GOVERNMENT OF PAKISTAN
PRIME MINISTER'S OFFICE
NATIONAL DISASTER MANAGEMENT AUTHORITY
ISLAMABAD
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F. No. 786/NDMA/IA&PD/2024

Subject: **Monsoon Infrastructure Advisory (9/25) – Pre-disaster Phase**

1. **In 2022, Pakistan experienced severe flood events** that caused widespread destruction across the country, highlighting the vulnerability of both urban and rural areas, particularly in relation to hydraulic infrastructures. While some regions faced more significant impacts, the entire nation was affected by **disruptions to key infrastructure such as dams, reservoirs, roads, bridges and canals, leading to the displacement of communities and significant economic losses.** Flash floods and Glacial Lake Outburst Floods (GLOFs) further exacerbated the situation, particularly in mountainous areas, where rapidly melting glaciers and unstable slopes present unique challenges to flood management systems. The damage to hydraulic structures, such as floodgates, weirs and levees, impaired the flow management and response during peak flood events. The 2022 floods underscored the **urgent need for climate-resilient infrastructure, enhanced early warning systems and targeted mitigation strategies to ensure the protection and functionality of hydraulic infrastructures ahead of the 2025 monsoon season.**

2. According to the National Disaster Management Authority (NDMA), Pakistan is expected to experience **above-normal monsoon activity from July to September 2025**, increasing the risk of flood-related hazards. The **Kabul River** is projected to have **medium to high flows**, raising the potential for localized flooding. Similarly, both the **Upper and Lower Indus Rivers** are expected to experience **medium to high flows**, heightening flood risks in low-lying areas, agricultural lands and urban settlements along the riverbanks. The **Chenab River** is also likely to see **medium to high flows** due to heavy rainfall in transboundary catchments, increasing the likelihood of flooding and disrupting local infrastructure. In contrast, the **Jhelum River** is expected to have low flows, which reduces the flood risk but could still experience localized flash floods from intense rainfall. The **Ravi and Sutlej Rivers** are forecasted to have **normal to low flows**, slightly mitigating flood risks.

3. To enhance resilience against future flood events, **it is strongly recommended that relevant departments initiate comprehensive infrastructure**

audits in vulnerable districts, focusing on critical hydraulic infrastructure such as dams, reservoirs, barrages, waterheads, weirs, canal systems, bridges over rivers, canals and dykes and levees. These audits should identify structural deficiencies, including erosion, sedimentation, poor construction quality and inadequate maintenance, which could compromise the effectiveness of these vital structures during high-water events. **The findings of these audits will serve as a foundation for retrofitting and reinforcement measures, ensuring that all hydraulic infrastructure is strengthened before the monsoon season.** By prioritizing retrofitting of key structures, the risk of infrastructure failure and widespread flooding can be significantly reduced, minimizing damage and protecting lives and property.

4. In the light of expected situation, **the following actions are to be ensured for Hydraulic Infrastructures** by all concerned Federal Ministries, Provincial Ministries / Departments, respective Local Government and their line departments:

Dams and Reservoirs

a. Conduct **immediate evaluations** of dam embankments, spillways and foundations to identify vulnerabilities. **Prioritize repairs or reinforcements** using reinforced concrete or steel to ensure stability during monsoon-induced flooding events.
b. Implement expedited **sediment removal processes** in reservoirs to maximize storage capacity. Establish **regular maintenance protocols** to clear debris from drainage channels, culverts and spillways, **ensuring unobstructed water flow** during heavy rainfall.
c. **Strengthen spillways** to manage excess water during peak flood conditions and **integrate automated water release systems**. This will allow rapid activation in response to rising water levels, reducing the risk of overtopping.
d. Deploy **temporary flood barriers** in flood-prone regions and **improve access roads to critical downstream areas** for efficient emergency evacuation. Establish **rapid response teams** with the necessary tools for **immediate repairs** during flood events.
e. Provide **targeted training programs** for local authorities and communities in flood-prone areas, covering **emergency response protocols, evacuation procedures and the proper use of temporary flood barriers**.

f. **Retrofit floodgates and locks with automated control systems** for real-time regulation of water levels during flood events, preventing overtopping and ensuring infrastructure protection.
g. Implement **backup power supplies and manual control mechanisms** for floodgates and locks to ensure continued operation during power outages or mechanical failures.
h. Establish a **schedule for testing and maintaining floodgate mechanisms, including seals and control systems**, to ensure optimal performance during peak flood conditions and minimize the risk of malfunctions.

Barrages and Headworks

a. Conduct **comprehensive assessments** of barrage and headwork structures to identify vulnerabilities. **Prioritize necessary repairs or upgrades** to ensure structural integrity during the monsoon season.
b. Regularly **clear water intake channels, gates and canals** of debris, sediment and blockages to maintain efficient flow management, preventing operational disruptions during peak rainfall.
c. **Install or upgrade surge protection mechanisms**, such as pressure relief valves and automated gates, to effectively manage sudden increases in water levels and reduce the risk of mechanical failure during flood events.
d. **Strengthen protective embankments and levees** surrounding headworks and barrages using **erosion-resistant materials** to prevent damage from strong currents and safeguard adjacent infrastructure.
e. Establish **rapid-response teams and maintain a stockpile of essential materials** (e.g., sandbags, reinforcement supplies) at strategic barrage and headwork locations for quick deployment during flood events and emergency repairs.
f. **Enhance communication systems** by implementing dedicated flood monitoring technologies with real-time data feeds. This will ensure timely communication with local authorities for effective response to rising water levels and the prevention of overflow.

Canal Systems

a. Conduct **comprehensive inspections of canal embankments and linings** to identify any structural deficiencies or erosion. **Implement necessary repairs**

and reinforcements to ensure uninterrupted water conveyance throughout the monsoon season.

b. Establish a **maintenance schedule for clearing canal networks** of sediment, debris and potential blockages. Ensure that water flow is not obstructed and the infrastructure remains operational during peak rainfall conditions.
c. Install strategically positioned **silt traps and sedimentation basins** along the canal system to capture and mitigate sediment build-up, thereby preserving the system's hydraulic efficiency and operational capacity during periods of high flow.
d. Enhance the canal system's drainage network by reinforcing channels and integrating additional drainage features to effectively manage **water diversion, prevent waterlogging in adjacent agricultural land** and mitigate flood risks during high-water events.
e. **Deploy automated monitoring systems across critical canal sections** to continuously **track water levels, flow velocities and potential blockages**. This will enable dynamic adjustments to flow management, ensuring rapid response to fluctuations in water flow during monsoon conditions.
f. Integrate **adjustable gates and weirs** into the canal infrastructure, providing **rapid-response flexibility to regulate and divert excess water** during extreme rainfall events, thereby reducing the potential for downstream flooding and optimizing system performance under varying hydrological conditions.

Weirs

a. Install **debris deflectors or booms upstream of weirs, utilizing locally sourced materials** such as steel or timber, to mitigate the accumulation of debris and prevent blockages. This approach will enhance hydraulic efficiency during flood events by maintaining unobstructed flow.
b. Construct **sedimentation ponds or basins upstream** of weirs in flood-prone zones to capture suspended silt and debris. These structures, constructed from cost-effective materials such as stone or reinforced concrete, should be maintained regularly to ensure their continued function in sediment management.
c. **Fortify the weir crests** using locally available **erosion-resistant materials like stone riprap or concrete**. These materials will protect the structure from

erosion induced by high-flow conditions, ensuring the long-term stability and operational capacity of the weir during flood events.

d. Install **cost-efficient flow monitoring systems**, including sensors or gauges, at strategic locations along the weir structure. These devices will enable continuous real-time monitoring of water levels and flow rates, providing critical data for flood management and decision-making.
e. **Retrofit existing weir spillways** by augmenting their discharge capacity with simple engineering solutions such as the **addition of concrete slabs or the construction of low-cost stepped spillways**. These modifications will ensure that the system can handle increased water volumes during flood events, reducing the risk of overtopping.

Dykes and Levees

a. **Fortify existing dykes and levees** by integrating erosion-resistant materials such as riprap, high-strength reinforced concrete or geotextile fabric systems to enhance the structural integrity and prevent failure under high hydrodynamic forces during peak flow conditions, especially in flood-prone regions.
b. Implement a **comprehensive, periodic inspection and maintenance protocol**, utilizing non-destructive testing methods (such as ultrasonic and radar surveys) to identify microfractures, structural deficiencies and erosive damage. Early detection and targeted remediation of these issues are critical to preserving the functional stability of dykes and levees during hydrological extremes.
c. Deploy **engineered vegetation solutions** (such as deep-rooted grasses and shrubs) along dyke and levee embankments, utilizing plant species known for their soil-binding properties. This biological reinforcement **minimizes surface erosion**, reduces the risk of undermining due to **water scouring** and improves the resilience of earthen embankments against **hydraulic loading**.
d. Construct **overflow channels or relief valves** at critical points in the dyke and levee systems to manage excess water during extreme flood conditions, preventing overtopping and breaches.
e. Establish **flood monitoring and early warning systems** near dyke and levee structures to allow for real-time data and prompt interventions before water levels exceed safe limits.

5. Forwarded for information / necessary action by all concerned, please.