Water Resources Management in Pakistan

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1335 – First Major Canal, Tughral (Later known as Western Yamna Canal)
1633 – Water Supply for Lahore, Shahjehan (Later known as Bari Doab Canal)
1879 – Bari Doab Canal (modified for irrigation by British)
1885 – Lower Swat Canal
1886 – Sidhnai Canal
1887 – Sirhind Canal
1890 – Sheikh Ratta Canal
1892 – Lower Chenab Canal
1895 – Western Yamna Canal
1901 – Lower Jehlum Canal
1905 – Ranbir Canal
1913 – Lower Bari Doab Canal
1915 – Upper Swat; Upper Jehlum; and, Upper Chenab
1918 – Depalpur Canal
1927 – Bahawal Canal; Bikaner Canal; Eastern Sadqia Canal; Fordwah Canal; Melsi Canal; Pakpattan Canal; Qaim Canal
1932 – Dadu Canal; Nara Canal; Northwest Canal; Rice Canal; Rohri Canal
1935 – Koranga Feeder Canal; Panjnad Canal
1938 – Abbasia Canal; Abbasia Feeder
1939 – Haveli Canal; Rangpur Canal
1948 India Shuts Canals feeding into Pakistan
Inter-Dominion Accord

• Soon after creation of Pakistan, India resorted to canal closures from Madhupur and Hussainiwala headworks which irrigated areas inside Pakistan.

• On May 4, 1948 ‘Inter-Dominion Accord’ was signed. The accord:-
  • required India to release water for our irrigation canals
  • in return Pakistan will make annual payments

• However, India kept insisting that this accord was a temporary arrangement to meet immediate requirements

• India kept insisting that Pakistan has to find its own water – which they knew we could not.
India’s Open Aggression on Shared Waters

• India planned to the maximum extent possible, blocking and directing waters of Ravi, Beas and Sutlej rivers which then formed the backbone of our agriculture in Punjab

• However, there was not enough infrastructure on these three rivers which allowed India to shut these rivers

• India embarked on structural measures on mega scale to shut these rivers
1948 – BRBD Link Canal
India’s Open Aggression on Shared Waters

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1949 – Thal Canal
1950-54:

Bhakra dam was a large project and would take time. So in order to pinch Pakistan as early as possible, a smaller dam at Nangal, 13 kilometers downstream of Bhakra Dam was completed along with a 165 kilometer long diversion canal with a capacity of 12,500 cusec.
1952-53

Ferozepur Feeder off-taking from Harike Headworks was constructed. This feeder canal, with a capacity of 11192 cusec, runs 51 kilometer and diverted Ravi-Beas waters to Sirhind Feeder, Eastern Canal systems of Indian Punjab and Bikaner Canal of Rajasthan.
1952-54

Roper Headwork and Sirhind Canal System were remodeled to divert more waters from Sutlej.
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1954 – Balloki Sulemanki Link Canal; Bhakra Canal
1954-55

Hussainiwala Headworks, which regulated water for Dipalpur Canal feeding Lahore and Sahiwal and Eastern Canal to Bahawalpur, were replaced with Harike Headworks to facilitate diversion of Sutlej and Beas waters away from Pakistan. Dipalpur Canal went dry after this.
1955

Geological and hydrological studies were carried out to put a dam on Beas river at Pong site which would store more than 6.9 MAF, enabling India to have full control over the river.
1955 – Fuleli Canal; Korti Canal; Lined Canal; Pinyari Canal
1955

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1956 – Marala Ravi Link Canal System; Sirhind Feeder Canal;
1958 – Katch Kot Canal; Rajasthan
Indra Gandhi Canal; Rajasthan Feeder
1959 – Dera Ghazi Khan Canal; Muzaffar Garh Canal
1961

Indus Basin Water Treaty was signed
1962 – Beghari Canal; Desert Canal; Ghotki Canal; Warsak Canal
1958-61

Off taking from Harike Headwork, Rajisthan Canal was constructed with a capacity of 18,500 cusec to divert waters of Ravi, Beas and Sutlej into Rajisthan.
1965 – Sidhnai Mailsi Link Canal
1966 – Bist Doab Canal
1967 – Qadirabad-Balloki link Canal; Lower Chenab Canal Feeder;
1970 Taunsa-Panjnad Link Canal
1975 Ravi Canal
1990 Sidhmukh Feeder
Post Treaty works by India

• **1963**: Bhakra dam was completed after which flow in Pakistan in Sutlej river completely stopped

• Construction on Pong Dam on Beas started in **1961** and completed in **1974**.

• Construction on Thein Dam started in **1981** and completed in **2001**. Since then, bed of Ravi river is running dry in Pakistan except exceptional flows of monsoon
1994 Sutlej-Yamna Link Canal
2011 Pehur High Level Canal
Irrigation Demand on Water Resources

World Wide Share of Irrigation

Indus Basin Share of Irrigation

Irrigation | Other uses
---|---
Irrigation | Other uses

(NGS 2010; Mulk 2009)
Worst water use efficiency in agriculture

Figure 3: Wheat yields per unit of land and water
Unsustainability
Irrigation Canals

- Provide water for irrigation but cause land degradation
  - Water logging
  - Salinity
- Flood irrigation on gravity
  - Flood irrigation creates pools of water on the surface providing ideal breeding grounds to mosquitos and pests
  - Transport seeds of the weeds into farmer’s fields
- Fertilizers, Pesticides and herbicides to increase per-acre yields
  - Add poisonous chemicals in the environment and soils
  - Leaching into drinking water aquifers though flood irrigation
  - Public health issues
- Barrages to divert canals
  - Excessive siltation of river channels exacerbating floods
- Dykes to protect floods
  - Destruction of riverine ecosystems and loss of ecological services
  - River avulsions causing even more damage
- Irrigation Drains to prevent water logging and salinity
  - Pollution and nuisance in the landscape
  - Increased water logging and salinity at tail ends of drains!
Dams

- **Hydel power:**
  - Does not emit CO2 at turbines but large swaths of vegetation and ecosystems which absorbed CO2 and produced O2 get submerged under the reservoir lake.
  - Not only lakes stop existing ecological services, but also decaying organic matter in the reservoirs produce CH4 – a gas 20 times more potent than CO2.

- **Storage**
  - Create storage for flood protection but severely reduce natural ability of river basin to absorb floods.
  - Provide water for irrigation but deprive water to natural foods production systems in wetlands, riverine ecology and river delta.
  - Destroy social cultures in riverine areas.
  - Destroy flowing-water fisheries.
  - Wreck navigation potential of natural waterways.

- **Economic Benefits**
  - Temporary benefits in power and agriculture sector but permanent losses riverine economy and environment!
  - When build with foreign loans, put a country in a perpetual cycle of debt servicing.
What is this? A cesspool??
Comminity Drinking Water!!!!
Community Drinking Water
Salinity
Salinity
Seas of Salinity
Water logging
Urban Salinity
SCARP Drain – an eyesore and a hazard
Possibilities and way forward

Decision Support Systems through Abundant Data
What really goes on...

- Transpiration
- Evaporation
- Deep drainage
ZiZAK Farms

- Acronym derived from Urdu for يميزير
ZiZAK Slogan

Do not water the plant, **only water the roots**
A Fish-eye View of the Growing Field
Uniform and Healthy Growth
Cobs full of Grains

Photo: Hassan Abbas
No Moisture on Surface
Full Growth
Full Growth
State of Soil Moisture
Comparison with Punjab and USA

![Graph comparing USA, Punjab, and FATA in terms of Yield and Water Productivity.]

- **USA**: High Yield and Water Productivity
- **Punjab**: Moderate Yield and Water Productivity
- **FATA**: Low Yield and Water Productivity
Comparison of Maize Production in FATA
Returning Back the River its Waters

Sustainable Approach
What do the water savings look like?

- Water Diverted from the River (BCM/yr):
  - Using 22 BCM/yr
  - Sparing 106 BCM/yr
  - 43 BCM/yr

- Irrigated Area (Mha): 130
50-50-20 Scenario!

- Water Diverted from the River (BCM/yr):
  - 22 BCM/yr
  - 43 BCM/yr
  - Sparing 106 BCM/yr

- Irrigated Area (Mha): 14
Sava River (Europe)

- Shared between 4 countries (Slovenia, Bosnia & Herzegovina, Croatia and Serbia)
- 48 BCM mean annual flow
- 900 km navigable length
- Population served 8.2 million
- Installed hydel power 196MW
- Mean daily power production 1.55 GWh (approximately 33% of installed capacity)

Indus Basin

- Shared between 4 countries (Pakistan, China, Afghanistan and India)
- 381 BCM mean annual flow
- 3,500 km navigable length
- Population served 250 million
- Installed hydel power 7,000 MW
- Mean daily power production 84 GWh (approximately 50% of installed capacity)
Sava and its River People!
Indus and its River People!
Q: Why Sava looks good?
A: Because they let it flow, and flow with it!
Strategising for water management. The Sava Commission is currently working on developing the Sava River Basin Management Plan as well as developing the strategy to implement the FASRB, establishing the Sava Information System, creating additional protocols to the FASRB and preparing a set of rules and other documents related to navigation. “The FASRB plays a significant role in implementation of the EU Water Framework Directive”, said Andrej Vizjak, Minister of Economy for Slovenia, “ whilst planning the development in the Sava River Basin as the richest water area in the Danube Basin.”
Value of Flowing Rivers

As the world’s leading maritime and trading nation, the United States relies on an efficient Maritime Transportation System (MITS) to maintain its role as a global power. The Federal government’s involvement in navigation projects dates to the early days of the United States, when rivers and coastal harbors were the primary paths of commerce in the new country. Federal interest in navigation stems from the Commerce Clause of the Constitution and subsequent Supreme Court decisions defining the Federal government’s authority to regulate commerce and navigations and to provide navigation improvements.
Transportation Mode Comparison

180km is the distance a ferry can commute with one litre fuel and carrying a ton of cargo, compared to 25km covered on road and 75km on rails.

- 1 Barge = 15 Jumbo Rail Hoppers
- 1 15-Barge Tow = 21/4 Unit Trains
- 1/4 Mile 15 Barge Tow = 2 3/4 Miles 2 1/4 Unit Trains
- 34 1/2 Miles Assuming 150 Ft. Between Trucks

Comparing:

- Barge: 1500 Ton, 52,500 Bushels, 453,000 Gallons
- 15-Barge Tow: 22,500 Ton, 767,500 Bushels, 6,804,000 Gallons
- Jumbo Hopper Car: 100 Ton
- 100 Car Unit Train: 10,000 Ton, 350,000 Bushels
- Large Semi: 26 Ton, 910 Bushels, 7,865 Gallons

870 Trucks
Engineering & Institutional Solutions
India plans to overhaul rivers for shipping

Plans to turn the country’s waterways into major shipping channels will require large scale engineering and linking of river basins

Neeta Lal, July 24, 2015
India’s internal controversies and disadvantaged position
Pakistan’s Advantage
Global Impact
Today we have

... things that can render *old treaties* and *outdated technologies* **irrelevant** and lead us into a sustainable and prosperous future.
Thanks!

Questions?