

# Exploration on the Feasibility and Mode of the Whole River Water and Sediment Regulation in the Yellow River Basin

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# Content

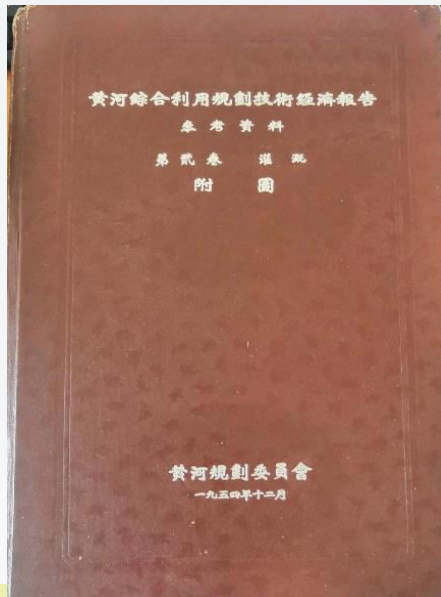
- **Research background**
- **Feasibility research**

## □ Technical and Economic Report on Yellow River Comprehensive Utilization Planning-1954

A series of barrages and reservoirs were built on the main stream and tributaries of the Yellow River. Relying on these dams and reservoirs, we can store flood water and sediment to prevent and control water hazards; we can regulate the volume of water to develop irrigation and navigation.

## □ Ning Qian-1978

The key reservoirs in the Yellow River Basin should be utilized to carry out water and sediment regulation, reduce the amount of sediment discharged, reduce siltation in the river channel and improve the site of silt deposition



Regulatory Objective

physical simulation

Engineering Distribution

numerical simulation

Theoretical Technique

The theory of YR water and sediment regulation has made great progress

## Sanmenxia (SMX, 1960)-Liujiaxia (LJX, 1969)-Longyangxia (LYX, 1986)-Wanjiashai (WJZ, 1998)-Xiaolangdi (XLD, 1999)

### Sanmenxia

- Realization of long-term siltation balance and effective reservoir capacity maintenance
- Confirmation of the possibility of long-term use of large reservoirs in sediment-laden rivers

### Long-Liu

- Laying the engineering foundation of the upstream section for water and sediment regulation of the whole river

### Wanjiashai

- Initial formation of the engineering basis for joint scheduling of mid-stream gradient reservoirs

### Xiaolangdi

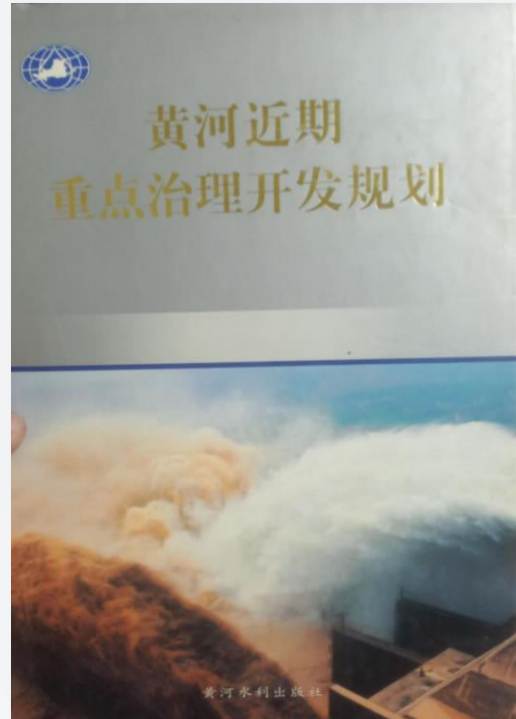
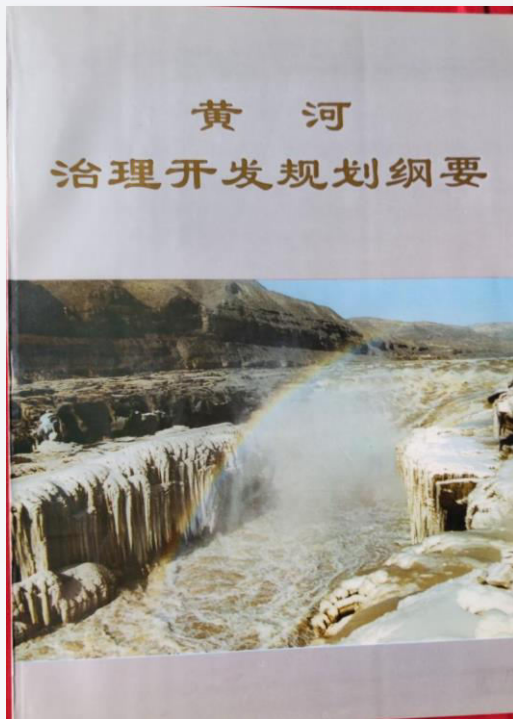
- Siltation mitigation, ecological restoration and comprehensive benefits



## □ Outline of the Yellow River Management and Development Plan-1997

## □ Recent Key Management and Development Plan for the Yellow River-2002

- Proposed the construction of the Yellow River water and sand control system with 7 major key reservoir projects as the main body.



## 7 major controlling key reservoirs

### Up-stream

Longyangxia

Liujiaxia

Heishanxia

### Mid-stream

Qikou

Guxian

Sanmenxia

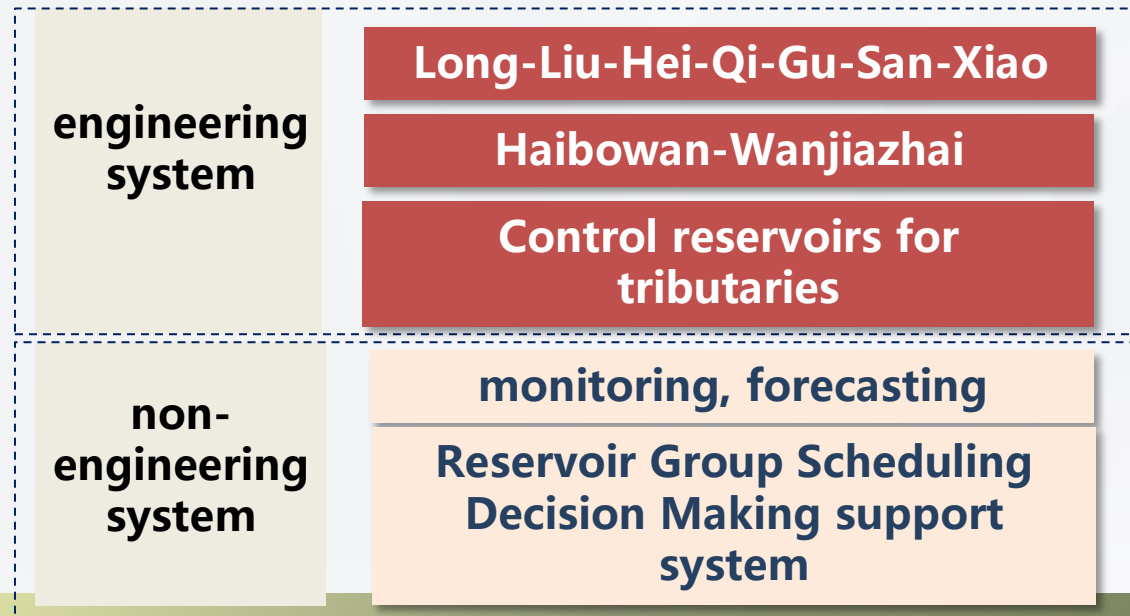
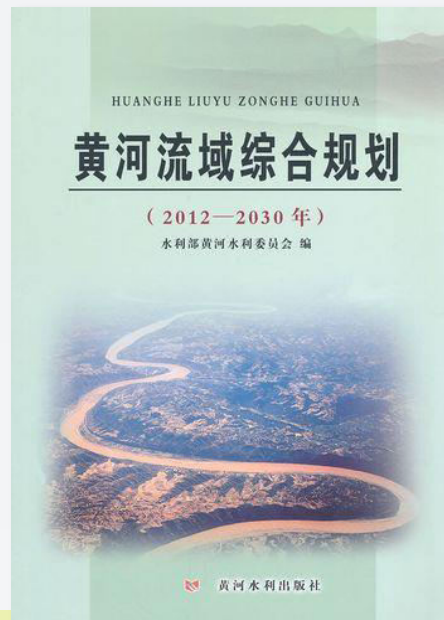
Xiaolangdi

## □ Li Guoying-2005

- For the first time, the concept of "Whole River Water and Sediment Regulation" was explicitly put forward

## □ Yellow River Basin Comprehensive Plan-2012

- By 2020, initially build YR water and sediment regulation system and flood control system
- By 2030, basically complete YR water and sediment regulation system and flood control system
- Water and sediment regulation **engineering system + non-engineering system**



## □ Incomplete distribution of water and sediment regulation systems (lack 3 of 7)

- Long-Liu and Xiao are more than 2000km apart, making it difficult to achieve the linkage effect
- The siltation of Ningmeng River has formed a new overhanging river
- The remaining capacity of Wan is 545 million m<sup>3</sup>, and there is not much space for utilization.
- Tongguan Elevation restricts the function of Sanmenxia Reservoir.
- Follow-up discharge of Xiao water and sediment regulation is not enough



Pre-flood discharge of Long Liu  
Moderate regulation of Wan

Precise water and sediment  
regulation  
Strict water resources  
management

Is it possible to achieve whole  
river water and sediment  
regulation under weak  
hydraulic linkage conditions?

# Content

- Research background
- **Feasibility research**

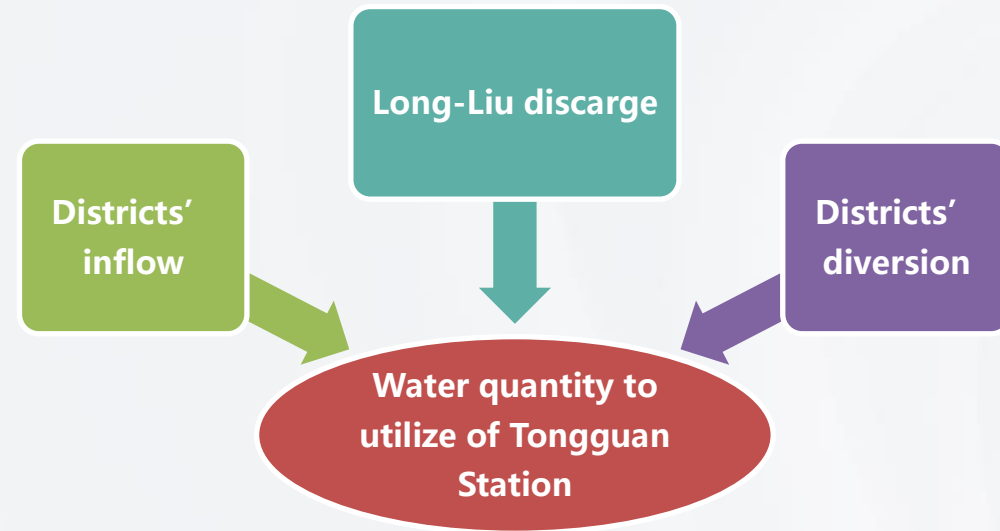
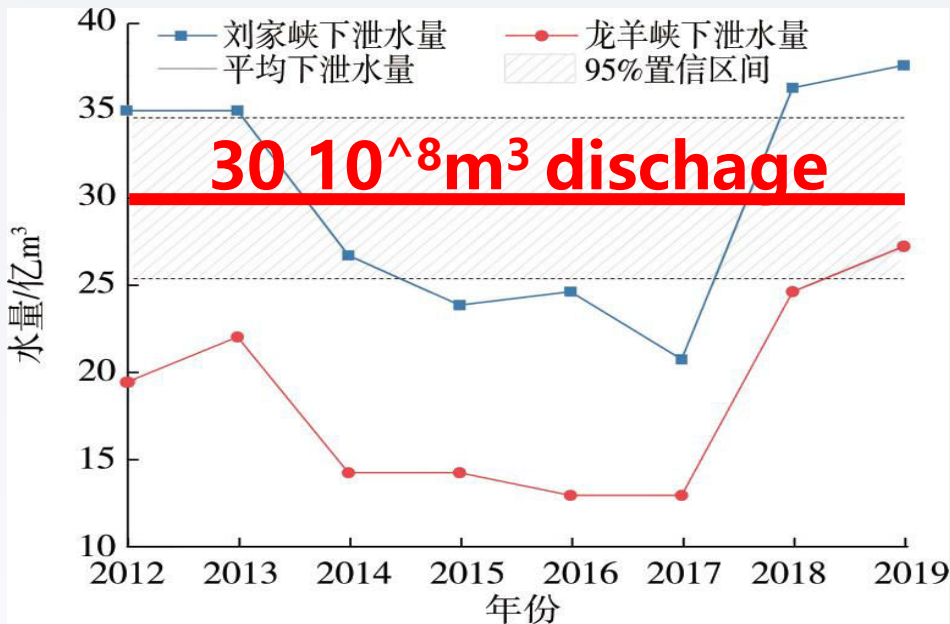


## Adjustable water quantity of Long-Liu

- The water quantity between normal storage level and flood limit level, theoretically 4.24 billion m<sup>3</sup>
- The average value of water discharge in June 2012-2019 is 3 billion m<sup>3</sup>.

## Water inflow and diversion between districts

- 2012-2019, June, Ningmeng River, North Main Stream River section, incoming and diverted water



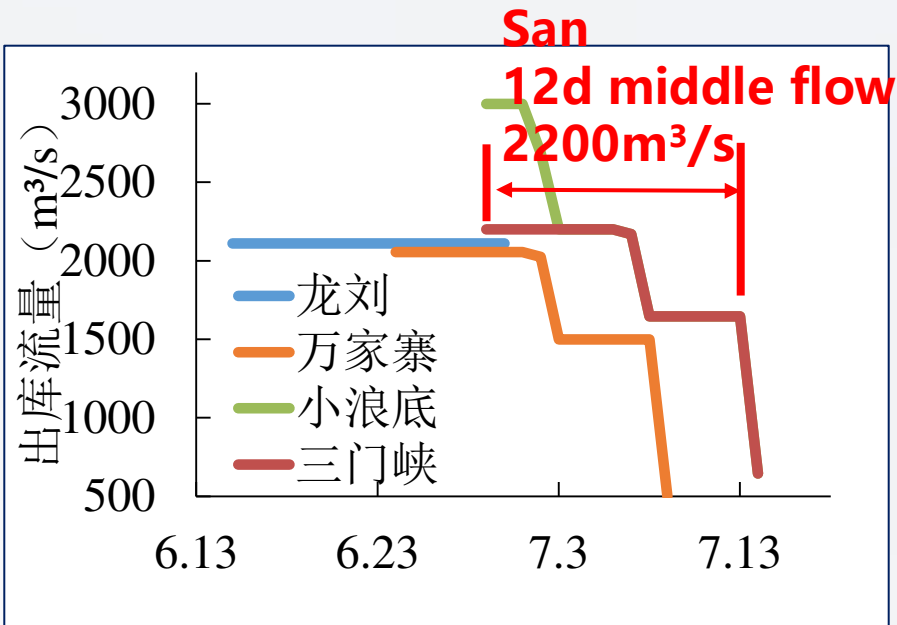
**Tongguan Station, 1.8 billion m<sup>3</sup> of water can be utilized**

## □ Conventional mode

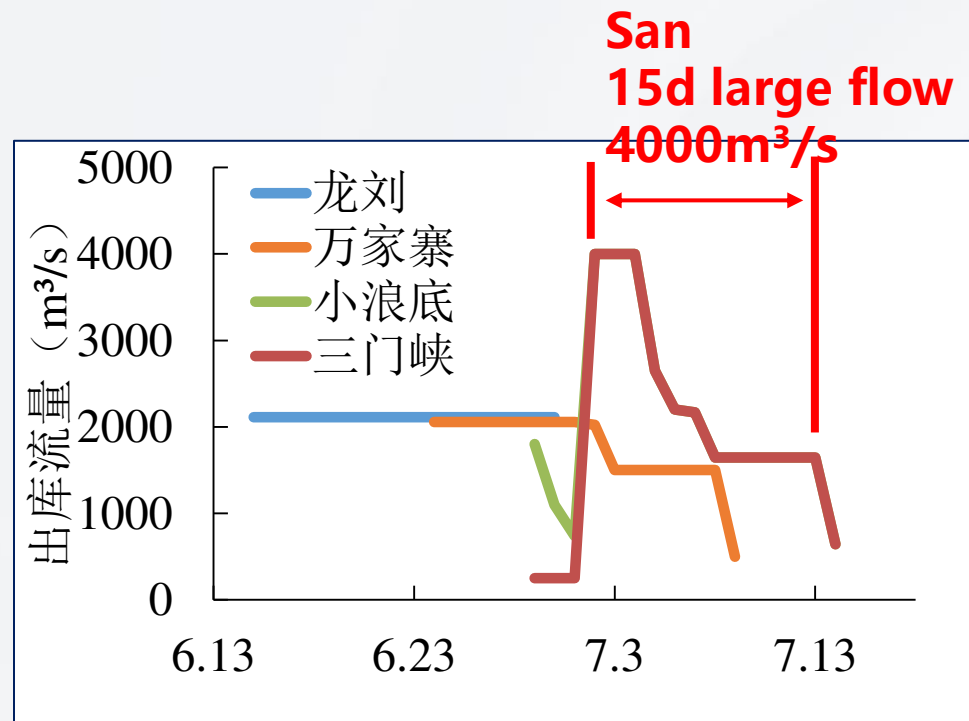
- Long-Liu-Wan-San-Xiao, Reservoir groups are all operated under existing scheduling rules

## □ Unconventional mode

- San can briefly break through the 305m flood limit water level during the flood period, the highest water level can be stored up to 318m



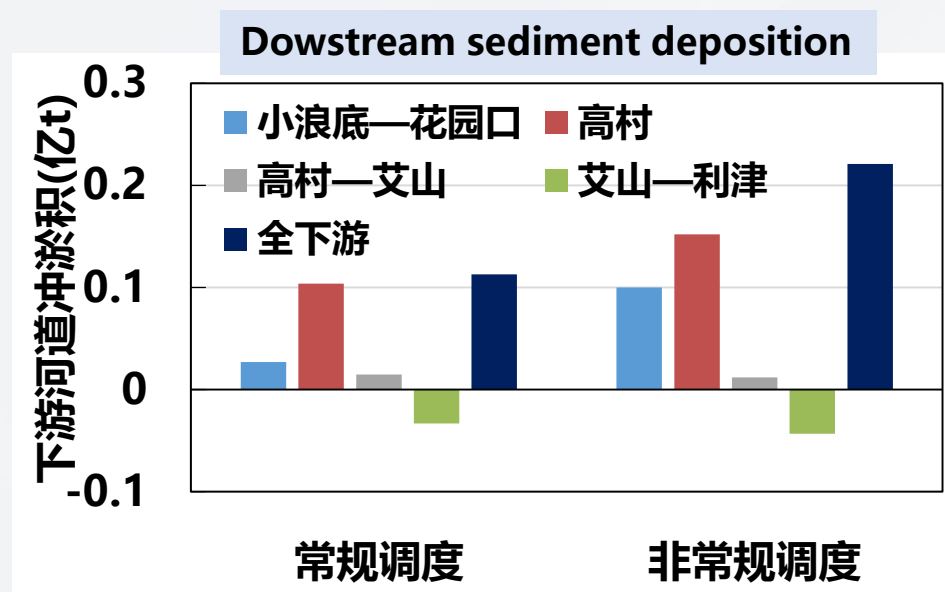
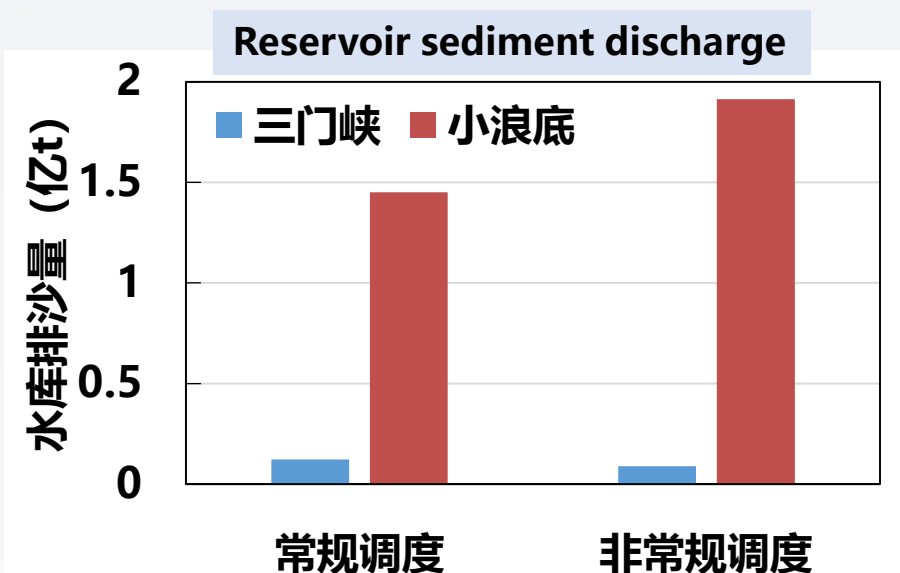
Conventional mode



Unconventional mode

## Comparison of regulation effects

- Conventional mode, Xiao sediment discharge is 145.1 million tons, downstream channel sediment deposition is 11.3million tons
- Unconventional mode, Xiao sediment discharge is 191.3 million tons, downstream channel sediment deposition is 22.1 million tons

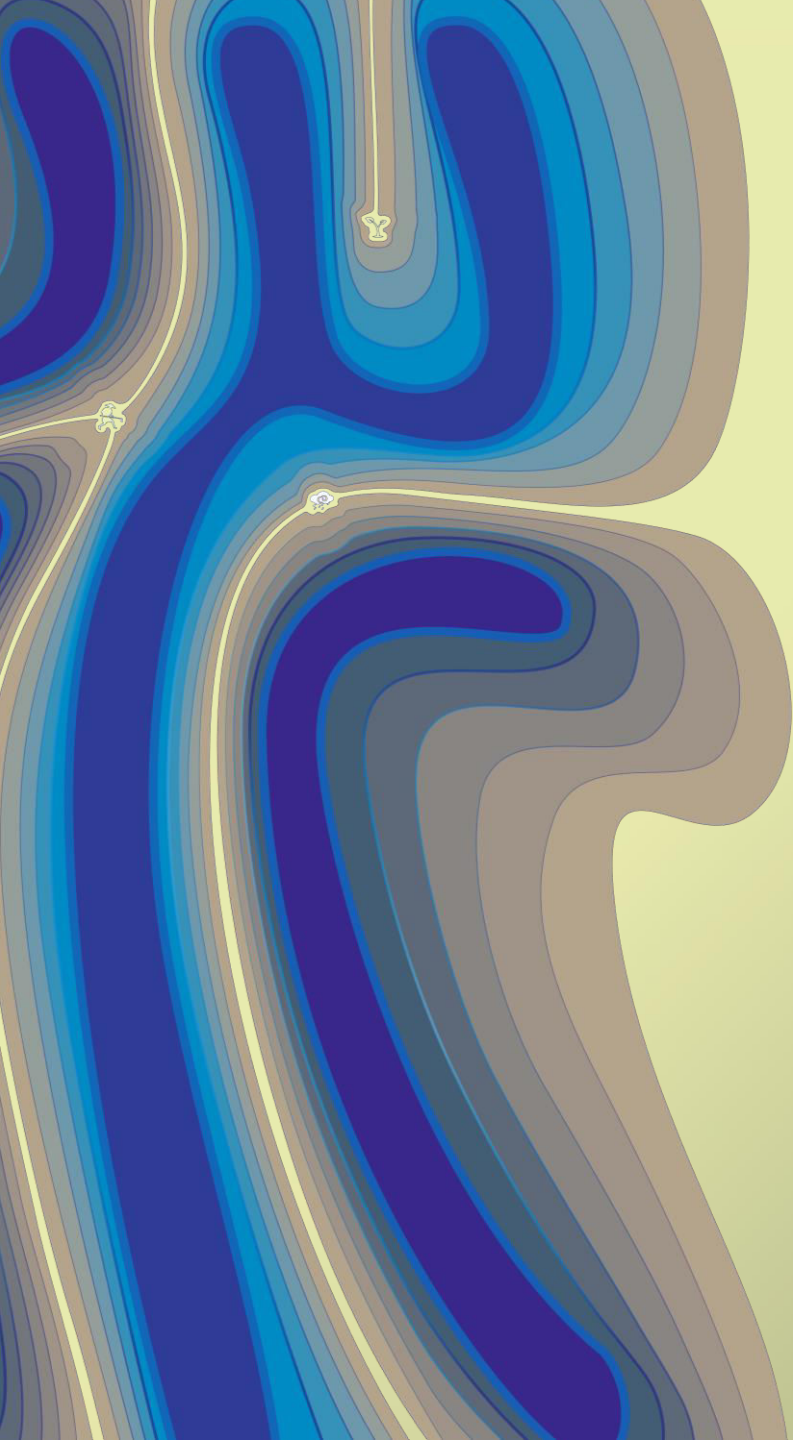


Unconventional mode can realize **169 million tons** of sediment into the sea

Both modes can achieve



**Whole River Water and Sediment Regulation under current engineering conditions is fully feasible**



# Thank you for listening

Zhang Ling

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