

# THE OUTCOMES AND APPLICATIONS OF HAI RIVER BASIN INTEGRATED WATER AND ENVIRONMENT MANAGEMENT PROJECT

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# Foreword



Sustainable development demand in the Haihe River Basin is pressing due to the severe water resource and environmental problems in the basin. Since the 9th Five-Year Plan, the Haihe River Basin has always been kept on the priority of the state, the Ministry of Environmental Protection and the Ministry of Water Resources for pollution prevention, one of water pollution prevention and control basins of "Three Major Rivers and Three Major Lakes" . To effectively alleviate water resource shortage, restore the ecological environment and reduce the pollution of basin land sources to the Bohai Sea and really improve the water environment, the Ministry of Environmental Protection and the Ministry of Water Resources began to design the GEF Hai River Basin Water Resources and Water Environment Management Project ( hereinafter referred to as the "GEF Hai River Project") in 2002 with the strong support from the Global Environment Facility and the World Bank. The Ministry of Environmental Protection and the Ministry of Water Resources jointly initiated the GEF Hai River Project in September 2004. As for the project fund, 17 million dollars were donated by the GEF and financial departments of various levels invested 17.65 million dollars. Established objectives of the project have been realized under the joint efforts of parties concerned 8 years since the implementation of the project. The project explored the innovative integrated basin management mode in the Hai River Basin, which created an innovative basin integrated management mechanism involved in both domestic and overseas cross-department multi-disciplinary experts and scholars, thus setting a good example for domestic environmental protection department and water resource department to carry out basin integrated management cooperation.

Reviewing the implementation of the GEF Hai River Project, the following contributed a lot to the success of the project: Firstly, high importance the Ministry of Environmental Protection and the Ministry of Water Resources had attached to

provide a strong organization guarantee. The Ministry of Environmental Protection and the Ministry of Water Resources established a Project Guidance Committee for the comprehensive management of water resources and water environment of the GEF Hai River Basin. The vice minister in charge was appointed as the director of the committee and leaders of related departments as well as leaders of the Environmental Protection Department (Bureau) of Beijing, Tianjin and Hebei were appointed as committee members. The Committee took charge of and coordinated works of the project, which provided strong organization guarantee for the successful implementation of the project. The Pollution Prevention and Control Department of the Ministry of Environmental Protection, as the Zhangweinan Sub-Basin Project Coordination Leading Group Unit and the Water Resources Department of the Ministry of Water Resources as the Zhangweinan Sub-Basin Project Coordination Vice-Leading Group Unit were involved in the whole implementation of the project. They played a crucial role in the successful implementation of the project of the Zhangweinan Sub-basin until the whole Hai River and laid a solid foundation for the subsequent promotion of the project achievement application. Secondly, the project employed over one hundred famous experts and scholars home and abroad to establish a technical think tank. Domestic experts involved were from Chinese Academy of Sciences, Chinese Research Academy of Environmental Sciences, Chinese Academy for Environmental Planning, Tsinghua University, Peking University, China Agricultural University, China Institute of Water Resources and Hydropower Research and other well-known research institutes and universities; overseas experts involved were from the United States, Canada, Australia and Europe with rich experiences in basin management. They had conducted extensive exchanges and consultations as well as seminars with the domestic project implementation unit focusing on the integrated management plan of water resources and environment, knowledge management, water conservation management, small city waste water management, basin non-point source pollution control, monitor and evaluation, which had raised the project management level and technology content comprehensively. Thirdly, project organization management and project results had innovative and practical application value. The GEF Hai River Project created a precedent for the domestic environmental protection department and water resource department to cooperate and implement projects. Such cross-department cooperation

mechanism created and operated in this project set a good example for domestic cross-department cooperation; pushed by the project, the Ministry of Environmental Protection and the Ministry of Water Resources signed a Hai River Basin Data Sharing Agreement, which greatly promoted the integrated management of domestic basin. Integrated basin management based on water consumption management was carried out from the basin level and non-point source pollution prevention and control research were carried out in cooperation with the agricultural department for the first time. The project preparation team completed 8 Integrated Management and Strategy Research on Water Resources and Water Environment. They also completed 2 Integrated Management and Strategic Action Plans on Water Resources and Water Environment for the Haihe river basin and Zhangweinan sub-basin. Additionally, they completed 17 Integrated Management Plans On Water Resources And Water Environment and more than 10 platforms for Knowledge Management System and 6 water-conservation and projects for pollution reduction demonstration. These results had been widely publicized both home and abroad in the form of international thesis released on international conferences and aroused wide attention from domestic and foreign counterparts, and played an active role in the actual work in the environmental protection department and the water resources department of various levels. The above achievements were widely used in the implementation of the 11th Five-Year Plan and the preparation of the 12th Five-Year Plan of the Ministry of Environmental Protection and the Ministry of Water Resources, Beijing, Tianjin and governments of various levels in Hebei Provinces. Fourthly, a batch of water resources and water pollution control and prevention technical experts and project management personnel with international standards had been cultivated through project implementation and the capacity of units involved in project construction had been improved comprehensively, laying a solid foundation for future all-round integrated management on Hai River Basin Water Resources and Water Environment.

The book is the fruit of hard work of hundreds of research and project management personnel involved in the GEF Hai River Project. Only main compilers of the book are listed. Due to the objective conditions, it is difficult to include all experts and representatives involved in the project management and research in the book. Here we would like to take advantage of this book-publishing opportunity to extend our



sincere appreciation to leaders and experts from the Global Environment Facility, the World Bank, the Ministry of Finance, the Ministry of Environmental Protection and the Ministry of Water Resources involved in the GEF Hai River Project. Our gratitude also goes to experts, scholars and technical personnel involved in the research work of the project as well as experts and scholars home and abroad who have given support to the project. As internationally advanced experiences and technologies were introduced in the project, studying and application of new technologies and methods can inevitably avoid inadequacy. We hope that experts and scholars can give us more criticism and guidance.

Editor

October 2012

## ABBREVIATIONS and ACRONYMS

BOD <sub>5</sub>	Biological Oxygen Demand (over a 5 day period)
COD	Chemical Oxygen Demand
CPMO	Central Project Management Office
DIN	Dissolved inorganic nitrogen
DSS	Decision support system
EPB	Environmental Protection Bureau (local levels)
ET	Evapotranspiration
GEF	Global Environment Facility (UN "green fund")
HWCC	Haihe Water Conservancy Commission (Hai river basin commission)
IEP	International Expert Panel
IWEM	Integrated Water and Environment Management
IWRM	Integrated Water Resource Management
CJEG	Central Joint Expert Group
KM	Knowledge Management
m <sup>3</sup>	cubic meters
M&E	Monitoring and Evaluation
MEP	Ministry of Environmental Protection
MIS	Management Information System
MWR	Ministry of Water Resources
NH <sub>3</sub>	Ammonia
NPS	Non-point Source (pollution)
PAD	Project Appraisal Document
ppm	Parts per million
RS	Remote Sensing
SNWT	South to North Water Transfer Scheme
TDP	Total Dissolved Phosphorus
ToR	Terms of Reference
TUDEP	Tianjin Urban Development & Environment Project
WRPB	Water Resources Protection Bureau (part of HWCC)

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# Chapter 1

## OVERVIEW OF HAI RIVER BASIN AND BOHAI SEA

### 1.1 BOHAI SEA — The Context

The driving force behind this GEF project is the deteriorated status of Bohai Sea caused mainly by loss of freshwater input to the Sea, high levels of pollution, and consequent ecosystem dysfunction.

#### 1.1.1 Physical and Biological Environment of Bohai Sea and Bohai Bay

Bohai Sea is a partially enclosed inland sea in the northeastern part of China (Figure 1.1) connected to the Yellow Sea. It stretches from Laotie Mountain in Liaodong Peninsula in the northeast to the Shandong Peninsula (Penglai angle) in the south. The sea covers an area from west  $117^{\circ}32'E$  to east  $122^{\circ}08'E$ , and from  $37^{\circ}07'N$  to  $40^{\circ}55'N$ . This encompasses sea area of  $77,000\text{ km}^2$  with northeast to southwest distance about 555 km and east-west width of 346 km. Bohai Sea has total coastline length about 3,780 km, which there is approximately 3,020 km of land coastline. It is surrounded by four provinces of Liaoning, Hebei, Tianjin



Figure 1.1 General map of Bohai Sea (A) and surrounding area (from Google maps)

and Shandong. Bohai Sea has an average depth about 18 m with maximum depth about 80 m . Bohai Sea consists of five parts which are Liaodong Bay in the north, Bohai Bay in the west, Laizhou Bay in the south, the central basin in the middle and Bohai Strait in the east that connects Bohai Sea to the Yellow Sea. Few of the rivers entering the gulf include the Yellow River, Hai River, Liao River, and Luan River. Bohai Bay and Liaodong Bay receive the drainage from the Hai River Basin. Details of these areas are found in Table 1.1.

Table 1.1 Marine areas of Bohai Sea

Location	Area/km <sup>2</sup>	Average Depth/m	Maximum Depth/m	Coastal Rivers
Liaodong Bay	18,000	22	32	Liao River
Bohai Bay	12,500	20	26	Hai River
Laizhou Bay	7,400	13	—	Coastal River
Central basin	—	20 ~ 25	30	Liao River

The Miao Island Archipelago is oriented north-south in the central and southern parts of the Bohai Strait, dividing the strait into 12 waterways. These waterways vary from each other in width and depth. Generally, these are wider in the north and narrower in the south, deeper in the north and shallower in the south. The deepest and widest waterway in the northern part is the Laotieshan Waterway with a maximum depth of 80 m. The Bohai Sea contains 406 islands with 268 larger than 500 m<sup>2</sup>. There are vast areas of shallow sea and tidelands in Bohai Sea, as well as tens of thousands of hectares of coastal areas of low-lying saline-alkali soil. These areas are some of the most actively developed and most valuable resources for marine development. Bohai Bay, with a small mouth, is relatively weak in water exchange. There are many studies and reports about the time needed for full water exchange cycle in Bohai Sea; these range from 16 years, 40 years or 160 years however there is no consensus on this matter.

There are more than 600 species of life in the Bohai Sea, including >120 species of phytoplankton with an annual primary productivity of 112 mg/m<sup>2</sup>; >100 kinds of zooplankton, >100 kinds of intertidal benthic plants, >140 kinds of intertidal benthic fauna, >200 kinds of sub-tidal shallow water benthic fauna, and >120 kinds of aquatic animals. There are 5 families and 27 species of fish, as well as shrimp, sea cucumber, abalone and other seafood. The entire Bohai Sea is suitable for fishery. The main farmed species along the Bohai Sea include seaweed, shellfish and shrimp, sea cucumber,



abalone and so on .

## 1.1.2 Exploitation of Natural Resources of Bohai Sea

**Marine Traffic:** Bohai Sea has many bedrock harbors with deep water and has more than 70 coastal sections suitable for harbor building. There are currently 66 harbors completed or under construction, including 48 fishing ports. It is China's most port-intensive area with the key ports such as Dalian, Qinhuangdao, Tianjin, Yantai, Yingkou, etc. Throughput from Bohai Sea ports accounts for 45% of the country's major ports.

**Oil and Gas Production:** There are rich oil resources in the Bohai Bay area which is China's second largest oil-production area. The oil and gas resources are mainly located in coastal, land and offshore continental shelves. The basin covers all or parts of ZhongYuan Oil-field, North China Oil-field, Dagang Oil-field, and Shengli Oil-field. It has about 1.5 billion tons of reserves, with an annual extraction volume of 36 million tons .

**Salinity:** Bohai Sea has a high salinity of  $>30\%$ ; evaporation is greater than precipitation. There are broad tidal flats and rich brine resources, all of which make it suitable for the salt industry. There are 16 salt fields with 1,600 km<sup>2</sup> of salt works areas. The salt fields that could be developed and utilized are up to 2,500 km<sup>2</sup>, which make the Bohai Sea the country's largest salt production base.

**Minerals:** The area surrounding Bohai Sea is also rich in mineral resources. Reserves of coal, oil, natural gas, iron, aluminum, gypsum, graphite, sea salt, etc. are among the largest in the country. Especially for coal, reserves are thought to be up to 202.6 billion tons, accounting for 45% of the country's total reserves; annual output is 280 million tons accounting for 20% of the national output.

**Tourism:** The Bohai area is rich in tourism resources and is famous for mountains, ocean sceneries and cultural heritage. Well-known tourist sites include the Great Wall, the Watertown, and the Palatinate for Emperor Qin, the Imperial Palace complex, etc..

**Fishery:** There has been a decrease in fish species and its diversity in Bohai Sea. The fishery decline in Bohai Sea is mainly caused by over-fishing, reduction of runoff into the sea, rising of salinity and environmental pollution. Reduction of fishery resources is mainly characterized by the substantial reduction of high economic value demersal fish and the decline in its proportion of the total catch. Also important species are decreasing