Yellow River

Basin issues and management

January, 2012

Management of the Yellow River Basin

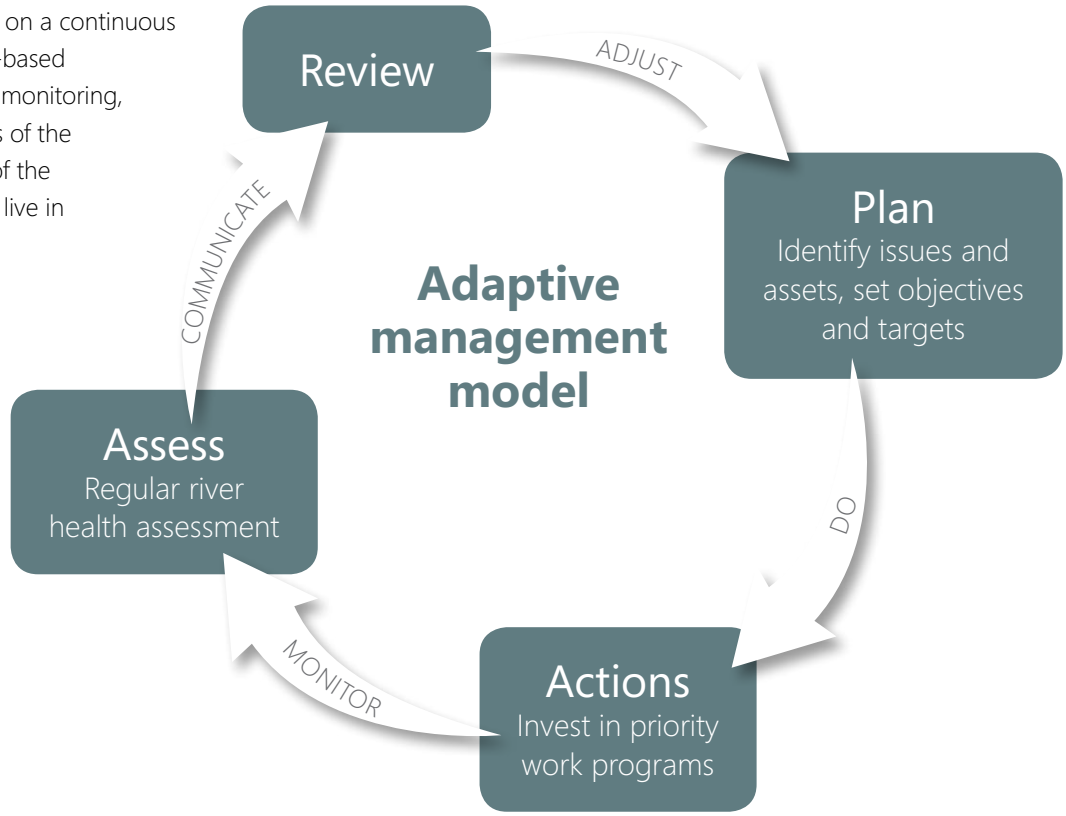
The Yellow River Conservancy Commission (YRCC) is responsible for flood, sediment, ice, drought, water quality, water allocation and environmental water management in the whole Yellow River Basin. This work is carried out in an integrated way, with one of the key objectives being investing in management actions that jointly improve ecological outcomes and enhance the welfare of the people who live in the Basin.

Management to improve ecological health and welfare of the people

YRCC invests in actions that improve ecological river health through provision of environmental flows and better water quality, and at the same time provide benefits for people living in the Basin in terms of reduced risk of floods, more secure water supply, more reliable peak electricity supply, and better natural values for recreation. YRCC follow an adaptive management model, whereby the actions are based on a continuous review of science-based investigation and monitoring, and an awareness of the changing needs of the communities that live in the Basin.

Background to this document

This document has been prepared as part of the River Health and Environmental Flow in China Project, funded by AusAID as part of the Australia-China Environment Development Partnership. The project included a pilot river health assessment in the lower Yellow River. Based on that study, a river health Report Card has been prepared. This document supports the Report Card by illustrating the main actions undertaken by YRCC to achieve their river health goals.



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Yellow River Basin

The Yellow River Basin

The Yellow River basin is the cradle of Chinese civilisation, with agricultural societies appearing on the banks of the river more than 7,000 years ago. The Yellow River originates in the Qinghai-Tibetan plateau and empties into the Bohai Gulf in the Yellow Sea. The basin is traditionally divided into the upper, middle and lower reaches, which can be described as three down-sloping steps: the Tibetan Plateau, the Loess Plateau, and the alluvial plain.

Basin facts

Drainage: 794,712 km^2

River length: 5,464km

Irrigation area: 5 million hectares

Population: 110 million in the basin, plus ~55 million in areas outside the basin but irrigated by the Yellow River (data from 2000)

Water uses: Irrigation, domestic and industrial use, electricity generation, supporting ecological health of areas of high conservation value

Key management issues

Six of the key Yellow River issues managed by YRCC are:

- Land degradation in the Loess Plateau
- Risk of loss of life and economic losses due to major floods
- Build up of sediment within the river system
- Shortage of water to meet all human and ecological demands
- Protection of the ecological values of the Delta
- Maintaining water quality of an acceptable standard

Conserving soil and water

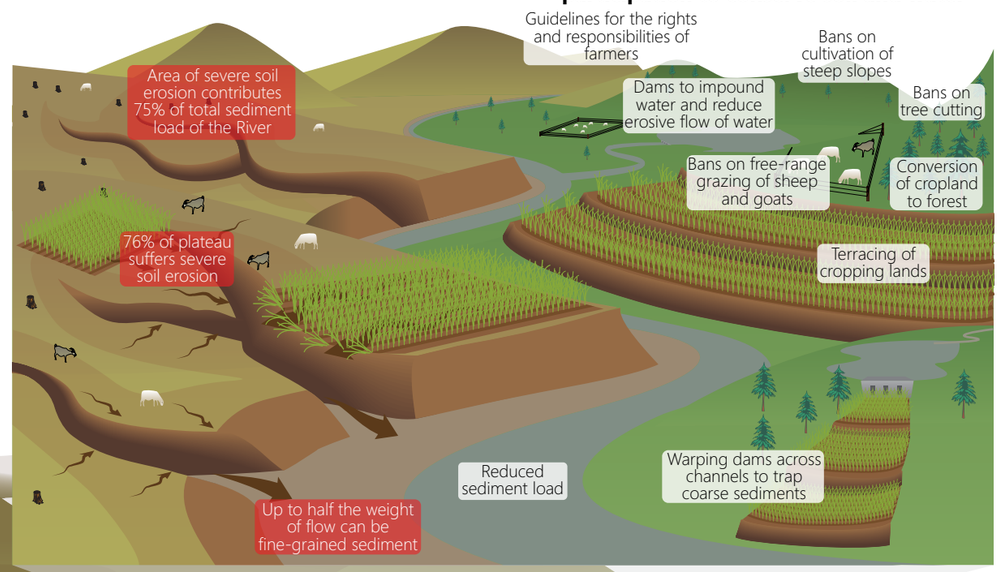
The Loess Plateau covers the middle part of the Yellow River basin. Loess is wind-blown soil up to 100 m thick and containing about 6 percent sand, 60 percent silt and 34 percent clay. Within the Plateau a hilly area of coarser sediment and severe soil erosion has been identified. The rates of soil erosion on the Loess Plateau have been up to four times greater than occurred in the geological past. This middle basin contributes around 90 percent of the total sediment load of the Yellow River, with the area of severe erosion contributing 75 percent of the total.

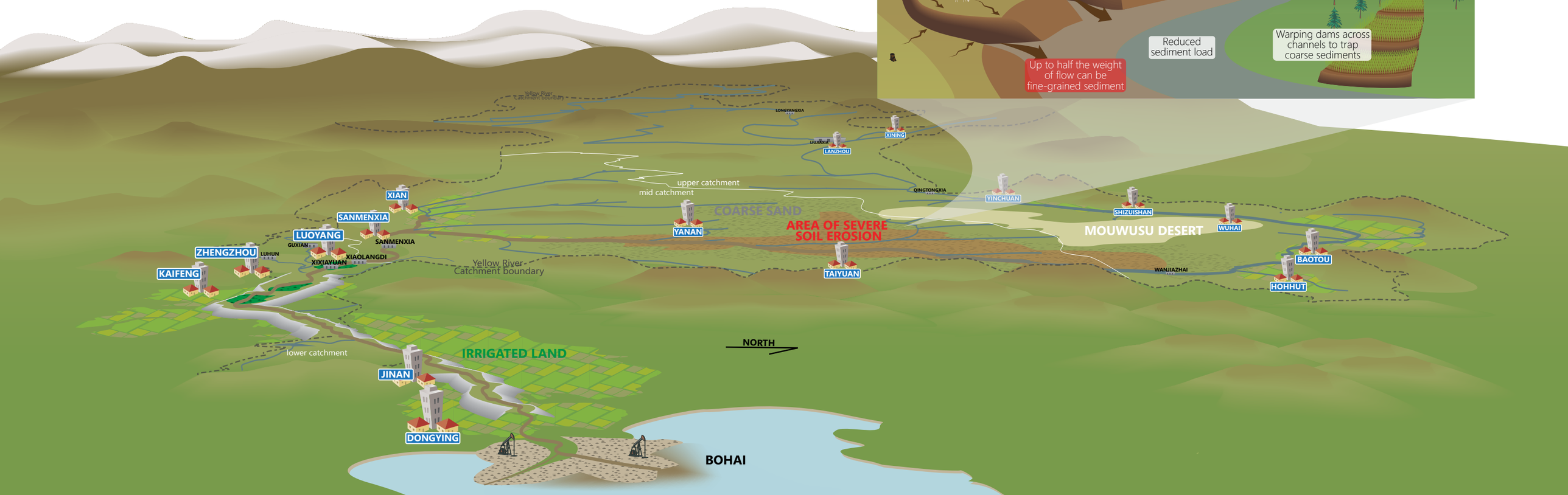
Achievements

The Loess Plateau Watershed Rehabilitation Project benefitted around 1 million farmers through increased production: grain output increased 1.5 times, annual fruit output increased 4 times, and average income increased by 4 times. Overall, water and soil conservation measures in the Loess Plateau have reduced the sediment load of the Yellow River by up to 40 percent.

Soil and water conservation issues

Actions developed through stakeholder participation to conserve soil and water





Reducing flood risks

Achievements

- The capacity of Xiaolangdi reservoir is large enough that the risk of a flood with potential to breach the dikes, putting over 30 million people at direct risk, has been reduced from once every 60 years to once every 1,000 years. The chance of lesser floods that threaten 2 million people living within the flood dikes has also been markedly reduced
- Operation of Xiaolangdi has reduced the risk of ice jam floods, with the average length of frozen river half that observed before the dam was built
- The bed scouring effect of the annual sediment flushing event from Xiaolangdi, together with flood detention basins and upgraded river training works and flood dikes, have further reduced flood risk

Since historians began keeping records in 602 B.C., the Yellow River has experienced around 1,500 major floods, resulting in the deaths of millions of people. The most recent large floods in the Yellow River, in 1996, resulted in great economic losses for people living in the lower floodplain area, due to the sedimentation in the lower Yellow River and reduced flood transportation capacity. As well as the risk of floods from storm events during in summer, in most winters parts of the river in Shandong Province and the Inner Mongolia Autonomous Region suffer from the risk of floods caused by ice jams.

Water and sediment regulation

The high sediment load of the Yellow River is a curse if the sediment deposits on the bed of the channel and reduces its capacity, thereby increasing the risk of flooding. Also, rapid deposition of sediment in reservoirs situated along the river is a problem as it reduces their effectiveness for flood control and water storage.

Achievements

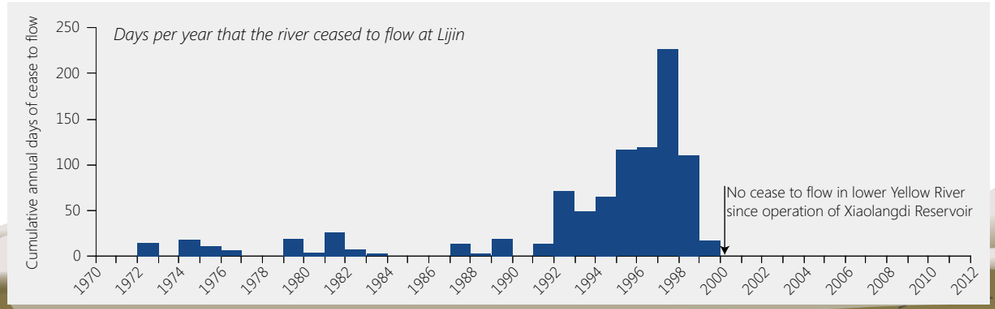
- Since 2002, coordinated annual water and sediment flushing events have been released from dams to remove some sediment from reservoirs and scour the bed of the lower river
- The bed scour has steadily increased the capacity of the channel, such that by 2010 the target of 4,000 m^3/s was exceeded all the way from Xiaolangdi to Lijin
- Controlled flushing events have lowered the bed of the river by several metres in places

Managing water usage

Achievements

- In consultation with the provinces, the YRCC now coordinates water allocation in the basin. Allocations to provinces and water abstractors are adjusted annually, monthly and at times daily, based on the water available. Around one-third of annual runoff is reserved for environmental purposes.
- Since 1999, when YRCC was authorized to implement integrated management of the lower Yellow River, the river has never ceased to flow.
- The social benefits include uninterrupted agricultural and industrial production, no disruption of city water supplies, and achievement of the required water quality grade for most of the time.
- The ecosystem has benefitted through maintenance of the longitudinal continuity of the river from Xiaolangdi to the Bohai
- Xiaolangdi reservoir allowed YRCC to implement. environmental flows in the lower Yellow River, in the form of increased baseflows to benefit water quality and aquatic life, a high flow component to flush sediment, and an allocation of water to wetlands of the Delta.

The relative scarcity of water creates a tension between allocating water for the benefit of river health, and for direct social and economic benefit. Irrigation uses 80% of the water consumed from the river, with the rest supplying industry, and drinking water for cities along the river and outside of the basin (Tianjin, Cangzhou and Qingdao). During the 1980s and 1990s the lower river dried up nearly every year, resulting in lost cereal production, suspension of some industries, and insufficient water supplies for more than 100,000 residents, who had to queue daily for drinking water. As well as costing around RMB40 billion in lost production, there was a serious decline in the ecological health of the river.

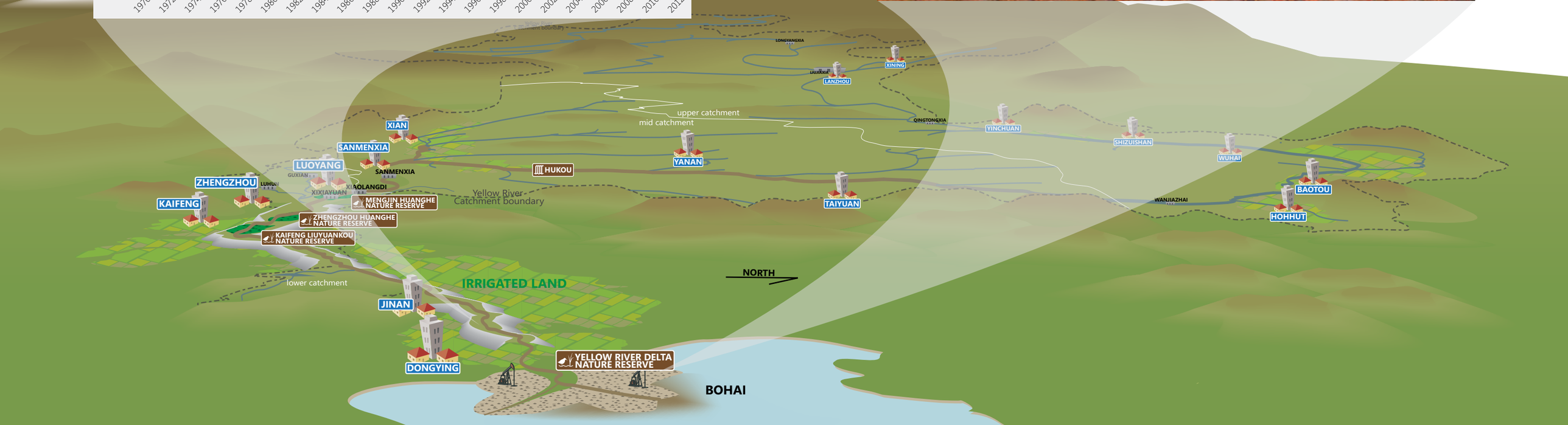


Protecting ecosystems

The diversity of habitat types and extensive areas of wetlands within the Ramsar-listed Yellow River Delta support at least 265 bird species. The birds, fish and macroinvertebrates in the delta rely on healthy and diverse vegetation communities, which in turn depend upon on annual freshwater flooding and the associated high sediment loads. Degradation of the ecosystem of the Delta has been documented, especially from the late-1990s, due to increased human activities and a significant decrease in the flow of freshwater to the Delta wetlands. This has led to saltwater intrusion and increased soil salinisation. Restoration activities involving the artificial delivery of freshwater to the wetlands began in July 2002.

Achievements

- Diversion of freshwater to the Delta resulted in locally reduced soil salinity and increased biodiversity
- Since 2002 there has been a significant increase in the area of reed swamp (Phragmites australis) and an area of shallow open freshwater habitat has been restored since 2005
- In 2011 a proportion of the annual high flow event was directed into the former Diaokou Promontory course through the northern part of the Delta which had been dry since the river's course to the sea was re-directed to the east in 1976



Improving water quality

Achievements

- Reduced input of sediment and contaminants to the river through source control efforts and trapping of sediments in dams
- Increased baseflows released from Xiaolangdi reservoir to dilute contaminants and improve the natural pollution assimilation process
- From 2007, the target Grade III was achieved for more than 80 percent of the time at Huayuankou and Lijin

The water quality of the Yellow River is affected by wastewater discharge from industries, sewerage outfalls, urban runoff, and excess fertiliser and agricultural waste washing into the river, plus contaminants associated with the naturally high sediment load. Water quality is also dependent on the flow in the river. The official target for the lower Yellow River is Grade III, although the aquatic health would benefit from achievement of a higher water quality grade. Towards the end of the 1990s and in the early 2000s the water quality of the lower Yellow River was below the Grade III for much of the time. The reduction in pollution generation from urban and agricultural areas, plus the better quality of the river water, has improved the quality of life for those living along the river.