

# INNOVATIVE INITIATIVES IN WATER STRESSED AREA BY EFFECTIVE MONITORING OF CANAL OPERATIONS

**1<sup>st</sup> Author**  
**Dr. Muhammad Riaz**  
 Director

**Co-Author**  
**Muhammad Kamran**  
 Assistant Director/IWRM



Programme Monitoring & Implementation Unit (PMIU)  
 Punjab Irrigation Department



3<sup>rd</sup> World Irrigation Forum  
 1-7 September 2019, Bali, Indonesia

1

## Outlines

- **Introduction**
  - Introduction to Punjab Irrigation System
  - Issues in Punjab Irrigation System
- **Policy**
  - Challenges of water
  - Challenges of food security
- **Approach to Modernization**
  - Project Information
  - Implementation of modernization proposal
  - Lessons learnt including benefits from modernization
- **Future Directions**



3<sup>rd</sup> World Irrigation Forum  
 1-7 September 2019, Bali, Indonesia

2

## Introduction to Punjab Irrigation System

Item	Description
Major Reservoirs	3 No.
Barrages /Headworks	18 No.
Link Canals	12 No.
Canal Systems	45 No.
Length of Watercourses	107,000 km
Length of Canals	54,073 km
Average Canal Water Diversion	104.3 MAF
Groundwater Extractions	41.5 MAF
Tube wells	1,000,000 No.
Irrigated Area	44.5 Million acres



Mangla Reservoir Storage Capacity = 7.356 MAF  
 Tarbela Reservoir Storage Capacity = 6.101 MAF  
 Chashma Reservoir Storage Capacity = 0.3482 MAF

PROVINCE	Rabi(MAF)	Kharif(MAF)	TOTAL(MAF)
PUNJAB	37.07	18.57	55.64
SINDH	33.94	14.82	48.76
N.W.F.P.	3.48	2.30	5.78
(a) CIVIL CANALS**	1.80	1.20	3.00
BALUCHISTAN	2.85	1.02	3.87
TOTAL	77.34	37.01	114.35
	+ 1.80	+ 1.20	+ 3.00

3<sup>rd</sup> World Irrigation Forum  
 1-7 September 2019, Bali, Indonesia

3

## Introduction to Punjab Irrigation System

- ❖ Rotational plans are made on **8 days** rotation of the canals
- ❖ Rotational Plans are made on division level on season wise (Rabi and Kharif)
- ❖ In the **1<sup>st</sup>** priorities canals run on their design discharge with (+10% of the design discharge ) variation
- ❖ **2<sup>nd</sup>** and **3<sup>rd</sup>** priority channels run as per water availability in the parent channel
- ❖ **Rotational plans are strict and cannot be violated.**

3<sup>rd</sup> World Irrigation Forum  
 1-7 September 2019, Bali, Indonesia

4

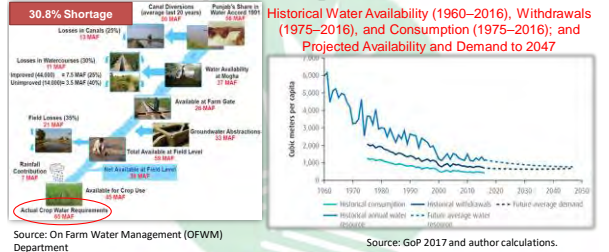
## Issues in Punjab Irrigation System

- ❑ Supply driven rather than demand led distribution of water without considering cropping pattern
- ❑ Inequity of irrigation water at both inter and intra provincial level and water course level
- ❑ Deferred operation and maintenance of centuries old irrigation system
- ❑ System losses as high as 55 %
- ❑ Lack of water conservation and application techniques at the farm level

3<sup>rd</sup> World Irrigation Forum  
 1-7 September 2019, Bali, Indonesia

5

## Policy: Challenges of Water

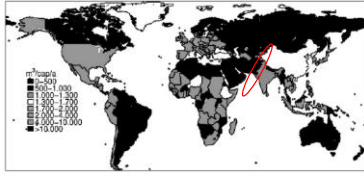


3<sup>rd</sup> World Irrigation Forum  
 1-7 September 2019, Bali, Indonesia

6

### Policy: Challenges of Food Security

- I. Pakistan is a low-income country abundant with natural resources.
- II. Agriculture is the most important sector of the country meeting food requirements of the fast-growing population.
- III. According to several studies conducted by Sustainable Development Policy Institute Pakistan (SDPI), the district facing the governance issues are worse affected by food insecurity.



Values which are less than 1300 m<sup>3</sup>/capita /year are in deficit ;Source : Rockstrom, et al. (2008) cities in Falken mark, etc. (2009)

3<sup>rd</sup> World Irrigation Forum

1-7 September 2019, Bali, Indonesia

7

### Project Information

Improvement and Modernization of the Irrigation and Water Management System" under the components **B-1**

- Task-A:** Review / upgrading of Water Resources Management Information System (WRMIS) and integration with Decision Support System (DSS).
- Task-B:** Hydrological Modelling for Forecast of Water Availability and Determination of Punjab's Share.
- Task-C:** Development of a Real-Time Operations Model.
- Task-D:** Determination and Mapping of Water Table Fluctuations.
- Task-E:** Development of Hydraulic Models of all Main and Branch Canals of Punjab Irrigation System.

3<sup>rd</sup> World Irrigation Forum

1-7 September 2019, Bali, Indonesia

8

### Project Information

Improvement and Modernization of the Irrigation and Water Management System" under the components **B-2**  
Real Time Flow Monitoring System (RTFMS)

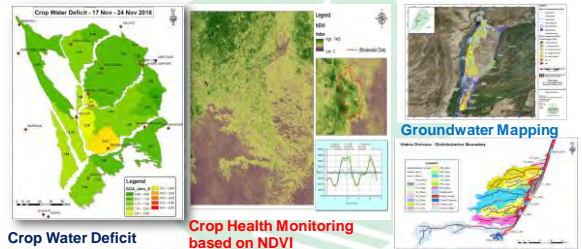


3<sup>rd</sup> World Irrigation Forum

1-7 September 2019, Bali, Indonesia

9

### Implementation of Modernization (GIS Approach)



3<sup>rd</sup> World Irrigation Forum

1-7 September 2019, Bali, Indonesia

10

### Implementation of Modernization (Water Resource Management)

**Hydraulic Modeling for canal operation**

**Real Time Network Model**

**Modern Approach (ADCP) for discharge measurement**

**Groundwater Monitoring**

**Satellite Based Near Real Time data use for forecast at rim stations**

Site Station	Forecasted by (MSM) (M3)	Actual (M3)	% Diff w.r.t. (M3)	% Diff w.r.t. (M3)	% Diff w.r.t. (M3)
Indus @ Feroze	40.762	41.89	20.312	-3%	4%
Indus @ Mangla	8.87	11.054	11.379	30%	3%
Chenab @ Mandla	18.077	18.89	19.821	-5%	-12%

3<sup>rd</sup> World Irrigation Forum

1-7 September 2019, Bali, Indonesia

11

### Real Time Flow Monitoring System

**Benefits:**

- Control on theft of water.
- As RTFM System is without human interruption so any change in flow of water in distributaries/ canals is immediately automatically reported to head office.
- Monitoring of violation of Rotational Program 24/7.
- Transparency in water distribution.

**Web base Server for RTFMS**

3<sup>rd</sup> World Irrigation Forum

1-7 September 2019, Bali, Indonesia

12

### Lessons learnt including benefits from modernization

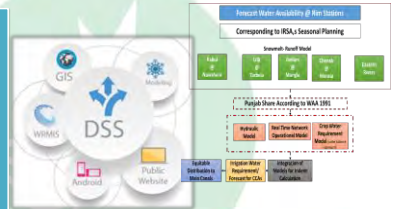
- Satellite data based forecasting is most useful for forecast of water availability at rim stations
- Monitoring of violation of Rotational Program 24/7 using RTFMS.
- Real Time Crop water Module is very useful for ensuring the equity at ditsy level
- Hydraulics models for canal is helpful for canal operator to ensure the water at tail level
- Transparency in water distribution.
- **Modern Database:** Redesigning of existing and proposed data models for efficient storage and retrieval of data for various functional requirements.
- **Modern Web-Application:** Redesigning of existing IMIS system by incorporating additional functionalities to automate the business process



13

### Way Forward Future Directions

- I. Integration of all the models for Decision Support System (DSS)
- II. cost sensors both for surface and GW in the future coming projects
- III. Water budget estimation to distinguish consumption of irrigation water, Groundwater and rainfall using GIS and Remote Sensing technique



14

# THANK YOU



15