = 8.968 MAF

## 3.5.7 Flood Peaks Recorded during Major Historical Floods

Highest ever recorded flood peaks at various control points of Indus Basin are given in the **Table 3.12**. Flood peaks recorded at important control structures across major rivers during 2022 Monsoon Season are given in **Table 3.13**.

The details about flood flows (inflows & outflows) of major rivers observed during Monsoon Season 2022 at important control structures i.e. Reservoirs & Barrages are attached as **Appendix-II**, whereas rainfall data of Monsoon Season 2022 is attached as **Appendix-III**.

Historic Escapages below Kotri Barrage (1976 to 2021) as received from IRSA are also attached as **Appendix-IV**.

# Table: 3.12: Historic Peak Discharges (Cusec) in Major Rivers -Continued

Site	Design Capacity	Historic Max. Flood	Max of 1973	Max of 1975	Max of 1976	Max of 1988	Max of 1992	Max of 1993	Max of 1994
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
River Indus									
Tarbela	15,00,000	6,04,000 30-7-2010	4,20,000		3,04,000 3- 8-76	4,50,000 4-8-88	5,00,000 10-9-92	3,70,000 10-7-93	
Kalabagh	9 50 000	9 50 000	5 64 000	6 02 541	8 61 965 2-	6 05 000	8 49 245	3 77 491	
italabagii	0,00,000	14-7-42	20-7-73	21-8-75	8-76	2-8-88	10-9-92	11-7-93	
Chashma	9,50,000	10,36,673	5,10,000	555,300	7,86,600 3-	5,80,000	6,68,336	4,05,180	
		2-8-2010	22-7-73	23-8-75	8-76	3-8-88	11-8-92	15-7-93	
Taunsa	11,00,000	9,59,991	5,67,623	5,24,495 26-8-75	6,75,233 7- 8-76	5,60,000 28-7-88	6,55,079	3,81,000	
Cuddu	12.00.000	28-8-2010	29-1-13	20-0-75	11 00 670	20-7-00	14-9-92	20-1-93	
Guadu	12,00,000	15-8-76	10,83,742	10,02,496 30-8-75	15-8-76	30-7-88	10,86,919	6,26,410 31-7-93	
Sukkur	9,00,000	11,61,000	10,77,000	10,25,000	11,61,000	11,18,856	10,68,072	5,69,160	
		16-8-76	21-8-73	2-9-75	16-8-76	31-7-88	20-9-92	2-8-93	
Kotri	8,50,000	9,81,000	7,86,000	4,76,000	7,65,000	6,48,290	6,89,309	4,20,417	
		14-8-56				11-8-88	30-9-92	5-8-93	
River Jhelum									
Mangla	10,60,000	10,90,000	2,20,000 9-8-73	1,09,000 29-8-75	4,80,060	4,25,515	10,90,000	3,36,110 10-7-93	
Pacul	8 50 000	0.52.170	2 60 076	1 25 507	2 60 330	2 61 664	0.52.170	1 07 108	Ta
Nasui	0,50,000	3,32,170 10-0-02	2,09,970 9-8-73	30-8-75	2,09,000	17-7-88	10-9-92	11-7-93	ole o
River Chenal	<u> </u>	10-3-32			+-0-70				i
Marala	11 00 000	11 00 000	7 70 000	5 82 600	5 49 400	7 50 975	8 45 090	4 09 490	linu
maraia	11,00,000	26-8-57	9-8-73	16-7-75	1-8-76	25-9-88	10-9-92	11-7-93	ing a
Khanki	8,00,000	10,86,460	10,00,496	6,66,241	6,15,043	8,64,220	9,10,512	4,30,410	hea
		27-8-57	10-8-73	16-7-75	2-8-76	26-9-88	10-9-92	11-7-93	d o
Qadirabad	9,00,000	9,48,530	8,54,341	6,69,819	6,28,741	8,92,299	9,48,530	4,43,053	
		11-9-92	10-8-73	17-7-75	2-8-76	26-9-88	11-9-92	11-7-93	es
Trimmu	6,45,000	9,43,225	7,52,910	4,58,247	7,06,433	5,84,110	8,88,117	3,36,761	ubs
		8-7-59	12-8-73	20,7,75	10-8-76	19-7-88	14-9-92	13-7-93	equ
Panjnad	7,00,000	8,02,516	8,02,516	4,77,846	7,10,000	5,07,345	7,44,152	3,35,136	ent
		17-8-73	17-8-73	29-7-75	12-8-76	27-7-88	18-8-92	20,7,93	paç
River Ravi									Je
Madhopur		9,20,000 25-9-88				9,20,000 25-9-88	1,55,000 10-9-92	4,50,000 10-7-93	
Jassar	2,75,000	6,80,000	2,27,500	2,06,300	1,70,150	1,21,800	1,48,543	1,30,470	
		5-10-55	10-8-73	17-7-75	9-8-76	25-9-88	11-9-92	11-7-93	
Ravi	4,50,000	6,59,000	2,16,000	1,66,000	1,82,000	3,25,040	80,683	1,28,188	
Syphon		6-10-55				27-9-88	12-9-92	13-7-93	
Shahdara	2,50,000	5,76,000	2,37,380	1,83,330	1,70,175	5,76,000	62,641	91,415	
		22-9-88	11-8-73	18-7-75	10-8-76	27-9-88	12-9-92	14-7-93	
Balloki	2,25,000	3,36,200	2,43,908	1,80,205	2,53,974	3,89,845	1,12,157	1,49,392	
		28-9-1988	13-8-73	20-7-75	11-8-76	28-9-88	13-9-92	15,7,93	
Sidhnai	1,50,000	3,30,210	2,10,339	1,22,251	2,44,348	3,30,210	95,510	1,20,274	
		2-10-88	18-8-73	25-7-75	15-8-76	2-10-88	16-9-92	19-7-93	
River Sutlej									
Sulemanki	3,25,000	5,98,872	1,77,081	48,688	1,18,582	3,99,453	1,97,293	1,62,092	
		8-10-55	15-8-73	21-9-75	6-9-76	30-9-88	3-9-92	16-7-93	
Islam	3,00,000	4,92,581	1,66,453	46,996	1,11,427	3,08,425	1,82,637	89,705	
		11-10-55	17-8-73	23-9-75	8-9-76	4-10-88	7-9-92	19-7-93	

# Table: 3.12: Historic Peak Discharges (Cusec) in Major Rivers (Continued)

Site	Max of 1994	Max of 1995	Max of 1996	Max of1997	Max of 1998	Max of 1999	Max of 2000	Max of 2001	Peak 2002
1.	10.	11.	12.	13.	14.	15.	16.	17.	18.
River Indus									
Tarbela	4,20,000 24-7-94	4,80,000 26-7-95	4,02,000 14-8-96	4,00,000 17-8-97	3,65,000 13-7-98	3,82,000 4-9-99	1,99,200 1-7-2000	2,29,900 22-8-2001	
Kalabagh	5,03,946 13-7-94	5,51,553 27-7-95	4,75,000 17-8-96	6,60,590 8-8-97	4,80,700 15-7-98	4,63,700 10-8-99	2,61,100 2-8-2000	4,17,200 24-7-2017	
Chashma	5,46,636 11-8-94	5,76,709 28-7-95	4,98,875 17-8-96	6,37,636 28-8-97	5,10,200 14-7-98	5,48,300 11-8-99	2,54,800 2-8-2000	3,00500 25-7-2017	
Taunsa	5,73,520 15-7-94	6,07,884 29-7-95	5,21,708 19-8-96	5,36,199 31-8-97	5,28,500 18-7-98	4,09,700 13-8-98	2,03,100 5-7-2000	2,81,900 27-7-2017	
Guddu	7,73,305 29-7-94	9,88,665 3-8-95	7,90,163 22-8-96	8,31,287 6-9-97	6,67,500 22-7-98	4,19,800 17-8-99	1,71,600 6-8-2000	2,30,100 30-7-2017	
Sukkur	7,57,350 2-8-94	9,58,929 7-8-95	7,57,390 24-8-96	8,01,170 8-9-97	6,28,700 23-7-98	3,90,000 19-8-99	1,17,700 8-8-2000	1,68,900 31-7-2017	
Kotri	8,26,369 25-8-94	7,99,447 18-8-95	4,15,000 29-8-96	3,21,180 13-9-97	2,95,900 1-8-98	2,20,700 23-8-99	47,800 12-8-2000	62,800 03-9-2017	
River Jhelum									
Mangla	2,91,550 4-8-94	3,02,322 27-7-95	2,14,700 20-6-96	5,48,670 27-8-97	1,20,600 16-7-98	1,23,900 7-8-99	42,200 22-9-2000	42,800 15-9-2017	
Rasul	1,48,135 28-7-94	2,86,076 28-7-95	1,36,712 27-6-96	5,49,598 27-8-97	75,500 24-7-98	22,800 15-9-99	37,800 22-7-2000	37,800 24-7-2017	Table
River Chenab									8
Marala	4,12,520 20-9-94	4,39,970 27-7-95	7,66,860 23-8-96	7,75,525 28-8-97	1,48,200 13-7-98	1,90,300 7-8-99	2,23,400 22-7-2000	1,32,500 23-7-2017	ntinuin
Khanki	4,25,160 20-7-94	6,30,517 28-7-95	8,51,269 24-8-96	8,47,650 28-8-97	1,32,700 17-7-98	1,60,200 7-8-99	3,03,300 23-7-2000	1,31,900 24-7-2017	g ahea
Qadirabad	4,37,067 21-7-94	6,44,697 29-7-95	8,53,231 24-8-96	8,37,442 28-8-97	1,56,500 11-7-98	1,42,400 8-8-99	2,91,300 23-7-2000	1,18,100 15-8-2017	ld on ti
Trimmu	3,33,499 23-7-94	6,29,561 1-8-95	5,43,708 27-8-96	6,77,417 1-9-97	1,60,600 13-7-98	82,500 22-7-99	1,16,200 26-7-2000	72,400 18-8-2017	he sub
Panjnad	2,66,949 25-7-94	6,05,523 5-9-95	5,71,746 31-8-96	5,27,662 4-9-97	1,58,400 21-7-98	47,800 17-8-99	63,400 7-8-2000	46,600 22-8-2017	sequer
River Ravi									nt p
Madhopur	1,75,000 7-7-94	3,32,000 5-9-95	1,32,000 23-8-96	1,21,000 28-8-97					lge
Jassar	1,73,000 21-7-94	2,20,000 5-9-95	1,51,080 23-8-96	1,57,600 28-8-97	34,500 23-9-98	20,400 7-8-99	34,500 28-7-2000	46,100 15-8-2001	
Ravi Syphon	1,01,791 22-7-94	2,57,000 6-9-95	1,96,080 25-8-96	1,59,200 30-8-97	55,900 24-9-98	40,600 8-8-99	41,200 30-7-2000	44,100 15-8-2001	
Shahdara	54,101 22-7-94	1,71,520 7-9-95	1,82,340 25-8-96	1,23,080 30-8-97	58,200 24-9-98	45,500 11-8-99	51,800 29-7-2000	41,000 16-8-2001	
Balloki	1,15,635 12-8-94	2,22,800 8-9-95	2,35,000 26-8-96	1,76,950 31-8-97	90,500 25-9-98	74,800 22-8-99	46,500 30-7-2000	46,900 16-8-2017	
Sidhnai	1,06,321 28-8-94	2,12,340 12-9-95	1,95,362 30-8-96	1,33,237 3-9-97	59,200 27-9-98	38,900 24-8-99	37,200 2-8-2000	30,600 19-8-2017	
River Sutlej									1
Sulemanki	1,37,854 27-8-94	3,01,865 10-9-95	77,559 27-8-96	55,501 31-8-97	91,100 26-9-98	38,600 16-8-99	16,000 22-7-2000	13,600 20-8-2017	
Islam	92,630 31-8-94	1,83,902 14-9-95	47,559 27-8-96	40,838 3-9-97	66,800 30-9-98	14,300 17-8-99	13,800 27-7-200	3,500 23-8-2017	8

# Table: 3.12: Historic Peak Discharges (Cusec) in Major Rivers (Continued)

Site	Peak 2002	Peak 2003	Peak 2004	Peak 2005	Peak 2006	Peak 2007	Peak 2008	Peak 2009	Peak 2010	Peak 2011	Peak 2012
1.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.
River Indus											
Tarbela	2,90,900 14-8-02	3,50,000 21-7-03	2,69,900 16-7-04	3,72,900 16-7-05	3,71,800 5-8-06	2,92,600 03-8-07	2,58,500 12-8-08	3,06,000 16-8-09	6,04,000 30-7-10	2,68,500 16-9-11	
Kalabagh	3,79,600 14-8-02	3,99,400 03-8-03	2,45,100 10-7-04	5,15,100 02-7-05	4,89,600 6-8-06	3,59,900 16-8-07	3,36,500 5-8-08	3,48,300 17-8-09	9,36,453 30-7-10	2,68,400 26-7-11	
Chashma	3,48,800 15-8-02	4,63,800 05-8-20	2,20,300 11-7-04	5,33,200 20-7-05	5,84,700 06-8-06	4,03,400 15-8-07	3,21,300 21-7-08	3,80,800 19-8-09	1,036,673 2-8-10	3,49,700 28-7-11	
Taunsa	3,06,700 17-8-02	4,21,200 06-8-03	1,82,400 14-7-04	5,31,200 20-7-05	6,12,300 9-8-06	3,35,400 18-8-07	2,63,300 8-8-08	3,20,300 21-8-09	9,59,991 2-8-10	2,23,200 31-8-11	
Guddu	2,55,100 21-8-02	3,65,300 02-8-03	1,32,500 18-7-04	5,15,900 23-7-05	5,70,500 13-8-06	3,22,600 22-8-07	2,56,200 13-8-08	2,32,300 25-8-09	1,148,200 8-8-10	2,72,200 4-9-11	
Sukkur	1,81,100 23-8-02	2,97,700 07-8-03	64,800 20-7-04	4,47,400 25-7-05	5,14,000 16-8-06	2,58,700 24-8-07	1,91,700 15-8-08	1,34,600 26-8-09	1,108,795 10-8-10	2,60,800 6-9-11	
Kotri	84,300 11-9-02	2,31,400 11-8-03	9,000 5-7-04	2,74,300 12-8-05	3,56,500 25-8-06	1,28,400 28-8-07	2,00,000 20-8-08	1,15,800 31-8-09	9,39,442 27-8-10	2,60,400 16-9-11	
River Jhelun	n										
Mangla	66,900 22-8- 2002	4,07,400 03-8- 2003	47,600 18-8- 2004	1,69,600 1-7-2005	1,62,100 5-8-2006	1,34,400 1-7-2007	94,200 7-8-2008	9,59,00 21-7-09	2,49,100 10-8-10	7,200 12-8-11	
Rasul	34,700 13-8-02	85,300 4-9-03	42,800 22-7-04	95,700 16-7-05	1,42,000 4-8-06	43,400 8-7-07	44,500 25-9-08	81,300 16-8-09	2,25,496 30-7-10	1,31,300 16-9-11	Table c
River Chena	b										ontin
Marala	2,24,800 14-8-02	52,900 05-9-03	15,800 4-9-04	92,200 17-7-05	1,65,900 13-7-06	34,100 7-7-07	20,600 16-9-08	56,800 17-8-09	2,63,795 30-7-10	9,69,00 17-9-11	uing ah
Khanki	2,40,400 14-8-02	1,37,200 15-8-03	93,200 17-8-04	3,33,700 07-7-05	3,33,000 3-9-06	1,13,800 12-8-07	1,63,500 31-7-08	93,200 28-7-09	2,82,418 6-8-2010	1,42,500 16-9-11	ead on
Qadirabad	2,26,400 14-8-02	1,72,600 05-8-03	1,06,900 17-8-04	3,68,100 08-7-05	4,18,700 4-9-06	1,41,100 14-8-07	1,93,400 31-7-08	97,100 29-7-09	3,27,637 7-8-10	1,42,500 17-9-11	the sub
Trimmu	1,08,600 17-8-02	1,69,300 05-8-03	90,000 18-8-04	3,69,800 8-7-05	4,43,200 4-9-06	61,900 1-7-07	1,90,400 1-8-08	76,400 29-7-09	3,19,733 7-8-2010	1,66,400 17-9-11	sequent
Panjnad	56,800 21-8-02	1,22,800 08-8-03	42,800 20-8-04	1,62,100 11-7-05	2,66,300 7-9-06	55,300 2-7-07	54,200 6,-8-08	43,800 21-8-09	3,23,026 11-8-10	1,27,800 20-9-11	page
River Ravi											
Madhopur	-	81,400 12-8-03	19,400 25-8-04	87,700 22-7-05	1,89,000 11-9-06	36,700 5-7-07	37,100 28-8-08	17,800 26-8-09	3,10,117 13-8-10	1,38,300 24-9-11	
Jassar	69,500 14-5-02	37,900 5-8-03	30,600 18-8-04	40,200 8-7-05	36,400 3-9-06	22,900 4-7-07	38,600 20-8-08	10,100 29-7-09	21,100 21-8-10	24,300 13-8-11	
Ravi Syphon	42,100 15-8-02	40,700 23-9-03	37,600 19-8-04	30,700 8-7-05	29,300 2-9-06	38,000 24-7-07	32,000 17-8-08	23,900 30-8-09	41,200 21-8-10	42,300 14-8-11	
Shahdara	37,000 15-8-02	38,800 5-8-03	51,900 2-8-04	30,200 17-8-05	23,600 28-7-06	30,600 1-7-07	32,000 18-8-08	22,200 13-8-09	41,900 21-8-10	43,000 14-8-11	
Balloki	28,100 15-8-02	44,700 06-8-03	40,400 20-8-04	25,200 8-7-05	41,300 3-9-06	37,900 1-7-07	67,200 18-8-08	14,000 31-7-09	41,200 23-8-10	44,000 15-8-11	
Sidhnai	16,100 18-8-02	25,500 09-8-03	12,800 23-8-04	6,200 17-8-05	10,700 1-8-06	14,700 19-8-07	38,700 24-8-08	8,500 24-8-09	16,800 28-7-10	2,39,00 2-9-11	
River Sutlej											
Sulemanki	8,500 3-9-02	7,000 09-9-03	4,200 10-8-04	18,000 13-8-05	9,100 10-9-06	9,100 8-8-07	90,100 18-8-08	3,400 3-8-09	44,300 30-9-10	76,200 29-8-11	
Islam	2,100 20-9-02	1,700 15-9-03	8,00 16-8-04	16,400 16-8-05	1,800 4-7-06	2,800 13-7-07	35,800 25-8-08	1,200 10-9-09	28,900 20-9-10	49,900 4-9-11	

 Table: 3.12: Historic Peak Discharges (Cusec) in Major Rivers

Site	Max of	Max of	Max of	Max of	Max of	Max of	Max of	Max of	Max of	Max of
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow	Outflow
1.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.
River Indus										
Tarbela	278000	338,100	240,100	486,900	3,02,900	3,36,000	242,300	311700	3,35,800	2,70,000
	05-8-12	14-8-13	15-8-14	26-7	17-7	03-8	2-8	9-8	02-9	22-07
Kalabagh	277000	472,303	249,992	528,698	3,51,490	419,460	311,154	354830	4,57,031	2,91,309
	17-7-12	13-8-13	25-7-14	02-8	05-7	03-8	15-8	15-8	02-9	01-08
Chashma	285500	620,672	257,632	636,512	3,73,659	446,361	319,912	370823	4,73,447	3,44,907
	08-7-12	14-8-13	22-6-14	3-8	05-7	05-8	15-8	2-8	04-9	02-08
Taunsa	235400	516,017	233,110	604714	3,43,024	423,861	276,215	378194	4,79,866	3,06,489
	10-9-12	17-8-13	18-7-14	5-8	05-7	06-9	17-8	14-8	06-9	04-08
Guddu	236100	542,100	34,0864	735,246	2,97,928	428,640	227,270	386041	5,40,750	2,66,344
	10-9-12	20-8-13	18-9-14	3-8	11- 7	09-8	20-8	21-8	09-09	07-08
Sukkur	210000	454,995	26,8935	660216	2,25,205	333,108	156,025	303625	4,58,390	19,3,045
	14-9-12	24-8-13	20-9-14	5-8	19-8	11-8	21-8	22-8	10-9	07-08
Kotri	138800	344,866	11,0345	603084	1,38,455	210,923	60,740	198579	2,83,910	95,085
	21-9-12	30-8-13	25-9-14	5-8	10-8	18-8	26-8	29-8	19-9	12-08
River Kabul										
Nowshera	1,00,700	155,100	1,18,100	165800	80,700	87,000	1,05,300	1,05,000	1,51,000	87,400
	8-712	15-6-13	4-7-14	NR	04-7	12-7	24-7	29-8	02-9	22-07
River Jhelum										
Mangla	44700	45,214	500,000	109232	62,701	67,882	69,127	125171	1,25,803	80,315
	05-8-12	13-8-13	5-9-14	26-7	07-8	22-9	7-7	17-6	28-8	<mark>01-08</mark>
Rasul	31400 05-8-12	23,610 19-9-13	516,000	99100 27-7	46,562 27-8	39,230 22-9	39,230 8-7	90554 19-6	1,26,951 28-8	43,135 15-06
River Chenab										
Marala	149200	369,690	858,000	153408	3,93,690	1,87,472	168,278	211000	2,98,884	1,71,150
	04-8-12	15-8-13	6-9-14	12-7	07-8	19-7	13-8	31-7	27-8	<u>29-07</u>
Khanki	186400 04-8-12	410,331 15-8-13	947,000	152000 13-7	4,18,736 07-8	1,70,021 13-7	182,025 13-8	181944 31-7	2,86,230 28-8	1,83,688 29-07
Qadirabad	180800 05-8-12	403,403 15-8-13	904,000	161100 13-7	4,05,542 08-8	1,57,842 19-7	172,031 14-8	159544 1-8	2,67,540 28-8	1,67,812 29-07
Trimmu	73700 07-8-12	267,609 20-8-13	626,000	135000 13-7	1,53,339 10-8	89,345 05-8	81,680 16-8	93021 22-8	1,96,077 01-9	1,06,967 <u>31-07</u>
Panjnad	65600	3,17,261	45,3570	135866	116029	63488	87383	70556	133646	59,725
	17-9-12	25-8-13	16-9-14	30-7	13-8	8-8	27-8	26-8	05-9	03-08
River Ravi										
Jassar	30500	67,700	67,700	36100	38,400	46,439	66,641	51000	30690	20,200
	26-8-12	16-8-13	7-9-14	15-8	08-8	10-8	25-9	18-8	28-8	27-08
Ravi Siphon	39800	73,600	93,300	39200	45081	46100	37,936	37936	34,531	37228
	24-8-12	18-8	8-9-14	24-9	28-7	2-8	14-8	19-8	28-8	14-7
Shahdara	40800	74,880	91,400	38400	44,595	39,313	37,587	37200	34,308	36,477
	22-8-12	17-8-13	8-9-14	24-9	08-8	02-8	14-8	19-8	28-8	14-07
Baloki	29300	97,970	118,000	57700	37,165	36,790	39,310	34900	37,250	32,200
	23-8-12	18-8-13	9-9-14	24-9	09-8	11-8	16-8	19-8	29-8	22-07
Sidhnai	24600	73,504	71,112	38500	12325	26954	8857	15384	28800	11,215
	14-9-12	23-8-13	12-9-14	28-7	1-8	7-8	1-8	2-9	31-8	25-08
River Sutlej										
Sulemanki	16900	78,846	21,383	49600	24,492	20,893	34772	66459	11897	7,212
	9-9-12	22-8-13	7-9-14	17-8	31-8	15-8	19-8	24-8	24-7	15-09
Islam	12700	70,932	17,807	43300	11145	14221	16460	52355	6609	3,971
	13-9-12	25-8-13	8-9-14	21-3	31-8	16-8	3-10	31-8	26-8	18-09

Source: FFC/PIDs/WAPDA/IRSA

## Table 3.13: Flood Peaks (Cusec) Recorded During 2022 Monsoon Season

Sitor	Historic Peaks (Previous Years)		Peak Inflows -2022		Peak (	Dutflows -2022	Classification	
Siles	Outflow	Date	Inflow	Date & Time	Outflow	Date & Time	Glassification	
River Indus								
Tarbela*	604,000	30-7-2010	404,000	26-08 at 2359 hrs	419,600	26-08 at1800 hrs	Medium Flood	
Kalabagh	950,000	14-7-1942	427,217	28-08 at 0600 hrs	423,271	28-08 at 0600 hrs	Medium Flood	
Chashma^	1036,673	01-8-2010	525,437	28-08 at 1200 hrs	523,937	28-08 at 1200 hrs	High Flood	
Taunsa	959,991	02-8-2010	622,095	30-08 at 0600 hrs	622,095	30-08 at 1500 hrs	High Flood	
Guddu	1199,672	15-8-1976	576,075	23-08 at 1800 hrs	576,075	23-08 at 1800 hrs	High Flood	
Sukkur	1161,000	16-8-1976	579,753	25-08 at 0600 hrs	579,753	25-08 at 0600 hrs	High Flood	
Kotri	981,000	14-8-1956	626,193	10-09 at 0600 hrs	600,018	10-09 at0600 hrs	High Flood	
River Kabul								
Nowshera	450,000	29-07-2010	-	-	336,500	28-08 at1800 hrs	V. High Flood	
Warsak			-	-	139,086	27-08 at 12:30 hrs	High Flood	
River Jhelum								
Mangla~	1090,000	10-09-1992	100,000	28-07 at1200 hrs	50,171	11-10 at 1800 hrs	Normal	
Rasul	952,170	10-9-1992	37,045	28-06 at 1800 hrs	23,610	22-06 at 1200 hrs	Normal	
River Chenab								
Marala	1100,000	26-8-1957	226,000	28-07 at 1600 hrs	211,000	28-07 at 1600 hrs	High Flood	
Khanki	1086,460	27-8-1959	216,907	12-08 at 0500 hrs	210,945	12-08 at 0500 hrs	High Flood	
Qadirabad	948,530	11-09-1992	221,149	12-08 at 1000 hrs	202,149	12-08 at 1000 hrs	High Flood	
Trimmu	943,225	08-7-1959	144,147	31-07 at 2359 hrs	122,115	18-08 at 1800 hrs	Normal	
Panjnad	802,516	17-8-1973	121,764	03-08 at 0600 hrs	112,564	03-08 at 0600 hrs	Normal	
River Ravi								
Jassar	680,000	05-10-1955	-	-	63,720	16-08 at 1500 hrs	Low Food	
Shahdara	680,000	22-9-1988	-	-	31,415	02-08 at 0600 hrs	Normal	
Balloki	336,200	28-9-1988	55,245	18-08 at1800 hrs	35,235	03-08 at 0600 hrs	Normal	
Sidhnai	330,210	02-10-1988	26,552	13-08at 0600 hrs	22,843	28-07 at2359hrs	Normal	
River Sutlej								
Suleimanki	598,872	08-10-1955	24,785	20-07 at0600 hrs	17,876	20-07 at0600 hrs	Normal	
Islam	492,581	11-10-1955	13,326	23-07 at 1800 hrs	12,501	23-07 at 1800 hrs	Normal	

\* Max. Water Level = 1550.12 feet on 3-9-2022 at 0600 hrs.

^ Max. Water Level = 649.00 feet on 12-7 at 2359 hrs.

~ Max. Water Level = 1193.10 feet on 16-9 at 1200hrs

Source: FFC/PIDs/WAPDA/IRSA

## 3.5.8 Post Disaster Assessment of Damages and their Restoration Cost

In order to obtain preliminary physical damage and economic loss assessment from provinces and federal line agencies with respect to 2022-floods, a Flood Coordination Cell was established in Ministry of Planning, Development & Special Initiatives. For Post Disaster Need Assessment (PDNA) exercise, three committees were constituted and focal persons nominated.

An Orientation meeting was organized on different sectors by the Asian Development Bank (ADB) and the World Bank (WB). They also shared templates mutually agreed with development partners for collecting useful information. For Sectoral Technical Committee, Ministry of Water Resources nominated Mr. Ahmed Kamal, Chief Engineering Advisor/ Chairman Federal Flood Commission as a Focal Person for the PDNA assignment. An online Orientation Meeting for Post Disaster Needs Assessment (PDNA) was held on **9<sup>th</sup> September 2022**.

All the stakeholder including Provincial Irrigation Departments (Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan), Federal Line Agencies (WAPDA, G-B & AJ&K) were requested for submission of damaged infrastructure details as per finalized proforma by Development Partners on **9**<sup>th</sup> **September 2022.** 

Interim data regarding Irrigation, Drainage & Flood Protection Infrastructure of WAPDA, PIDs & FLAs (on the template shared by ADB) was forwarded to Ministry of Water Resources and copy to M/o PD&SI, & SUPARCO on **20<sup>th</sup> September 2022**. Meeting of the Strategic Policy Committee on Post Disaster Needs Assessment (PDNA) was held on **21<sup>st</sup> September 2022**. Focal Persons of PIDs were requested for submission of finalized damages data to M/o PD&SI under intimation to FFC on **22<sup>nd</sup> September 2022**. Online PDNA Core Team Meetings were held on **24<sup>th</sup> September 2022** and 28th **September 2022**.

On the direction of M/o PD&SI, damaged infrastructure details were shared with the World Bank, ADB and Ministry of Planning Commission on **30<sup>th</sup> September 2022**. Final damaged infrastructure details were shared with the World Bank, ADB, UNDP and Ministry of Planning Commission on **6<sup>th</sup> October 2022**.

Total damages occurred to Irrigation, Drainage and Flood Protection Infrastructure in Punjab, Sindh, Khyber Pakhtunkhwa (Including Merged Areas), Balochistan, G-B and AJ&K alongwith WAPDA during Monsoon Season 2022 were reported to the tune of **Rs 154.465 billion**. Summary of the damages is given in **Table 3.14**:

Sr. #	Province/ Region	No. of Structures Damaged	Estimated Cost (Rs. in Billion)	
Α.	WAPDA			
1.	WAPDA	31	9.393	
	Sub-Total (A)	31	9.393	
В.	PIDs & Federal Line Agencies (FLAs)			
2.	Punjab	204	5.208	
3.	Sindh (Including Small Dams)	1,366	94.78	
4.	Khyber Pakhtunkhwa	2,885	22.387	
5.	Balochistan (Including Small Dams)	974	22.18	
6.	Azad Jammu & Kashmir (Water Channels, Water storage tanks & Flood Protection Structures)	82	0.115	
7.	Gilgit-Baltistan	464	0.402	
	Sub-Total (B)	5,975	145.072	
	Grand Total (A+B)	6,006	154.465	

## Table 3.14: Damages to Irrigation, Drainage & Flood Protection Infrastructure

The above damages to the water related infrastructure caused by the 2022 floods have been indicated in PDNA Report as US\$710.6 million. The highest damage was reported to the flood protection infrastructure is US\$258.5 million (36 %) followed by damage to Irrigation Channels as US\$229.9 million (32 %). The subsequent damages as reported to drainage system are US\$96.6 million (14 %); dams, Headworks, and weirs as US\$66.4 million (9 percent); and other supporting infrastructure at US\$59.3 million (8 percent) besides damages to Tube wells and inspection roads, reported as under assessment.

According to Post-Disaster Needs Assessment (PDNA) Report dated October 28, 2022, total 2022 flood damages have been assessed to exceed **USD 14.91 billion** and total economic losses to reach about **USD 15.23 billion**. Estimated needs for Rehabilitation and Reconstruction in a resilient way are at least **USD 16.26 billion**. Sector-wise details of 2022 Flood Damage, Losses and Restoration/ Rehabilitation & Reconstruction Needs are shown in **Figure 3.9**:



### Figure 3.9: Sector wise detail of 2022 Flood Damage, Losses and Restoration/ Rehabilitation & Reconstruction Needs

## 3.5.9 Country-Wide 2022 Flood Damages to Public & Private Infrastructure

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 2022 are given in **Table 3.15**.

## Table 3.15: Country-Wide 2022 Flood Damages to Public & Private Properties

Province/ Region	Persons Died	Persons Injured	Houses Damaged	Roads (km)	Bridges	Livestock	Affected Population
Punjab (including ICT)	224	3858	67,981	877	15	205,106	4,844,253
Sindh	799	8422	1,885,029	8,389	165	436,435	14,563,770
Khyber Pakhtunkhwa (incl. Merged Areas)	309	370	91,464	1,575	107	21,328	4,350,490
Balochistan	336	187	241,659	2,222	58	500,000	9,182,616
AJ&K	48	24	555	19	33	792	53,700
Gilgit Baltistan	23	06	1,793	33	61	609	51,500
G. TOTAL	1739	12867	2,288,481	13,115	439	1,164,270	33,046,329

\*Source; NDMA

## 3.5.10 Futuristic Measures to avoid 2022 Floods like devastation

Pakistan Engineering Council (PEC) organized a Brainstorming Session on **28<sup>th</sup> September 2022** regarding 2022 torrential flash floods and assessment of damages occurred to overall Infrastructure in Pakistan. The agenda of the session was to constitute a high profile PEC's Technical Committee under the leadership of Chairman, PEC to identify the root-causes of recent devastating flash floods of 2022 across Pakistan, make recommendations for rapid rehabilitation and recommend Way Forward to avoid such major destruction in future. Accordingly, a Central Technical Committee was constituted by PEC and subsequently two meetings of the Committee were held respectively on **16<sup>th</sup> November 2022** and **22<sup>nd</sup> December 2022** at PEC's HQ office at Islamabad.

Based on the above, a Policy Paper was prepared to identify the root-causes of recent devastating flash floods of 2022, make recommendations for rapid rehabilitation and take futuristic measures to avoid such major destruction in future. This paper identifies main causes of 2022 floods as (1) heavy rainfall caused by tropical weather (2) Deforestation (3) Inadequate/ inappropriate drainage systems designs and Poor Operation and Management of these systems (4) Encroachment

and unauthorized settlement in flood plains. Ever highest rains in Sindh and Balochistan made the situation more devastating. Since concerned authorities were not prepared for such sudden high downpour and drainage system was not operating properly, 2022 flash flood water couldn't be evacuated in time and heavy damage occurred. Encroachments in the waterways were also big obstruction in safe evacuation/ drainage of water. Further, Roads were either seriously damaged or inundated so the heavy machinery could not reach on site in time.

Based on the assessment of causes of 2022 floods stated above, following are some of the important measures recommended to avoid wide-spread flood devastation in the country, in future: -

- a. Immediate implementation of Fourth/4<sup>th</sup> National Flood Protection Plan which is already too late and further delay will cause loss to exchequer. The implementation of NFPP-IV has also been strongly recommended under 4RF (Resilient, Recovery, Rehabilitation & Reconstruction) Framework Report prepared by PD&SI Division.
- b. Construction of water storages, in particular for hill torrent regions. Early completion of under construction dams and immediate execution of already planned dams.
- c. Implementation of National Master Plan on Flood Telemetry Network
- d. Installation of Automatic weather stations across the country (especially in Balochistan).
- e. Establishment of Regional Flood Forecasting and warning Centers.
- f. Flood dispersal structures along major hill torrents
- g. Comprehensive study for remodeling of already constructed drainage channels (MNV, RBOD and LBOD system) to cater for storm water also in addition to irrigation effluents.
- h. Restoration and remodeling of natural waterways / drains in the light of lessons learnt from super floods of 2010 and 2022 based on the review and revision of return period of design discharges by all relevant authorities in the light of Flood 2022.
- i. Urban Flood Management and preparation of SOP's by District Administration; SOPs also for managing torrential heavy flood flows w.r.t their containment in existing irrigation and drainage structures.
- Enhanced Flood Resilience of major cities through structural interventions (Additional flood bypass channels). Likewise, replication of Lai Nullah Flood Forecasting System of Rawalpindi & Islamabad in other major cities;
- k. Urban flood management should also be pondered by FFC in collaboration with provincial governments for implementable pragmatic solutions to save urban areas from havocs of urban flood ponding;
- I. Large scale forestation/watershed management in upper catchments of all the rivers for reducing flood intensity in upper reaches and support combating climate change impacts;
- m. Unplanned urban development without appropriate drainage system should not be allowed and that in future the normal and storm drainage must be separated to avoid this major issue;

- n. The rehabilitation and reconstruction of strategic damaged works i.e. Roads, Bridges, Dams and Flood Protection Bunds should be undertaken on priority, well before next monsoon season;
- o. All storms waterways, Rivers, Hill torrents should be cleared off of wood logs and other obstructions and steps be taken to remove/ prevent encroachments with zero tolerance;
- p. Increased allocation of funds/ improved yardstick for O&M for existing flood protection infrastructure;
- Review of existing design criteria and standards to ensure Reinforcing/Climate proofing of the flood protection, irrigation & drainage infrastructure and to also consider applying additional safety factors, if so required;
- r. Review the existing network/ assess capacities of the already determined breaching sections on Barrages/Bridges, increase their capacity where required and make additional interventions/ provide flood bypass channels, if so needed;
- s. Technical studies for preparation of Emergency Contingency Plans for Tarbela & Mangla – Existing Contingency Plans at major reservoirs (Tarbela & Mangla) do not incorporate any contingency measures in case of their failure (God forbid) in future due to historical maximum floods and/or any other natural calamity like earthquake. Regarding preserving the long-term viability and sustainability of the irrigation, drainage, and flood control infrastructure, both the major reservoirs are crucial. In this context, technical studies should be conducted to prepare such Contingency Plans at priority for all major dams in Pakistan in particular for Tarbela & Mangla.
- t. Nature-based solutions (NbS) need to be promoted to ensure increased resilience to future floods and climate change impacts.
- u. Enactment of River Act in all provinces and strict implementation of existing land use regulations.
- v. Institutional Capacity Building and strengthening of Federal Flood Commission into vibrant Flood Management Authority with representation of all Provinces of Pakistan.

## 3.5.11 Post 2022 Floods Recommendations by International Experts

In wake of devastating 2022-floods, Chinese Governmental Flood Control Expert Group and Dutch DRR Mission visited Pakistan respectively in October 2022 & December 2022 and had in-person meetings with the stakeholder departments besides field visit to flood affected areas in Sindh province. With a view to ensure enhanced protection against future floods, Key recommendations made by the **Chinese Governmental Flood Control Expert Group** are given below:

- Construction Management of River-Related projects of Provinces to incorporate flood governance i.e. providing outlets for flood flows and space for flood storage;
- Reinforcement of major Flood Protection Bunds/Dikes;
- Construction of River Regime Control & Deflection Structures for major river reaches of Lower Indus;
- Flood Control through linking/ connecting rivers, drains/ canals etc.;

- Dredging of Drains and improve Drainage Capacity of Farmlands in areas prone to torrential and pluvial flash floods;
- Flood control required for managing floods exceeding design standards;
- Development of rainstorm & flash flood analysis models for small watersheds/ catchments of hill torrents;
- Forecasting Technology for Snow and Glacial Lakes Outburst (GLOFs);
- Measures for improving transmission of flood early warnings at communities' level;
- Build a National High-Resolution Comprehensive Database containing all elements of hydro metrology/ climatology;
- Formulation of an authoritative and binding Flood Prevention Plan and subsequent Flood Control Regulation scheme for Indus River Basin, by the Federal Government.

Likewise, **Dutch Experts,** based on their post 2022 flood analysis, made following key recommendations: -

- Thorough analysis of 2022 floods based on hydrodynamic and 2-dimentional modeling with LiDAR data (with overarching focus on Sindh province);
- Assessment of various flood generation processes and regional climate change analysis (PMD/GCISC etc.);
- Re-assessment of flow capacity and velocity of rivers (Through a separate study);
- Study on watershed management of dry land hill torrents;
- Analysis of existing Flood Management SOPs of important irrigation and drainage structures;
- Review of NFPP-IV and past flood events to formulate a proper NFPP-V including appropriate enhancement of drainage systems and measures for hill torrents flows;
- A planning study on operational requirements and potential of existing and under construction vis-à-vis new feasibility studies on multipurpose dams;
- Linking all the ongoing and upcoming projects with cross cutting issues of flood risk;
- Strengthening water governance at 'sub-basin' and 'basin' scale (through IRSA);
- Providing flood shelters in low lying areas of Sindh province and improving drainage;
- Introduce Nature based solutions through spatial catchment planning in hill torrent areas and land-use rights for community-based rainwater harvesting, improved vegetation/grazing and flood dispersion structures for water use and flood control;
- Updating of existing flood forecasting systems to incorporate the impact of newly introduced major infrastructure works (bridges, dikes etc.);
- Extension of present flood forecasting system to cover pluvial flooding; &

• An audit of legal frameworks and mandates to clarify the mandate of different organizations to eliminate overlaps in national and provincial strategic control.

**JICA Experts** also visited Pakistan after 2022 floods and recommended that disaster risk reduction should be considered as a development issue through the Sendai Framework. They stressed to recognize importance of intensive development on Flood DRR in Indus River to protect flood plains with concentration of population and assets. Subsequently, Government of Japan through JICA is supporting Pakistan side for conducting dikes' diagnostic survey, installation of 45 flood telemetry stations across the country and also for revamping of flood damaged dikes/ structures located along the Indus River & its tributaries.

Post 2022-flood visit of **US Delegation** was hosted by NDMA. US delegates also visited FFC and suggested for Bilateral cooperation in the field of Hydrological and Hydraulic Modelling for flood forecasting in the Upper Indus Basin using some existing HEC-HMS Rainfall/Snowpack/Snowmelt/Runoff models mostly above Tarbela Reservoir, besides for modelling the watershed above Mangla Reservoir. Accordingly, Pakistan side proposed a long term Capacity Building Program for Flood Managers and Modelers of Pakistan through US Army Core of Engineers for future collaboration. Besides, a comprehensive program for Technical Capacity Development in the field of Water Management, particularly Flood Forecasting, may also be put together that would benefit the Pakistani Government and people.

## 3.6 Future Vision and Technical Initiatives of FFC

# **3.6.1** Role of FFC as Member of the National Flood Response Coordination Centre (NFRCC)

Given unprecedented nature of flood situation in Pakistan during current Monsoon Season, the Honourable Prime Minister<sup>1</sup> of Pakistan, on September 01, 2022, directed to establish of a National Flood Response Coordination Center (NFRCC) to better synergize national response to the disaster caused by ever extreme torrential flash flooding of 2022. NFRCC has representation from Federal Ministries (including MoWR), Provincial Governments and Armed Forces. **The CEA/CFFC was designated as Focal Person from MoWR** to attend daily meetings of NFRCC and coordinate various facets of the response to 2022 floods.

NFRCC was established under the headship of the Prime Minister of Pakistan and with Minister for Planning, Development and Special Initiatives as its Deputy Chairman, besides, Commander Army Air Defence Command as National Coordinator. The Secretariat of NFRCC was housed at the NEOC, ERRA Headquarters to function under the National Coordinator. NFRCC performed its functions as a bridge between Government Institutions, Disaster Management Authorities and donors to ensure a seamless rehabilitation process of flood affectees all across Pakistan.

The CEA/CFFC regularly attended the NFRCC meetings held so far. Daily update on overall flood situation including details related to flood situation at Manchar lake, LBOD, RBOD etc., routing of flood peaks through major reservoirs, evacuation of flood water through relief cuts as well as breaches that naturally occurred and subsequent status with regard to plugging of these breaches, was presented to NFRCC by the CEA/CFFC during entire flood/ monsoon season 2022. There held also the presentation sessions relating to structural flood damages that occurred to

<sup>&</sup>lt;sup>1</sup> Reference PM's Office U.O. No. 3(1)/DS(Cabinet)/2022(559), dated 1<sup>st</sup> September 2022

existing flood protection, irrigation & drainage infrastructure and flood fighting activities carried out by the field formations in Provinces besides some presentation on other related topics (Like Thar Canal Project), as exclusively assigned by the NFRCC.

## 3.6.2 Updation of National Flood Protection Plan (NFPP-IV)

The 4<sup>th</sup> National Flood Protection Plan (i.e. NFPP-IV) was approved by CCI in its 31<sup>st</sup> meeting held on May 02, 2017 based on which, an Umbrella PC-I of National Flood Protection Plan-IV (NFPP-IV) costing to Rs. 332.246 billion was prepared and submitted to MoWR on 16<sup>th</sup> November 2018 for the approval of PD&SI Division. The same was consistently pursued since 2019 in the light of instructions issued by PD&SI Division. However, it could not be implemented for want of funds. Meanwhile, country faced devastating 2022-rains/floods last year that prompted updation of NFPP-IV based on lessons learnt during 2022 floods as per directions of the Prime Minister. M/s Deltares of the Netherlands is doing the updation work.

## 3.6.3 Flood Protection Sector Project-III (FPSP-III) updated

The investment plan of FPSP-III carries the priority sub-projects reflected under CCI approved National Flood Protection (NFPP-IV) besides those identified in post NFPP-IV approval period by the PID/ FLAs. FPSP-III aims to reduce flood damages to public & private infrastructure, future threats and mitigate residual hazards. Specific objectives are given as under:

- i) Reduction of flood losses.
- ii) Protection of cities & vital assets/infrastructure and agricultural lands etc.
- iii) Strengthening of flood forecasting & warning systems.
- iv) Integrated flood management for riverine & flash.
- v) Wetland managements for flood control etc.

CCP of FPSP-III has been approved by CDWP on **3.3.2020**. Based on this, umbrella PC-I at estimated cost of **Rs 332.246 million** was prepared by FFC and processed for approval by the competent forums, however, it could not be implemented for want of funds. On the directions of PD&SI Division issued in the aftermath of 2022 floods, Umbrella PC-I of Flood Protection Sector Project-III (FPSP-III) costing **Rs 194.625** billion has been updated in consultation with all stakeholders which was processed enroute MoWR for approval of competent forum (CDWP/ECNEC) on **December 16**, **2022**.

In view of scale and severity of devastating flooding of 2022 and emerging flood management issues related to climate change, the situation direly requires that updated FPSP-III is approved at priority & subsequently implemented on ground in order to augment existing structural and non-structural flood protection/ management works. The important structural and non-structural interventions proposed for implementation under FPSP-III (Refer again Table 3.5), include the following: -

a) Flood protection works along the major/ tributary rivers, storage dams and flood diversion/ dispersal structures along the hill torrents, including rehabilitation/ restoration and strengthening/ remodeling of flood embankments/dikes etc. (151 Sub-Projects Costing Rs 159.182 Billion proposed in the four Provinces, G-B and AJ&K (Punjab 12 No., Sindh 40 No., Khyber Pakhtunkhwa with Merged Areas 56 No., Balochistan 29 No., Gilgit- Baltistan 10 No. and AJ&K 4 No.);

- b) Improvement of Flood Forecasting & Early Warning System of PMD by installation of AWS and establishment of six (06) new Regional FF&EW Centres (2 No. Sub-projects costing Rs. 5.025 Billion);
- c) Expansion/ Strengthening of existing Flood Telemetry, Glacial Monitoring, Surface Water Hydrology & HF Radio Network by WAPDA including formulation of National Watershed Management Plan (5 No. Sub-projects costing Rs. 15.319 Billion);
- d) Ecosystem-based adaptation to floods contributes towards better climate resilience, water and food security and sustainable livelihood - Recharge Pakistan Project costing Rs. 6.000 Billion
- e) LiDAR Survey for Analysis of Flood Plains of Rivers Indus, Chenab, Jhelum & Kabul, costing Rs. 0.780 Billion
- f) Establishment of Project Coordination & Management Unit, Hiring of the Project Supervisory Consultants, including urban flood management & rainwater harvesting projects etc. including technical studies proposed by FFC as well as PCRWR. costing Rs. 8.318 Billion

Implementation depends on approval and identification of donor besides other formalities including establishment of PCMU and hiring of Consultants etc.

# **3.6.4** FFC's Role for Preparation of 4 RF (Resilient, Recovery, Rehabilitation & Reconstruction) Framework and PDNA Report of 2022 floods

Almost all sectors of economy sustained phenomenal damages during the devastating 2022 floods. FFC coordinated with all stakeholder departments for collection of damages occurred to flood protection, irrigation and drainage infrastructure and provided tangible inputs to PDSI Division for preparation of Post-Disaster Needs Assessment (PDNA) Report of the 2022 Floods through ADB, WB etc. In view of historically extreme flood of 2022, PD&SI Division also prepared the 4 RF (Resilient, Recovery, Rehabilitation & Reconstruction) Framework Report highlighting the fiscal requirements to build back better (BBB). During the various meeting held in this regard, it was stressed by O/o CEA/CFFC that funding requirements for NFPP-IV and FPSP-III should be made part of the 4-RF report so that same is available once potential donors are approached through EAD to meet these requirements. Accordingly, implementation of updated FPSP-III and updated NFPP-IV has been strongly recommended under 4 RF (Resilient, Recovery, Rehabilitation & Reconstruction & Recovery, Rehabilitation & Recovery, Rehabilitation & Recovery, Rehabilitation & Recovery.

## 3.6.5 National Master Plan for Flood Telemetry – Included in FPSP-III

WAPDA under the overall coordination of FFC and with the Technical Assistance of ADB in the form of Technical Experts has prepared National Master Plan for Flood Telemetry for improvement in the Flood Early Warning System on country-wide basis including four provinces, GB, AJ&K and Federal Capital area.

The scope of work envisaged under the Master Plan is as under;

- i) Review the status of Hydrological Gauging Network (telemetry/manual) installed by various government departments and agencies, their condition, and their data sharing mechanism as required for an assessment.
- ii) Establish the requirement for installation of telemetry system across the country based on gaps in existing system, hydrological condition of respective catchments/ sub-catchments fulfilling International Data

Standards / requirements to ensure registering of flow in all main rivers, secondary and tertiary rivers, small nullahs and streams, so that exact/ realtime estimate of flood discharges entering into main Indus & its tributary rivers (Jhelum, Chenab, Ravi, Sutlej and Kabul Rivers) is available to be ultimately used in precise flood flows forecast generation.

- iii) Prepare National Master Plan including all necessary details alongwith GIS Maps prepared for identified location for telemetry stations in Pakistan.
- PC-I of the Plan is covered under FPSP-III and shall be taken-up for implementation subject to realization of funds for FPSP-III.

### 3.6.6 Recharge Pakistan Project: Building Pakistan's Resilience to Climate Change through Ecosystem–based Adaptation for Integrated Flood Risk Management (MOCC, WWF & FFC)

The Ministry of Climate Change in collaboration with FFC, MoWR, and WWF- Pakistan has launched this 30 years long project, to address the environment challenges such as super floods, droughts and widespread rains and to build climate resilience of the most vulnerable communities living in the areas in the vicinity of Indus Basin. The project consists of three (03) phases with each phase spanning over ten (10) years. This long-term project envisions that by 2050, ecosystem-based adaptation contributes towards better climate resilience, water and food security and sustainable livelihood. More than 10 million people, which makes around 5% of Pakistan's population, will directly benefit from the project, while 20 million people across 50 vulnerable districts of Pakistan will be the indirect beneficiaries.

The Project will be implemented in selected sites, spanning over a stretch of 1,300 km of the Indus River, across Khyber Pakhtunkhwa, Punjab, Sindh and Balochistan. The sites will be selected based on (i) flood risks, (ii) climate projections, (iii) water storage, (iv) recharge potential, and (v) needs of the communities.

The Project will contribute to relevant policies and plans (National Climate Change Policy, National Water Policy, NFPP-IV and SDGs) and will lead to additional water reservoir capacity on the river system to regulate water discharge during high floods and will promote local rainwater harvesting and development of small storages on runoff the rivers during peak flows.

The vision, impact and project's components are described below: -

**Vision:** Ecosystem-based adaptation to flood risks contributes towards better climate resilience, water and food security and sustainable livelihoods in Pakistan

**Impact:** Reduction in flood risk and enhancement of water recharge in the Indus Basin, building resilience of approximately 10 million inhabitants of low lying areas and vulnerable ecosystems.

Main components of the project as the backbone of this project are as under;

- (i) Ecosystem-based Adaptation for integrated Flood Risk Management;
- (ii) Enhancing Resilience of vulnerable Communities to climate change; &
- (iii) Enabling a paradigm shift Ecosystem-based Adaptation in Pakistan.

**Rs. 6.00 Billion** has been kept under FPSP-III for the implementation of prospective interventions. A detailed feasibility study/ assessment of the central Indus wetlands (downstream Tarbela Dam to downstream Sukkur Barrage) shall be conducted as a step-1 with one-year through GCF and will result in detailed funding proposal to be submitted to GCF. The purpose is to identify potential sites for flood plain and hill

torrent management in order to store extra flood water, revive the adjoining wetlands, recharge ground aquifers and provide social and economic benefits to the local communities.

#### 3.6.7 Project for Capacity Development of Effective River Dikes Management Response to 2022 Flood

In response to the request from the Government of Islamic Republic of Pakistan (hereinafter referred to as "Pakistan") Japan International Cooperation Agency (hereinafter referred to as "JICA") Head Quarter dispatched Disaster Management Advisory Team on Flood Prospective from **October 31, 2022 to November 11, 2022**. The main purpose of the JICA's Advisory Team was to discuss about the Flood Telemetry GA Project, Rehabilitation work of Damaged Dikes/Embankments on Indus River and new Technical Cooperation scheme especially on Flood Management.

The JICA HQ Team held three (03) meetings with Federal Flood Commission (hereinafter referred to as "FFC") and other stakeholders (Provincial Irrigation Departments of Punjab & Sindh and WAPDA) respectively on **October 31, 2022** and **November 07 & 11, 2022** under the chairmanship of CEA/CFFC.

The JICA HQ Team also made a site visit to flood affected dike (SM Bund) situated downstream of Sukkur Barrage along left side of Indus River in Sindh Province. During the 2<sup>nd</sup> meeting held on **November 7, 2022**, FFC side presented draft application for a new Technical Cooperation Project "Project for Capacity Development of Effective River Dikes Management Response to 2022 Flood". The same was also discussed during 3<sup>rd</sup> meeting held on **11<sup>th</sup> November 2022**.

With regard to objections raised by Japanese Side regarding HR and Equipment support sought by FFC under Technical Cooperation, it was clarified that owing to acute resource constraints presently faced by FFC, it was becoming difficult for FFC to better accommodate the JICA Advisors already deputed to FFC in FFC building Complex, hence HR, Equipment and office space was also included by FFC, to be arranged with the support of Japanese Side under the Technical Cooperation Project. However, with a view to avail JICA's new Technical Cooperation Project facility, JICA Advisory Team's proposed amendments were accepted.

Owing to above, both sides agreed on the application document as suggested by JICA Disaster Management Advisory Team; the same stands submitted on **November 25**, **2022** to the Embassy of Japan through EAD for further approval/ action by the Government of Japan.

### **3.6.8** Development of Climate Change adaptation related Measurement, Reporting and Evaluation (MRE) Guidelines for Water Sector

Ministry of Water Resources has recently (vide its U.O. letter No. 6 (45)/2022/Admn dated **November 22, 2022**) assigned the CEA/CFFC to lead the task for Development of Climate Change adaptation related Measurement, Reporting and Evaluation (MRE) Guidelines for Water Sector, in consultation with Global Change Impact Study Centre (GCISC), MoCC and other Stakeholders including CITEPA i.e. Inter-Professional Technical Centre for the Study of Atmospheric Pollution (*Abbreviated in French as CITEPA i.e.* Centre inter professional technique detrudes de la pollution atmosphérique). CITEPA is going to provide necessary technical assistance to accomplish this important task for water sector.

Earlier CITEPA, in coordination with GCISC has developed similar guidelines for Agriculture Sector in Pakistan, which would be presented in tomorrow's main Workshop. The O/o CEA/CFFC, in collaboration with MoWR, CITEPA and GCISC, organized 1<sup>st</sup> Workshop on 2<sup>nd</sup> **December 2022** in the Committee Room of O/o CEA/CFFC at Islamabad. Earlier, a Pre-Workshop Discussion/Meeting with Stakeholder Organizations was also organized on 1<sup>st</sup> **December 2022** in the Committee Room of O/o CEA/CFFC at Islamabad. Agenda of the workshops was to discuss potential inputs on Climate Change adaptation related MRE guidelines for the water sector.

During the workshop, CITEPA Representative made presentations about the methodological approaches (Impact Chain and Log frame) adopted for the water sector regarding development of MRE guidelines. Based on the proceedings of workshops, CITEPA has submitted draft outcome of the workshop and Way forward, which is being reviewed. Keeping in view broader scope of work to be covered for water sector, the CEA/CFFC urged CITEPA to plan series of consultations with the concerned departments in future (in addition to only one anticipated physical workshop likely to be held in January 2023) and to also ensure involvement of all stakeholders including from private sector, INGOs and academia etc.

#### 3.6.9 TIKA Grant-in-Aid Project on Installation of Early Flood Warning System (WAPDA, PMD, O/o CEA/ CFFC), Estimated Cost Rs. 884.96 million

Consolidated Concept Clearance Paper (CCP) was framed collectively by PMD, WAPDA and FFC under the overall coordination of FFC. The scope comprises three main components as under;

Component-I; Installation of Eighteen (18) No. Flood Telemetric Stations (WAPDA); Component-II; Strengthening of Flood Early Warning System (PMD); and Institutional Strengthening and Capacity Building of Office of CEA/ CFFC.

Joint CCP based on inputs of PMD & WAPDA and in line with the decision taken in the meeting held in M/o (NFS&R) on **January 4, 2021** stands submitted to Ministry of PD&SI enroute MoWR for approval from CCC/ CDWP. FFC shall be the overall Coordination Agency whereas PMD and WAPDA will be the implementing partners. The project is included in the Pakistan-Turkey Strategic Economic Framework (SEF) and shall be taken-up for implementation once the CCP is approved and grant assistance under SEF is secured.