CRESCAT 1925 E FLUVIIS

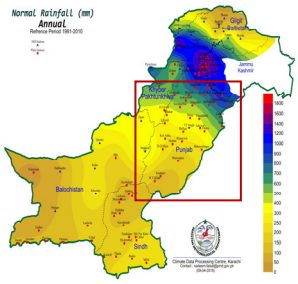
LET IT GROW FROM THE RIVERS

Water and Climate Change Initiatives

Irrigation Department

1

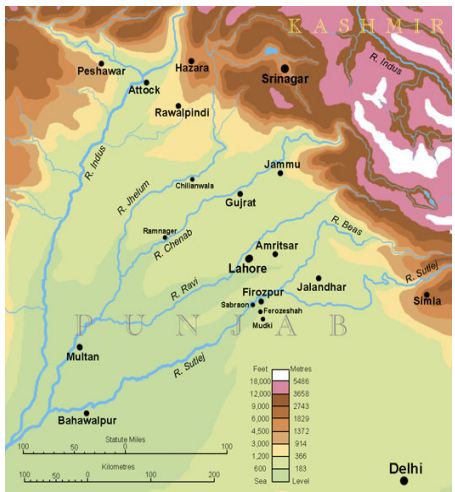
Rivers and Canals are Truly the Lifeline for Punjab



>100 MAF water (80% of Indus River System) diverted for agriculture

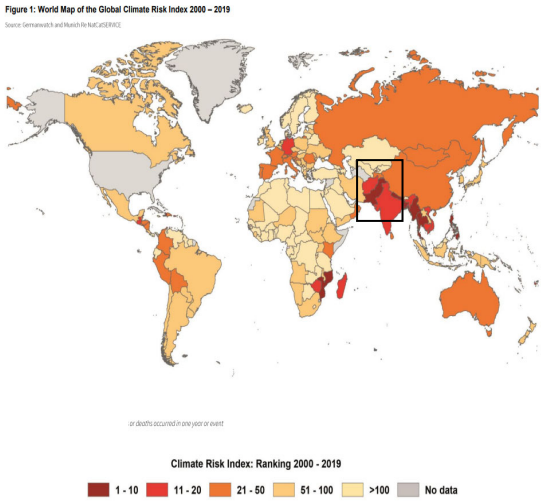
Agriculture contributes to 20% of GDP, employs 52% of labour force

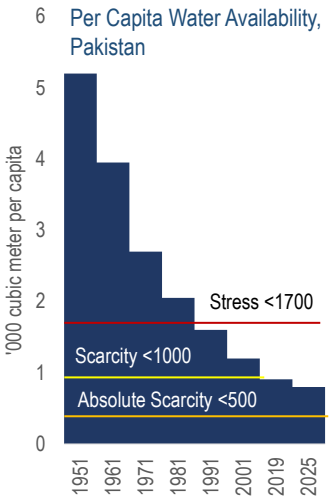
Punjab is at the center of Pakistan's food security prospect

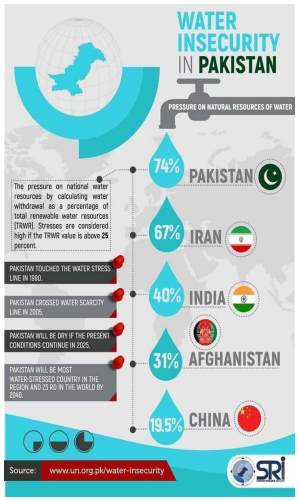


2

But Climate Risks are High & Water Availability is Declining

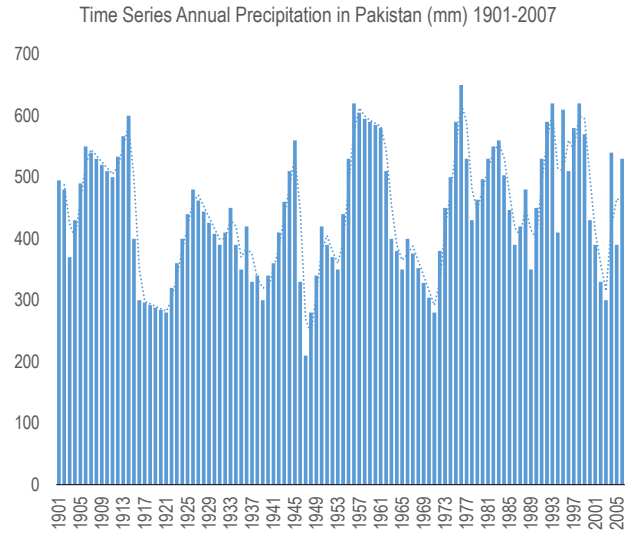


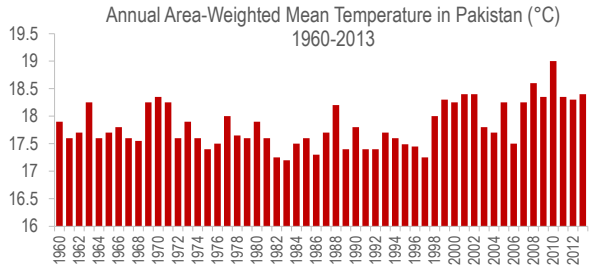


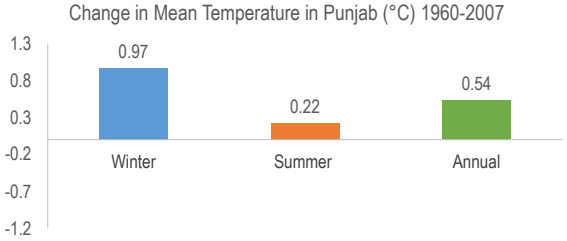


3

Rainfall Seems Stable but Temperatures are an Issue

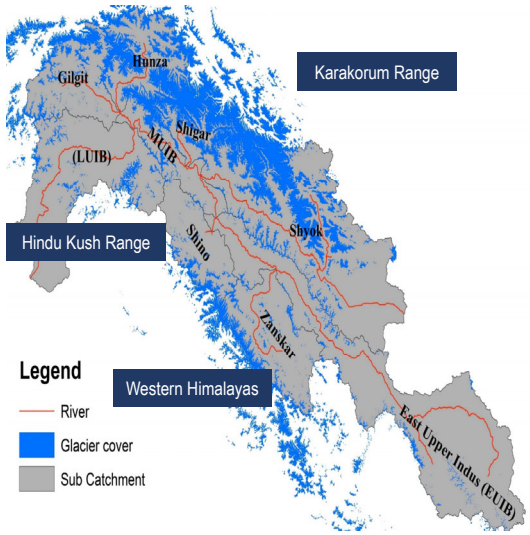






4

Behaviour of Northern Glaciers is Mixed at Best



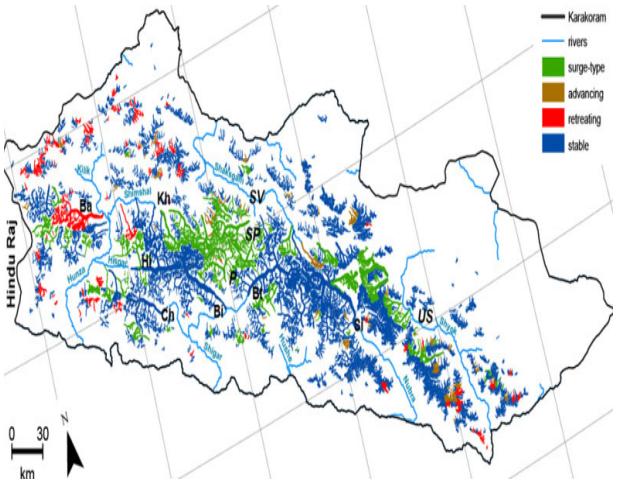


Figure 3. Spatial distribution of glaciers classified as surge-type, advancing, retreating, or stable across the Karakoram during the observation period 1976–2012. Abbreviations: Ba – Batura Glacier, Bi – Biafo Glacier, Bt – Baltoro Glacier, Ch – Chogo Lungma Glacier, Hi – Hispar Glacier, Kh – Khurdopin Glacier, Si – Siachen Glacier, P – Panmah Basin, SP – Sarpo Laggo Basin, SV – Shaksgam Valley, and US – upper Shyok Valley.

5

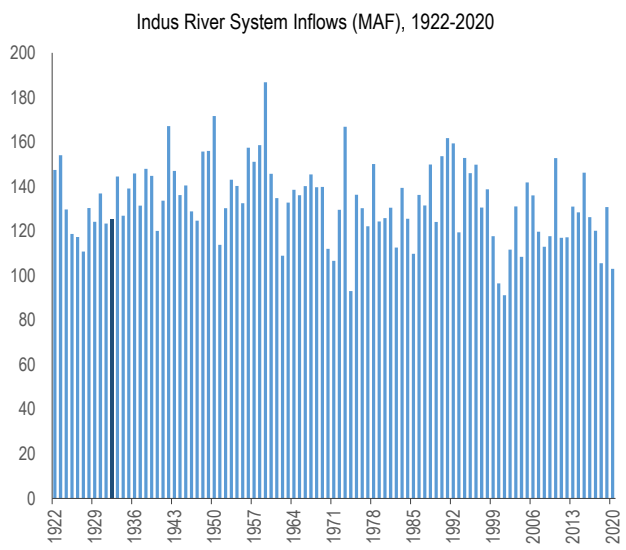
Behaviour of Northern Glaciers is Mixed at Best

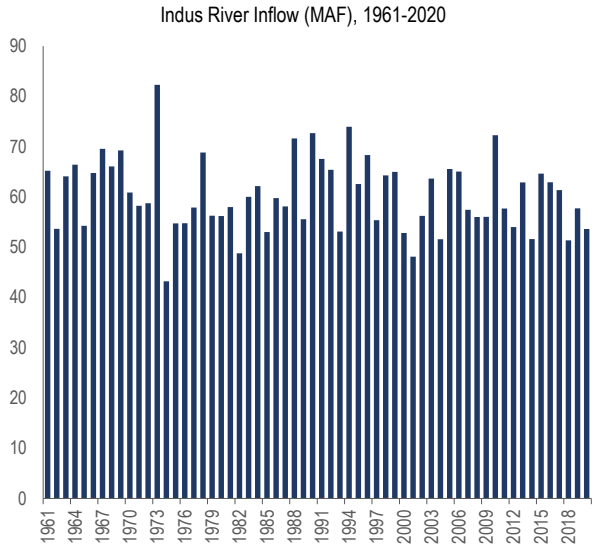
Mean surface elevation changes and mass budget for the single glaciers and different regions in the UIB from 2000 to 2019. Glacier area are acquired from the Randolph Glacier Inventory 6.0. Mean Δdh is mean surface elevation change and mass budget is the annual mass budget.

Region/Glacier name	Area (km^2)	2000–2013		2013–2019		2000–2019	
		Mean Δdh (m)	Mass budget (m w.e. a^{-1})	Mean Δdh (m)	Mass budget (m w.e. a^{-1})	Mean Δdh (m)	Mass budget (m w.e. a^{-1})
1 Batura	311.4	−5.26 ± 0.27	−0.34 ± 0.07	−4.75 ± 0.46	−0.67 ± 0.17	−9.54 ± 0.39	−0.43 ± 0.08
2 Hispar	495.3	−0.96 ± 0.27	−0.06 ± 0.07	−2.33 ± 0.46	−0.33 ± 0.17	−3.18 ± 0.39	−0.14 ± 0.08
3 Khurdopin	203.2	2.46 ± 0.27	0.16 ± 0.07	−5.25 ± 0.46	−0.74 ± 0.17	−3.36 ± 0.39	−0.15 ± 0.08
4 Virjerab	167.3	0.78 ± 0.27	0.05 ± 0.07	−3.06 ± 0.46	−0.43 ± 0.17	−2.87 ± 0.39	−0.13 ± 0.08
West Karakoram	5383.9	−1.32 ± 0.27	−0.09 ± 0.07	−4.22 ± 0.46	−0.60 ± 0.17	−5.03 ± 0.39	−0.23 ± 0.08
5 Chogo	295.1	−2.96 ± 0.37	−0.19 ± 0.09	−7.69 ± 0.48	−1.13 ± 0.18	−10.48 ± 0.45	−0.47 ± 0.09
6 Panmah	334.5	−2.00 ± 0.37	−0.13 ± 0.09	−2.95 ± 0.48	−0.42 ± 0.18	−3.52 ± 0.45	−0.16 ± 0.09
7 Biafo	559.4	0.18 ± 0.37	0.01 ± 0.09	1.61 ± 0.48	0.23 ± 0.18	2.31 ± 0.45	0.10 ± 0.09
8 Baltoro	808.8	−1.11 ± 0.37	−0.07 ± 0.09	1.48 ± 0.48	0.21 ± 0.18	0.61 ± 0.45	0.03 ± 0.09
Central Karakoram	3353.1	−1.23 ± 0.37	−0.08 ± 0.09	−0.31 ± 0.48	−0.04 ± 0.18	−1.45 ± 0.45	−0.06 ± 0.09
9 Siachen	1078.0	−1.64 ± 0.54	−0.11 ± 0.14	0.91 ± 0.79	0.13 ± 0.29	−0.72 ± 0.89	−0.03 ± 0.19
10 Rimo	439.8	−3.10 ± 0.54	−0.20 ± 0.14	−1.24 ± 0.79	−0.18 ± 0.29	−4.54 ± 0.89	−0.20 ± 0.19
11 Chamshing	27.2	−15.08 ± 0.54	−0.99 ± 0.14	8.43 ± 0.79	1.19 ± 0.29	−4.13 ± 0.89	−0.18 ± 0.19
12 Kichik Kumdan	66.3	−3.63 ± 0.54	−0.24 ± 0.14	6.85 ± 0.79	0.97 ± 0.29	4.08 ± 0.89	0.18 ± 0.19
East Karakoram	5774.4	−2.17 ± 0.54	−0.14 ± 0.14	2.64 ± 0.79	0.37 ± 0.29	0.79 ± 0.89	0.04 ± 0.19
Debris-covered region	2018.1	−5.24 ± 0.65	−0.34 ± 0.16	−3.22 ± 0.56	−0.46 ± 0.21	−8.29 ± 0.34	−0.37 ± 0.07
Clean-ice region	12493.3	−0.88 ± 0.65	−0.06 ± 0.16	0.88 ± 0.56	0.12 ± 0.21	0.17 ± 0.34	0.01 ± 0.07
Surge glacier	5704.1	−1.76 ± 0.65	−0.12 ± 0.16	0.76 ± 0.56	0.11 ± 0.21	−1.43 ± 0.34	−0.06 ± 0.07
Non-surge glacier	8807.4	−1.80 ± 0.65	−0.12 ± 0.16	1.54 ± 0.56	0.22 ± 0.21	−0.87 ± 0.34	−0.04 ± 0.07
Total	14511.4	−1.78 ± 0.65	−0.12 ± 0.16	−0.20 ± 0.56	−0.03 ± 0.21	−1.70 ± 0.34	−0.08 ± 0.07

6

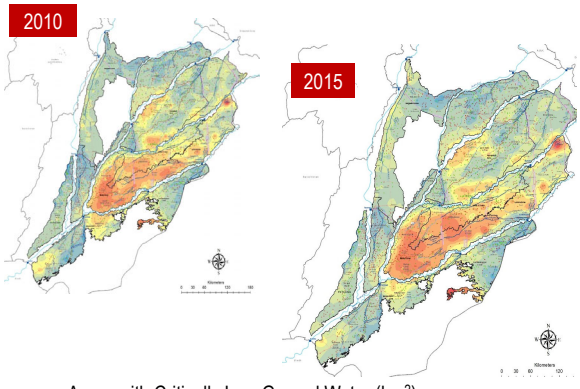
River Inflows Have However Remained Largely Stable

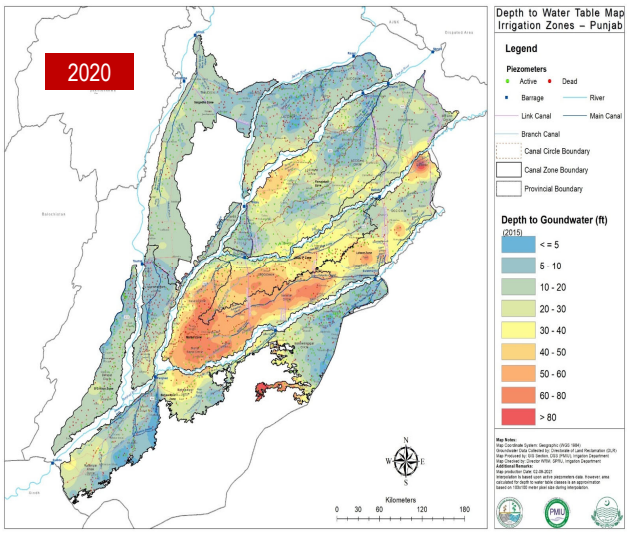




7

Rising Demand for Water has Overstressed the Aquifer





Areas with Critically Low Ground Water (km^2)

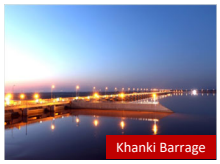
Year	50-60'	60-80'	>80'	Total
2010	9383	4489	52	13925
2015	7952	5966	670	14589
2020	8966	6871	1868	17706

8

What is Being Done: Resilient Infrastructure

Large scale investments to renew and rebuilt 8 old barrages and 600 miles of canal system to ensure sustainable and more effective irrigation for in excess of 15.6 m acres


Taunsa Barrage


Khanki Barrage


Balloki Barrage


Punjnad Barrage


Jinnah Barrage


Sulemanki Barrage


Trimmu Barrage


Islam Barrage

More than 400 miles levees strengthened against climate change impact to provide improved protection to1.6 m acres land and a population of 4.4 m

9

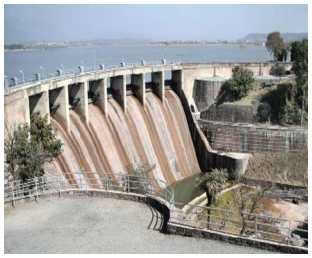
What is Being Done: Infrastructure to Conserve Water

Construction of a new canal system is under way, while construction of another is planned to commence next year. Together these will lead to sustained irrigation for xx acres with water which was otherwise wasted to sea


Underconstruction Jalalpur Canal

Plan are afoot to revitalize ecologically deteriorated and lost river basins. First work of this kind likely to commence in 2022.

Addition of 15 new dams to the existing inventory of 57 is underway. On their likely completion by 2024, these will allow adding around 410796 AF to existing storage capacity



Bringing efficiency in irrigation system at a large scale for increased productivity. First of such projects based on pressurized pipe irrigation system likely to be completed by 2023

10

What is Being Done: Improved Governance Arrangements

Transition from simply administering canals and rivers to a water resource management agency

Separate institutions to manage groundwater and to bring a focused approach towards integrated water management

New regulatory framework for appropriate water among various competing sectors and to regulate abstraction and supply of ground water and disposal of sewage

Service charges enhanced by xxx% over the last three years to achieve financial sustainability and to stimulate investments for improved efficiency and productivity in use of canal water

Using technology to improve operational performance and service delivery

- Experimenting with remote sensing technologies for managing canal water demand
- Flood risk assessment systems

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What Needs to be Done Further

- Sustained investments in water sector for more climate resilient infrastructure
- Developing and adopting policies and practices to support more efficient and productive use of water for agriculture and other purposes
- Need to develop indigenous capacity to study climate change phenomena and especially behaviour of northern glaciers which are the main source of fresh water not only for Pakistan but also the sub-continent as a whole
- Effective management of groundwater
- Institutional strengthening for these purposes
- Enhanced emphasis on adoption of nature based solutions at a large scale

12

THANK YOU

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MAJOR GLOF EVENTS REPORTED

Year	Event date	Glacier	River	Influencing factors
1973	—	Batura	Hunza	—
1974	—	Batura	Hunza	—
1977	—	Balt Bare	Hunza	—
1978	September	Darkot/Barados	Gilgit	—
1994	July	Sosot/Gupis lake	Gilgit	—
1999	6 August	Khalti/Gupis	Gilgit	Monsoon rainfall
2000	10 June	Shimshal	Hunza	High temperature
2000	27 July	Kand/Hushe	Indus	Monsoon rainfall
2005	July	Sosot/Gupis lake	Gilgit	
2007	5 April	Ghulkin	Hunza	Western disturbance
2008	6 January	Passu	Hunza	Western disturbance
2008	2 April	Ghulkin	Hunza	Western disturbance
2008	22 May	Ghulkin	Hunza	Persistent rainfall
2008	24 May	Ghulkin	Hunza	Persistent rainfall
2008	14/15 June	Ghulkin	Hunza	Heat wave
2009	26 March	Ghulkin	Hunza	Western disturbance
2018	17 July	Barsuwat glacier	Immit	Heat wave
2019	23 June	Shishper	Hunza	High temperature
2020	29 May	Shishper	Hunza	High temperature

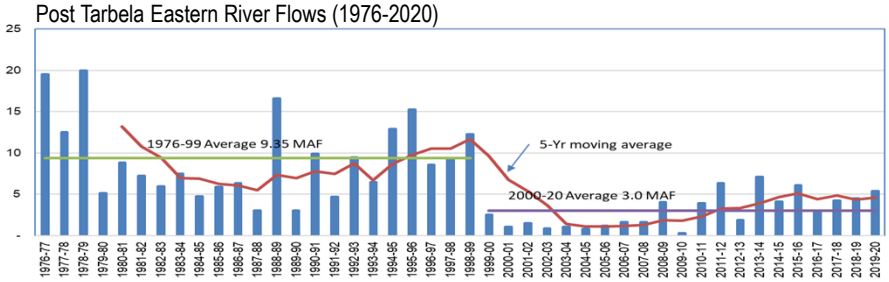
14

WATER AVAILABILITY IS REDUCING

Reservoir Storage Loss due to Sedimentation (2020)

	Designed live storage	Present live storage	Storage lost	
			MAF	%
Tarbela Dam on Indus	9.68	5.98	-3.7	38%
Mangla Dam on Jhelum	5.34	4.5	-0.84	16%
Raising of Mangla Dam	-	2.88	0	0%
Chashma Barrage on Indus	0.72	0.28	-0.44	61%
Total	15.74	13.64	-4.98	27%

Post Tarbela Eastern River Flows (1976-2020)



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15

POLLUTION- A CLIMATE CHANGE THREAT

- Water quality of the rivers is deteriorating with the decrease in water availability and increase in population.
- The current level of pollution in the River Ravi and its Nullah are some of the worst in the world. Sometimes called the killer canal. The River Ravi's dissolved oxygen levels are unable to sustain most aquatic life.
- Revitalization of River Ravi will take 30 years to improve. The estimated cost for revitalization is $ 5.4 billion.

16

PID INITIATIVES

- Rehabilitation of barrages and canals
- FERRP & DCRIP Projects for more resilient flood infrastructure
- PRF for Hill torrents and Canal Projects

17

POLICY AND LEGAL FRAMEWORK

Punjab Water Policy 2018

- Punjab Water Policy has been approved by the Provincial Cabinet in 2018 with an objective for improving water governance and sustainable management of surface and ground water use in the province which is the key to improving comprehensive water management

Punjab Water Act 2019

- A comprehensive Water Act for management of water resources in Punjab has also been approved by the Provincial Assembly. Currently, rules and regulations are in approval process - A licensing regime is being introduced in Punjab.

Punjab Irrigation, Drainage and River Act, 2021

- A new Act is being introduced to replace more than 100 years old Act to combat with new challenges in water sector

18

INSTITUTIONAL DEVELOPMENT

- Strategic Planning & Reform Unit

Responsible for overall policy and planning related functions of the department and implementation of various policy actions under water policy

- Flood Risk Assessment Unit

Established for estimation of flood extents and identification of flood prone areas along the river.

- Hydraulic Structures Safety Evaluation Unit

Established to conduct pre-flood and post-flood safety evaluations of the hydraulic structures. The unit regularly carries out visits to all the barrages, especially to the ones flagged for potential flood situations

- Water Resources Commission and Water Services Regulatory Authority are being set up for regulation of groundwater

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WAY FORWARD

- Sustainable investments in water sector for more climate resilient infrastructure
- Enhanced storage capacity
- Improve water use efficiency and agriculture productivity
- Develop more robust early warning systems
- Efficient use of groundwater to safeguard the groundwater aquifer from further depletion
- Beneficial use of flood water - emphasis on artificial recharge projects
- Extensively adopt nature based solutions
- Control on greenhouse emissions mainly through afforestation
- Develop institutions to foster water security

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THANK YOU

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BARRAGES REHABILITATION

Taunsa Barrage

- Command Area 1.8 Million Acres
- Design Discharge 1,000,000 cusec

Jinnah Barrage

- Command Area 1.9 Million Acres
- Design Discharge 950,000 cusec

22

BARRAGES REHABILITATION

New Khanki Barrage

- Command Area 3.031 M. Acres
- Design Discharge 800,000/1,100,00 cusec

Sulemanki Barrage

- Command Area 2.81 M. Acres
- Design Discharge 325,000 Cs

23

BARRAGES REHABILITATION

Balloki Barrage & LBDC

- Command Area 1.7 M. Acres
- Design Discharge of LBDC 8500 to 9841 Cs
- Design Discharge of Balloki Barrage 225,000 - 260,000 Cs

Trimmu Barrage

- Command Area 1.36 M. Acres
- Design Discharge 645,000 – 875,000 Cs

24

BARRAGES REHABILITATION

Punjnad Barrage

- Command Area 1.63 Million Acres
- Design Discharge 700,000/865,000 cusec

Islam Barrage

- Command Area 1 Million Acres
- Design Discharge 300,000/332,000 cusec

25

FERRP & DCRIP

- Flood Emergency Reconstruction and Resilience Project (Irrigation Components) - Project completed in April,2019 and 163 Km embankments rehabilitated. 320,541 Acres land protected from inundation and 1,736,126 No of persons saved from flood hazards

- Disaster & Climate Resilience Improvement Project - 248 Km length of embankment rehabilitated. 840,824 Acres agriculture land protected from inundation, 2,704,879 No. of persons saved from Flood hazards

26

PRF

- The Project Readiness facility for Punjab Water Resources Management has been launched. The existing feasibility studies will be reviewed / updated, and detailed engineering design will be prepared for following 5 No. projects;
  - Harnessing of Hill Torrents in Dera Ghazi Khan and Rajanpur
  - Greater Thal Canal Project – Phase III (Dhingana Branch, Nurpur Branch and Mahmood Sub Branch Canal)
  - Remodeling of R-Q, Q-B & B-S Link Canals
  - Remodeling and Upgrading of Dera Ghazi Khan Canal System
  - Rehabilitation and Upgrading of Upper Jhelum Canal System

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