

**SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT**

**HENAN WASTEWATER MANAGEMENT AND WATER SUPPLY PROJECT**

**IN THE**

**PEOPLE'S REPUBLIC OF CHINA**

**March 2005**

## CURRENCY EQUIVALENTS

(as of 01 March 2005)

Currency Unit	–	yuan (CNY)
CNY 1.00	=	\$0.21
\$1.00	=	CNY 8.27

The CNY exchange rate is determined by a floating exchange rate system. In this report a rate of \$ 1.00 = CNY 8.27 is used.

## ABBREVIATIONS

ADB	–	Asian Development Bank
A <sup>2</sup> O	–	anaerobic/anoxic/oxidation
BOD	–	biochemical oxygen demand
COD	–	chemical oxygen demand
CSC	–	construction supervision company
EIA	–	environmental impact assessment
EMC	–	environmental management consultant
EMP	–	environmental management plan
EPB	–	Environmental Protection Bureau
FSR	–	Feasibility Study Report
GDP	–	gross domestic product
HPMO	–	Henan Project Management Office
HPEPB	–	Henan Provincial Environmental Protection Bureau
HPG	–	Henan Provincial Government
HRB	–	Hai River Basin
H <sub>2</sub> S	–	hydrogen sulfide
IA	–	implementing agency
LEPB	–	local environmental protection bureau
NH <sub>3</sub> -N	–	ammonia nitrogen
NO <sub>2</sub>	–	nitrogen dioxide
NH <sub>3</sub>	–	ammonia
O&M	–	operation and maintenance
pH	–	factor of acidity
PMO	–	Project Management Office
PM <sub>10</sub>	–	particulate matter with particle size below 10 microns
PPTA	–	Project Preparatory Technical Assistance
PRC	–	People's Republic of China
RP	–	resettlement plan
SBR	–	sequencing batch reactor
SEIA	–	Summary Environmental Impact Assessment
SEPA	–	State Environmental Protection Administration
SNWTP	–	South-North Water Transfer Project
SO <sub>2</sub>	–	sulfur dioxide
SS	–	Suspended solids
TA	–	technical assistance
TSP	–	total suspended particles
WCB	–	Water Conservancy Bureau
WS	–	water supply subproject

WTP	–	water treatment plant
WWM	–	wastewater management subproject
WWTP	–	wastewater treatment plant

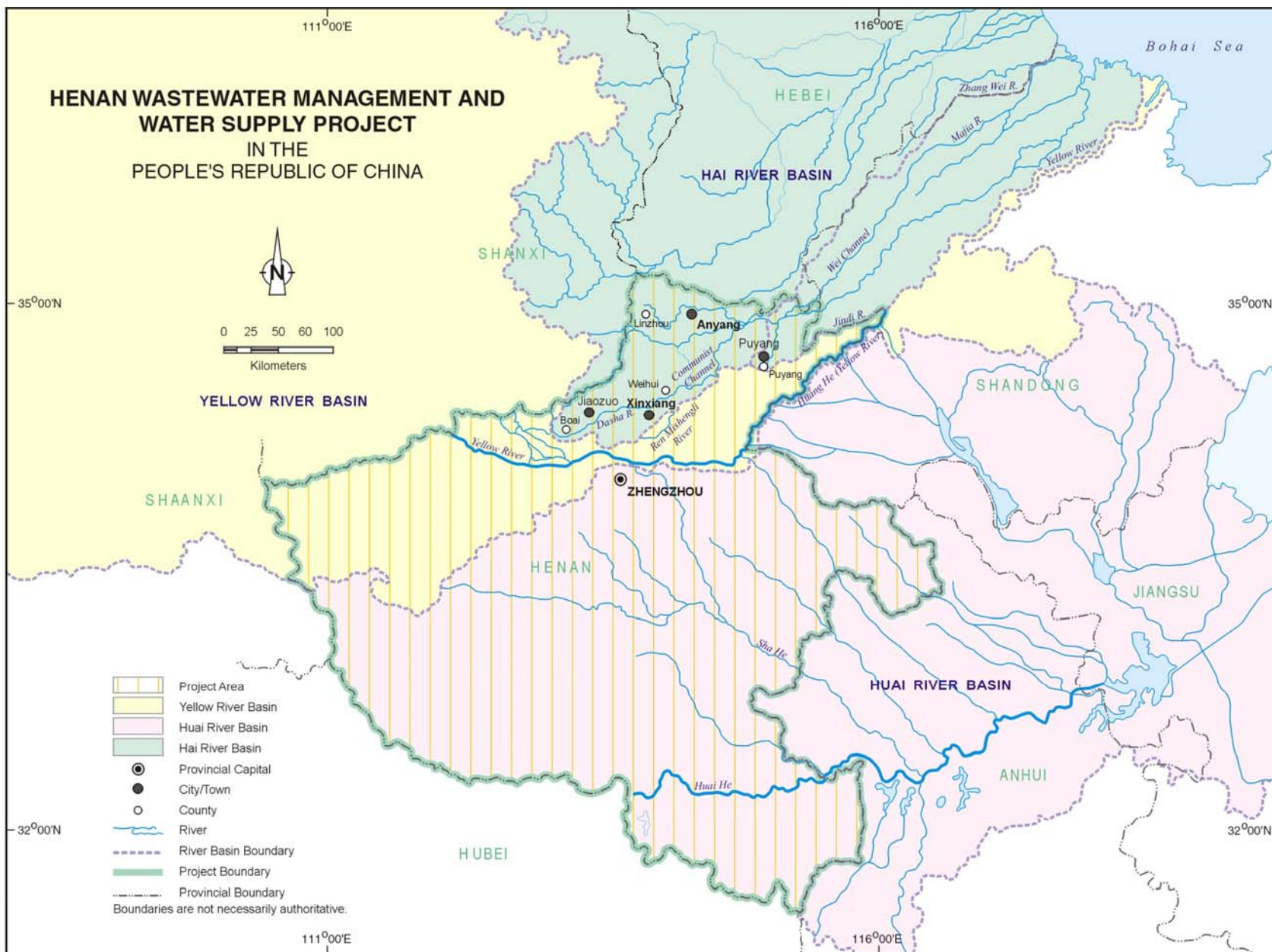
## **NOTES**

- (i) The fiscal year of the Government coincides with the calendar year.
- (ii) In this report, "\$" refers to US dollars.

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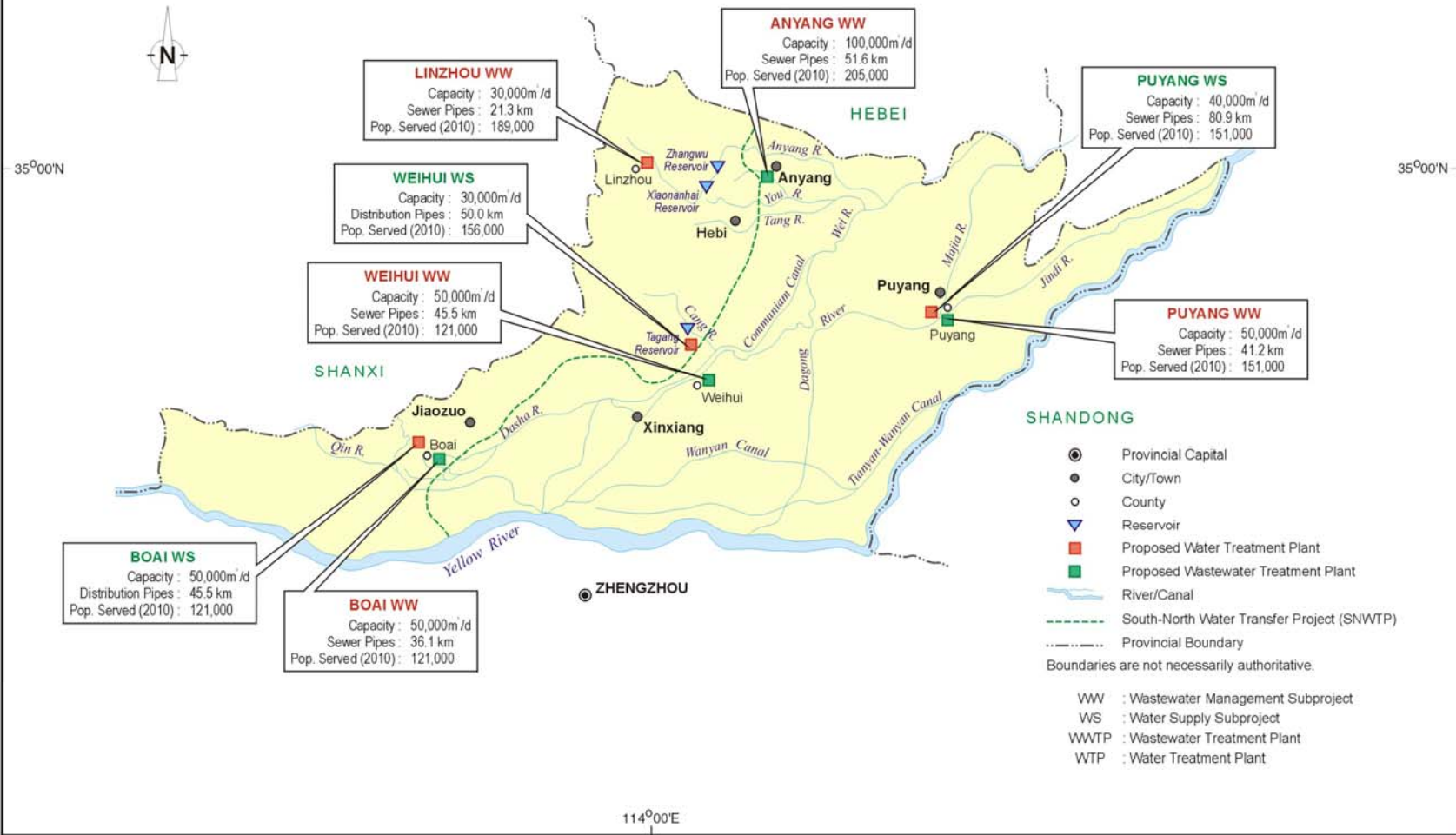
# HENAN WASTEWATER MANAGEMENT AND WATER SUPPLY PROJECT IN THE PEOPLE'S REPUBLIC OF CHINA



- Project Area
  - Yellow River Basin
  - Huai River Basin
  - Hai River Basin
  - Provincial Capital
  - City/Town
  - County
  - River
  - River Basin Boundary
  - Project Boundary
  - Provincial Boundary
- Boundaries are not necessarily authoritative.

114°00'E

### Figure 2 HENAN WASTEWATER MANAGEMENT AND WATER SUPPLY PROJECT PROPOSED REPRESENTATIVE SUBPROJECTS



35°00'N

35°00'N

114°00'E

## I. INTRODUCTION

1. The proposed project area, the northern part of Henan Province, is within the upstream catchment area of the Hai River basin (HRB). HRB covers a total area of 318,000 square kilometers (km<sup>2</sup>), and discharges into Bohai Bay (Figure 1). HRB has a total population of 122 million and includes the capital of the People's Republic of China (PRC), Beijing.
2. Rapid economic growth and continued urbanization and industrialization, coupled with a severe shortage of water resources, have resulted in heavy pollution of most of the rivers in the area. The continuously deteriorating water quality in the upstream HRB further threatens the water quality of the downstream HRB and Bohai Bay. River water quality is worsening and raw water sources for water supplies are becoming severely affected by wastewater pollution of both surface water and shallow groundwater. Groundwater, which is the primary drinking water source for urban and rural residents in many areas, is heavily polluted, and shallow groundwater sources are being severely drawn down, causing consolidation of soils and consequent subsidence of urban areas. The South–North Water Transfer (SNWT) Project crosses the project area, and there is a danger that the pollution in the project area will affect its operations.
3. The Hai River is one of the three rivers in the PRC's "Three Lakes and Three Rivers" pollution control program and is one of the six most sensitive water bodies and river basins in the PRC.<sup>1</sup> Controlling pollution in the HRB is therefore a national priority, but, although the HRB pollution load reduction targets have been identified, specific action is needed if they are to be achieved.
4. The *Tenth Five-Year Plan for Henan Provincial HRB Water Pollution Control* is the blueprint for comprehensive watershed management in the HRB and includes specific pollution control actions. It addresses HRB-wide needs, and, in response to the HRB pollution load reduction targets, it requires Henan Province to meet the secondary wastewater treatment plant discharge standards for water quality in all the rivers in the upstream parts of the HRB.
5. The national Water Law, 2002, emphasizes the need for integrated water resources management and promotes joint evaluations of water quantity and quality issues and comprehensive solutions. In line with this approach, Henan Province is developing subcatchment pollution control plans.
6. The Project is a response to urgent environmental needs, the requirements of the Water Law, and national and provincial planning goals. It aims to improve the urban environment and public health through better pollution control management in the HRB upstream catchment area. It will promote integrated water resources management; the interception, prevention, and control of water pollution in the upstream reaches of the HRB; and better coordination of water-resource and water-quality planning.
7. Specifically, the Project will promote comprehensive municipal wastewater management, and effective pollution collection and treatment. Sludge disposal is given particular attention. The Project will promote industrial pollution control by improving pretreatment of industrial waste. The sustainability of the water and wastewater infrastructure supported by the Project will be promoted through high standards of operation and maintenance (O&M) and environmental mitigation and management. The Project will promote water conservation, water reuse, leakage control, and effective enforcement of environmental regulations.

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<sup>1</sup> The three rivers are Hai River, Huai River, and Liao River

8. The Project is expected to improve the quality of surface water in line with the HRB pollution load reduction targets and to improve the environments of a number of HRB rivers. The Project will also improve the quality of life of the urban poor by reducing waterborne diseases, securing safe drinking water sources, and improving surface and groundwater quality.

9. This is a sector-type Project with wastewater management and water supply components.

## II. ENVIRONMENTAL ASSESSMENT AND REVIEW PROCEDURES

10. This summary environmental impact assessment (SEIA) covers eight representative wastewater management and water supply subprojects (the selection and appraisal criteria for the subprojects are in Appendix 3). Five of the subprojects will address wastewater collection and treatment. In line with the need to phase out use of shallow wells in urban areas as sources for domestic and industrial supplies, one of the three water supply subprojects will use deep-well sources of water, while the remaining two will use safe surface water sources from existing upland reservoirs.

11. The SEIA was prepared in accordance with the PRC Environmental Impact Assessment Technical Guidelines and the ADB *Environmental Assessment Guidelines* (May 2003). It was based on the environmental impact assessment (EIA) reports for individual subprojects prepared using methods and standards consistent with guidelines established by the State Environmental Protection Administration (SEPA) and in compliance with applicable laws and regulations. The individual subproject EIAs were approved by municipal or provincial environmental protection bureaus (EPBs) between September and December 2004. The SEIA has been formally approved by the Henan Provincial Environmental Protection Bureau (HPEPB).

12. The remaining subprojects will receive the same environmental safeguard scrutiny as that provided by the EIAs for the eight representative subprojects and this SEIA.

13. Like the eight representative subprojects, the EIAs for the remaining subprojects will require approval by municipal or provincial EPBs. The SEIA for the remaining subprojects will be developed by the Henan Project Management Office (PMO) and will follow the format of the SEIA for the eight representative subprojects. The Government has agreed that the risks and benefits and environmental monitoring and mitigation for the remaining subprojects will be defined in the same way as those for the eight representative subprojects. The remaining subprojects will share the same (i) description of the environment; (ii) analysis of alternatives; (iii) scope of mitigation and monitoring and range of the itemized costs; (iii) economic assessment; (iv) public consultation arrangements; and (v) environmental management plan format and structure. The environmental management plan will include the line of institutional responsibilities and authorities; institutional enhancement; training, reporting and supervision; work plan; procurement and cost estimates; and a mechanism for feedback and adjustment. Like the eight representative subprojects, the SEIA for the remaining subprojects will be submitted for formal confirmation to the HPEPB, and then forwarded to ADB for review by the regional department.

### III. DESCRIPTION OF THE PROJECT

14. The eight representative subprojects include five wastewater management subprojects (WWs) and three water supply subprojects (WSs) in the HRB. The key features of these subprojects are listed in Table 1 and their locations are shown in Figure 1.

**Table 1 Summary of Eight Representative Subprojects**

Municipality	County/City	Subproject	Sewer Pipes or Watermains (km)	Treatment Capacity (m <sup>3</sup> /day)
<b>Wastewater Management Subprojects</b>				
Anyang	Anyang City	Anyang Zongcun WWM	51.6	100,000
	Linzhou City	Linzhou WWM	21.3	50,000
Puyang	Puyang County	Puyang WWM	36.9	50,000
Xinxiang	Weihui City	Weihui WWM	48.3	50,000
Jiaozuo	Boai County	Boai WWM	36.1	50,000
<b>Water Supply Subprojects</b>				
Puyang	Puyang County	Puyang WS	80.9	40,000
Xinxiang	Weihui City	Weihui WS	50.0	30,000
Jiaozuo	Boai County	Boai WS	45.5	50,000

WS = water supply subproject; WWM = wastewater management subproject.

Source: Subproject's environmental impact assessment.

15. The outputs of the eight subprojects include: (i) wastewater treatment plants (WWTPs) capable of treating about 300,000 cubic meters per day (m<sup>3</sup>/day) of raw or partially-treated industrial and domestic wastewater to surface waters, (ii) more than 217 km of sewers and interceptors, (iii) improved security of water supply from protected and/or clean water sources, and (iv) more than 160 km of water supply and distribution pipelines. These subprojects will improve the urban environment for approximately 0.8 million urban residents in the five cities by 2010.

#### 1. Part A: Wastewater Management

16. **Anyang City Wastewater Subproject** serves the Zongcun area of Anyang City, an area of 27 km<sup>2</sup> in the western part of the city. The eastern part of the city is already serviced by three wastewater treatment plants. The population of the Zongcun area is estimated to be 150,000 and projected to be 205,000 in 2010. Untreated wastewater is currently discharged into the Wanjin Canal and Hong River tributaries of the Wei River. The subproject includes 51.6 km of collection system sewers and a WWTP with 100,000 m<sup>3</sup>/day capacity, capable of providing 40,000 m<sup>3</sup>/day of treated effluent for reuse in a nearby power station. After the subproject is completed, the treatment plant effluent will be discharged into the Hong River.

17. **Linzhou County Wastewater Subproject** serves an area of 11 km<sup>2</sup>. The population of the area was 130,000 in 2002 and is expected to reach 150,000 by 2010. There is no existing municipal wastewater treatment facility. Untreated wastewater is currently discharged untreated into the Sidao River, a tributary of the Wei River. The facilities proposed include 43.3 km of collection system sewers, and a WWTP with 50,000 m<sup>3</sup>/day capacity. The treated effluent from the new WWTP will be discharged into the Sidao River.

18. **Puyang County Wastewater Subproject** serves an area of 17 km<sup>2</sup> and a population that is expected to increase from 112,000 in 2001 to 151,000 in 2010. Untreated wastewater

from the area is currently discharged into the Majia River. The facilities proposed include 41.2 km of collection system sewers and a WWTP with 50,000 m<sup>3</sup>/day capacity. After the subproject is completed, treated effluent from the new WWTP will be discharged into the Majia River.

19. **Weihui County Wastewater Subproject** serves an area of 21 km<sup>2</sup> and a population that is expected to increase from 120,000 in 2002 to 156,000 in 2010. There is no wastewater treatment facility at present. Untreated wastewater from the area is currently discharged to both the Communism Channel and the East Mengjiangnu River. The wastewater collection system has 45.6 km of wastewater collection pipelines, which range from 300 millimeters (mm) to 1,200 mm in diameter. The new WWTP will have a capacity of 50,000 m<sup>3</sup>/day. Treated effluent from the new WWTP will be discharged into the East Mengjiangnu River.

20. **Boai County Wastewater Subproject** serves an area of 13 km<sup>2</sup> and had a population of 90,000 in 2001. The serviced population is expected to grow to 121,000 by 2010. Untreated wastewater is currently discharged into the Lema, Yunliang, and Dasha rivers. The wastewater subproject consists of 36.1 km of wastewater collection pipelines and a 50,000 m<sup>3</sup>/day WWTP. After the subproject is completed, treated effluent from the new WWTP will be discharged into the Dasha River.

## 2. Part B: Urban Water Supply

21. **Puyang Water Supply Subproject** serves an area of 17km<sup>2</sup> and a population that is expected to increase from 112,000 in 2001 to 151,000 in 2010. Currently Puyang County uses polluted groundwater from shallow wells. Puyang County will purchase 40,000 m<sup>3</sup>/day of treated water from Puyang City from a new deep well that is nearing completion. The water will be distributed throughout the urban area of Puyang County through 80.9 km<sup>2</sup> of distribution pipelines.

22. **Boai Water Supply Subproject** serves an area of 13 km<sup>2</sup> and a population that is expected to increase from 90,000 in 2001 to 121,000 by 2010. Currently Boai County uses polluted groundwater from shallow wells. The subproject will provide 50,000 m<sup>3</sup>/day of new water supply capacity drawn from the Yingdan Canal. The water will be treated at a new water treatment plant and distributed through 45.5 km of new distribution pipelines in the urban area of Boai County.

23. **Weihui Water Supply Subproject** serves an area of 21 km<sup>2</sup> and a population that is expected to increase from 120,000 in 2002 to 156,000 in 2010. Currently Weihui County uses polluted groundwater from shallow wells. The subproject will provide for 30,000 m<sup>3</sup>/day of raw water to be taken from Tagang Reservoir and treated in a new water treatment plant, transferred to Weihui County, and distributed through 50 km of new distribution pipeline in the urban area.

## IV. DESCRIPTION OF THE ENVIRONMENT

### A. General Project Setting and Physical Environment

24. The project area covers the part of Henan Province north of the Yellow River. The area is surrounded by Shanxi Province to the west, Hebei Province to the north, Shandong Province to the east, and the Yellow River and the southern part of Henan Province to the south. The project area covers 15,746 km<sup>2</sup> and the total population is 10.5 million. The project area is fairly flat with a mild slope of 1/8000 to 1/2000 from southwest to northeast. Except for a small hilly

area in the west of the project region at the edge of the Taihang Mountain Range, most of the area is alluvial plain with an elevation of about 50-80 m above the sea level.

25. The project area is in the temperate zone and has a monsoon climate characterized by distinct seasonal variations and sharp temperature changes. Average annual precipitation is 530–690 mm, with the majority occurring between June and September. The annual average temperature is 14.1°C, with recorded temperatures ranging from 42.9 °C (July) to -23.6 °C (January). The annual average relative moisture is 67% and average annual nonfrozen time is 216 days. The wind is primarily from the south in the summer and the north during the winter, with an annual average wind speed of 3.3 m/second.

26. In general, air quality in the project area meets category II ambient air quality standards<sup>2</sup> although total suspended particles (TSP) sometimes exceed the standard. The relatively good ambient air quality can be attributed to the absence of major industrial or other point sources of air pollution. The project sites enjoy a quiet environment. There are no major sources of noise and the monitored noise levels at the representative subproject sites are well within noise standards<sup>3</sup>.

## **B. River System and Hydrology**

27. The HRB's major watercourses currently receive raw wastewater discharges from existing urban areas and will receive final effluent discharges from the proposed WWTPs. The project area watercourses flow together through the Wei River, Wei Canal, and South Canal and then flow northeast to the Hai River or the Majia River (another major waterway in the HRB), and eventually into Bohai Bay. The central route of the SNWT Project will pass through the project area (including Boai and Weihui counties and Anyang City).

28. The total water resources in surface streams in the project area vary significantly from year to year and from season to season. The average per capita surface water resources are only about 200 m<sup>3</sup>, 10% of the national average. Many of the rivers in the project area are seasonal, with natural flows only in the summer season and are dry for the rest of the year. Raw wastewaters from domestic and industrial discharges are the only flows during the dry season in these rivers, which include the Wei River, Communism Canal, Huan River, Majia River, as well as smaller streams. Some waterways are manmade canals and some rivers originate from within the area and have no contributing upstream catchment.

29. Because surface water resources are insufficient, the groundwater is a major source of domestic and industrial water supplies. Groundwater overextraction resulting in decreasing groundwater levels is widespread over the project area. There has been evidence of serious groundwater contamination in parts of the project area, threatening the safety of drinking water supply.

30. The Yingdan Canal, the raw water source for the Boai water supply subproject, is a closed channel fed by the Qingtianhe Reservoir on the Danhe River. Water quality in the Yingdan Canal is class II. The Tagang Reservoir, the raw water source for the Weihui water supply subproject, is one of three reservoirs on the Cang River. Water quality in the Tagang Reservoir is class II.

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<sup>2</sup> Environmental Air Quality Standards GB3095-1996.

<sup>3</sup> Urban Area Environmental Noise Standards, GB3096-93.

### C. Water Quality

31. The water quality in the major surface water courses in the Project area is significantly below class V, indicating heavy pollution. Because of accelerated urbanization and increased industrial activities, many of the rivers and canals are below the lowest water quality standard, rendering the water bodies devoid of any functional use except as receiving water for raw wastewater discharges. This threatens the water quality of the downstream HRB and Bohai Bay, which are already heavily polluted.

32. Water quality monitoring during the project EIA also indicated that water quality in the project area rivers was poor, as shown in Table 2.

**Table 2 Surface Water Quality**

River/Canal	Monitoring Section	Current Water Quality	Water Quality Target (COD-mg/L)
Majia River	Puyang	> class V	30 (class IV)
	Puyang City	> class V	30 (class IV)
East Mengjiangnu River	Weihui	> class V	40 (class V)
Wei River	Weihui	> class V	40 (class V)
Communism Canal	Weihui	> class V	40(class V)
Sidao River	Linzhou	> class V	
Huan River	Linzhou	> class V	30 (class V)
Hong River	Anyang City	> class V	40 (class V)
Wanjin Canal	Anyang City	> class V	40 (class V)

COD = chemical oxygen demand

Source: Based on the State Standard Environmental Quality Standards for Surface Water (GB3838-2002).

33. Shallow groundwater in the vicinity of the heavily polluted rivers is poor or very poor in terms of water quality and unsuitable as a source of drinking water. However, groundwater from deep wells (over 300 meters deep) appears to be of an acceptable quality for drinking water.

34. The lack of proper water resources management in the project area, particularly the lack of provision of collection and treatment facilities for wastewater from various sources, compounded by an increase in industrial activities, frequent droughts that further reduce the already low natural dilution and assimilative capacity in rivers, has resulted in severe pollution of surface and shallow groundwater. This results in: (i) loss of beneficial use of the rivers in the project area, including industrial and municipal water supply sources (urban and rural), aquaculture, irrigation, and groundwater recharge; (ii) extinction of fish and other waterborne species in most rivers within the project area and destructive effects on the aquatic ecosystem; (iii) pollution of shallow groundwater layers in the short term and of deep groundwater aquifers over the long term; (iv) health risks from drinking contaminated drinking water, especially for rural residents who rely heavily and, in many cases exclusively, on shallow water wells as their drinking water sources; (v) contamination of farm land; (vi) adverse impacts on water quality in the downstream HRB and Bohai Bay; and (vii) potentially adverse impacts on the South–North Water Transfer Project (SNWTP) which will be a major water source for Beijing, Tianjin, and other areas in the northern PRC.

35. The urgency of the need to improve the HRB environment is apparent. The Project will be part of the effort to achieve state and provincial environmental goals.

#### D. Ecological Environment

36. Human activities, including industrial and agricultural developments, have caused the extinction of most native vegetation and large wildlife in the area. Currently vegetation is mainly characterized by planted trees and agricultural crops, while wildlife is mostly limited to small reptiles, local birds, insects and lower life-forms. The severe water pollution has made virtually all natural fisheries in the area's rivers and canals extinct. Freshwater fish may now only be found in reservoirs, fish farming ponds and a few rivers. Table 3 summarizes the major biota and agricultural resources in the project area.

**Table 3 Biota and Agricultural Resources in the Project Area**

Category		Major Species
Natural	Trees	Poplar, willow, elm, kiri, cypress, pine
	Bush	Brier
	Birds	Sparrow, swallow, owl, woodpecker, thrush, cuckoo
	Reptiles	Frogs, snakes
	Animals	Rabbits, rats, foxes, weasels, badgers, hedgehog, hares
Domestic	Water fowls (domestic)	Ducks, geese, partridges
	Livestock and domestic animals	Pigs, chickens, goats, cows, horses, donkeys, rabbits
	Major crops	Wheat, corn, rice, soybean
	Cash crops	Vegetables, herbs, flowers, cotton, peanut, sesame, cole
	Fruits	Dates, peaches, apples, apricot, pear, grape, persimmon, hawthorn, guava

Source: Subproject's environmental impact assessments.

#### E. Social and Economic Conditions

37. The key socioeconomic indicators of the Project area are summarized in Table 4.

38. The proposed Project will not interfere with any cultural or heritage sites.

### V. ALTERNATIVES

39. During project development, various alternatives have been proposed, screened and their technical, economic and environmental criteria have been compared. In terms of environmental criteria, the primary objective was to identify and adopt the options on a least-cost basis, giving full consideration to environmental impacts and benefits.

**Table 4 Key Socioeconomic Indicators of the Project area**

Item	Indicator
Population	<ul style="list-style-type: none"> <li>• Total population: 4.0 million (province: 96.7 million)</li> <li>• Agricultural population: 2.9 million (province: 77.2 million)</li> <li>• Non-agricultural population: 1.1 million (province: 19.5 million)</li> <li>• Population density: 645 person/km<sup>2</sup> (province: 579 person/km<sup>2</sup>)</li> </ul>
Land	<ul style="list-style-type: none"> <li>• Total area: 6,359 km<sup>2</sup> (province: 167,000 km<sup>2</sup>)</li> <li>• Cultivated land: 248,370 ha (province: 7,187,000 ha)</li> </ul>
Urbanization	<ul style="list-style-type: none"> <li>• Cities: 3                      Counties: 2                      Townships and villages: 72</li> </ul>
Economics	<ul style="list-style-type: none"> <li>• GDP: CNY 32.7 billion in 2003 (province: 704.9 billion)</li> <li>• Value Added of Industry: CNY 16.6 billion (province: 300.9 billion)</li> <li>• Major industries: pulp and paper, food processing, chemicals, machining, textile, tobacco</li> <li>• Major crops: wheat, corn, soya bean, peanut, tubers, cotton, vegetables, fruits</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Expressway: 721 km              Highways: 4,220 km              Railways: 428km</li> <li>• Existing WWTPs: 3 in Anyang City                      Sewer line: 431km</li> <li>• Power plants: 7</li> </ul>
Social services	<ul style="list-style-type: none"> <li>• Medical facilities: 259              Schools: 2,699                      Cultural facilities: 94</li> <li>• Cultural and heritage sites: 262                      Parks: 9</li> </ul>

CNY = Chinese yuan, GDP = gross domestic product, ha = hectare, km<sup>2</sup> = square kilometer, WWTPs = wastewater treatment plants.

Source: Subproject's environmental impact assessments.

#### **A. With or Without the Project**

40. Without the Project, rapid industrialization, urbanization, and population growth will result in increasing volumes of untreated domestic and industrial wastewater being discharged into the rivers and canals and a consequent deterioration in surface water quality. The polluted surface water quality would continue to affect the groundwater, threatening drinking water safety and thus the health of urban and rural residents. The area's ecosystem, and particularly aquatic life, will be damaged. The quality and yields of agricultural products will be reduced. The downstream water quality in the HRB will be affected. The quality of life and the standard of living of residents of the project area will deteriorate, and eventually the opportunities to carry out sustainable economic development in the region will diminish. The deteriorating water quality in the region will also pose a risk to the safety of the SNWTP.

41. With the implementation of the Project, on the other hand, the direct discharge of untreated wastewater will be significantly reduced, contributing to the long-term goal of cleaning up the HRB and improving related ecological, physical, and health conditions. Treated effluent will be available for reuse in industry and agriculture.

#### **B. Wastewater Collection**

42. Wastewater can be collected either by using combined drainage systems, or by using a new system of separate sewers. The subprojects provide for sewer separation in newly developed areas and some degree of separation in areas which are already developed.

### **C. Treatment of Industrial Water**

43. The following approaches for treatment of industrial wastewater are possible:
- (i) construct full industrial wastewater treatment facilities for major industries, so that environmental discharge standards are met and allow construction of smaller municipal wastewater treatment plants for treatment of domestic wastewater only;
  - (ii) construct pretreatment facilities at individual industrial sites to meet sewer discharge standards and construct municipal wastewater treatment plants capable of receiving all domestic and pretreated industrial wastewater; or
  - (iii) construct municipal wastewater treatment plants, capable not only of receiving the total volume of industrial and domestic wastewaters but also of treating potentially high levels of industrial effluents.
44. The second alternative is the most environmentally reliable and has the least negative impact. Pretreatment provides protection through biological treatment processes at municipal WWTPs. Professionally-managed municipal WWTPs would be more reliable than many industry-operated WWTPs discharging effluent directly into watercourses.

### **D. Alternative Treatment Processes**

45. For the WWTPs, various treatment processes have been considered, taking account of the reliability of the technology, the expected characteristics of the wastewater, the capacity of the WWTPs and other site conditions. The proposed processes have been selected for their ease of operation, reliability, and ability to meet the required effluent standards. Generally, an oxidation ditch process has been selected for the wastewater subprojects, except for Anyang where a modified A2/O process is proposed. For the water treatment plants, standard treatment processes, consisting of clarification, rapid sand filtration, and chlorine disinfection were selected, mainly because of the quality of the water sources. Surface water has been selected as the water source where protected upland reservoirs are available, and deep groundwater has been selected elsewhere.

### **E. Alternative Sludge Disposal Options**

46. Various alternatives have been considered for the disposal of sludge from WWTPs, including agricultural utilization, land reclamation, incineration and sanitary landfill. Sanitary landfill has been selected for most subprojects to minimize potential impacts of sludge disposal on the surrounding environment. Few subprojects currently have existing sanitary landfill facilities, and if facilities are not available by the time the WWTPs are operational, sludge will be temporarily transported to nearby municipal landfill sites. Land reclamation will be used if the sludge quality is suitable.

### **F. Wastewater Reuse**

47. Reuse of treated wastewater represents a potential new water resource in an area that is water stressed. The limited natural flow in many local rivers means there is an apparent economic justification for recycling and reuse of WWTP effluent, and this is proposed for the Anyang subproject.

## **G. Alternative Treatment Plant Sites**

48. For most of the representative subprojects, alternative sites were considered for the treatment plants. Selection of the proposed sites took account of existing and proposed land use, the ease of connection to the wastewater collection system, the possibility of odor and other nuisance to the community, and the availability of a suitable watercourse for discharge of treated effluent.

## **VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

### **A. Positive Impacts**

49. The Project will bring significant benefits to the HRB, both within Henan Province and to the water systems downstream. Most industrial and domestic wastewaters currently discharged to the environment in the urban areas of the subprojects will be intercepted. After the Project is implemented, the surface water quality in rivers will be significantly improved, and will be moving towards compliance with class IV or class V standards. By reducing pollutant discharges and improving area surface water quality, the Project will help to protect the SNWTP.

50. The quality of groundwater, which is one of the most important domestic and industrial water supply sources, is also expected to improve, as polluted rivers are the primary sources for groundwater recharge.

51. Freshwater fish farms and aquaculture will benefit from improved water quality. The adverse effects of irrigation with untreated wastewater will be reduced following project implementation.

52. In terms of the pollution of the HRB, the five representative wastewater management subprojects will reduce the total chemical oxygen demand (COD) load by about 33,500 tonnes per year. This will contribute significantly to the target of the *Tenth Five-Year Plan for Henan Provincial Hai River Basin Water Pollution Control* to reduce the total COD discharged into receiving waters by 126,300 tons per year.

53. Other additional potential benefits of the Project include: (i) improved sanitation and hygiene for residents near HRB watercourses; (ii) increased property values for land alongside HRB rivers; (iii) improved recreation and environmental aesthetics for the communities of the project area; (iv) improved biodiversity and ecosystems; (v) increased quality of life and standard of living for residents living downstream from the project area; (vi) improved public health through reduced risk of waterborne and water-related diseases; and (vii) increased public satisfaction with the urban environment. It has been estimated that the Project should reduce health costs associated with waterborne and water-related diseases by about 40%.

### **B. Mitigation Measures during Design Phase**

54. The following mitigation measures will be undertaken during the design phase: (i) all subproject sites will be carefully selected to avoid or minimize potential impacts to the environment and surrounding communities; (ii) the treatment plant layouts will be designed so sources of noise and odors will be as far from nearby villages as possible; and (iii) mitigation measures requiring design such as landfill site drainage control, leachate collection and treatment plants, will be incorporated into the design of sanitary landfills.

### C. Environmental Impacts and Mitigation Measures during Construction Phase

55. Construction activities are expected to generate the following adverse impacts:
- (i) **Airborne dust** will be caused by excavation, demolition, vehicle movement and materials handling, particularly downwind from the construction sites.
  - (ii) **Air pollution** will be caused by emissions from vehicles and construction machinery.
  - (iii) **Noise** will be caused by construction equipment and vehicular movement, potentially affecting residents of nearby villages and schools.
  - (iv) **Traffic congestion** will be caused by pipeline construction and increased construction traffic in urban areas. Roads may be fully or partially closed during construction, causing temporary inconvenience to residents, commercial operations and institutions.
  - (v) **Waste discharge from construction camps.** The discharge of wastewater from construction camps could create new pollution sources. The camps could also be sources of solid waste and waste oil from machinery maintenance.
  - (vi) **Excavated materials.** Pipeline construction and demolition will generate 2.1 million m<sup>3</sup> of excess materials for disposal, while site preparation for the treatment plants will need 1.6 million m<sup>3</sup> of fill material.
  - (vii) **Interruption of municipal services.** Construction of project facilities may require relocation of underground municipal utilities such as sewers, gas, water supplies, communication cables, and power poles.
  - (viii) **Land impact.** About 90 hectares (ha) of land in urban areas will be temporarily occupied by construction activities while pipelines are being installed and pumping stations constructed, which may require removal of vegetation and temporary disturbance to livelihoods.
56. Based on the results of the impact assessments, the following mitigation measures will be taken during the construction phase:
- (i) Construction sites, transportation routes and materials handling sites will be water-sprayed on dry and windy days up to three times a day, especially if these sites are near sensitive receptors, such as residential areas.
  - (ii) Vehicles and construction machinery will be required to be properly maintained and to comply with relevant emission standards.
  - (iii) Construction activities will be scheduled carefully to minimize the impact of noise from construction machinery. Nighttime uses of certain noisy machines, such as pile drivers and concrete vibrators, will be prohibited.
  - (iv) In conjunction with the relevant authority, traffic plans will be prepared before construction in the congested urban centers.
  - (v) Sewage and other wastewater from construction camps will be collected and treated using septic tanks before being discharged to avoid contamination of the surrounding areas.
  - (vi) Temporary land occupation will be planned well ahead of construction to minimize the impact of the disturbance. Land will be reinstated to its original condition on completion of construction.
  - (vii) Materials will be stored in appropriate places and covered or sprayed to minimize dust.
  - (viii) Construction waste will be promptly removed from the sites. Burning of construction waste will be prohibited.
  - (ix) Materials will be covered during transportation to avoid spillage or leakage.

- (x) Construction will be immediately suspended if any archaeological or other cultural properties are found. The relevant cultural authority, as well as the project management office (PMO), will be notified promptly, and only after a thorough investigation will construction resume.
- (xi) Contractors will be required to take safety measures at the construction sites to protect the public, and warning signs will be provided to alert the public of potential safety hazards at and around the construction sites.
- (xii) All contractors and construction supervisors will be required to participate in an environmental training program before construction begins.

57. The above mitigation measures will, where appropriate, be included in the tender documents and subsequently in the construction contracts.

#### **D. Environmental Impacts and Mitigation Measures during Operation Phase**

58. The primary air emissions from the wastewater treatment plants will be nuisance odors generated by screening, grit removal, primary tanks, secondary (aeration) tanks, and sludge handling processes. The pumping stations could also be a source of such odors. The main constituents of such odors are typically  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , and methyl sulfide.

59. An air diffusion model was used by the domestic consultants in the EIAs to predict the concentrations of the air emission constituents which cause odor. The modeling results (Table 5) show that the shortest distance between residential areas and the treatment plant varies from about 180 m to 300 m. It is generally above the protected (safe) distance and exceeds the predicted impacted distance. However, sites of treatment plants have been selected so that most villages are in the least frequent wind direction from the WWTPs. Village residents may therefore be affected by odor nuisance from the treatment plants only during the rare occasions (about 1%) when the wind direction is toward the village.

**Table 5 Odor Protection**

<b>Subproject</b>	<b>Impacted Distance (m)</b>	<b>Protected (Safe) Distance (m)</b>	<b>Shortest Distance to Village (m)</b>
Boai WWTP	190	200	250
Puyang WWTP	200	200	300
Weihui WWTP	-	200	200
Anyang WWTP	80	150	180
Linzhou WWTP	70	100	300

m = meter, WWTP = wastewater treatment plant.

Based on residential standards of  $0.2 \text{ mg/m}^3$  for  $\text{NH}_3$  (acidulous odor),  $0.01 \text{ mg/m}^3$  for  $\text{H}_2\text{S}$  (bad egg odor) and a detection threshold of  $0.0021 \text{ mg/m}^3$  for methyl sulfide (acidulous sulfur odor).

Source: Subproject's environmental impact assessments.

60. Overall there will be a significant positive impact in terms of air quality related to odor. Currently, there are tens of thousands of urban and rural residents living very close to open ditches, rivers, or canals which essentially carry nothing but raw sewage and industrial wastewater. Site investigation of these areas and discussions with residents showed that there are regular nuisance odors, as well as other health and hygiene concerns, from these virtually

open sewers. Particularly in the summer, such odors and other concerns reach unacceptable levels. Through the construction of sewers to collect wastewater, many of these open ditches will be improved or covered. The wastewater treatment plants in the project will substantially improve the water quality of the receiving waters and this will also reduce odors downstream.

61. The five representative municipal WWTPs will generate a total of about 150 tons per day of sludge cake containing around 80% moisture. Handling and final disposal of this in a safe, proper, and environmentally responsible manner will be a substantial task. The Project will use two methods: landfill at existing or proposed solid waste disposal sites and land application if the sludge quality is suitable.

62. A key potential environmental concern is contamination of groundwater by leachate from the solid waste disposal sites, which may contain high concentrations of organics and heavy metals. The leachate may contaminate ground and surface water unless it is contained by an impermeable layer which allows leachate to be collected for subsequent treatment. Leachate treatment will be included in the sanitary landfills design. Regarding odor nuisance, there are no sensitive receptors in areas immediately adjacent to the existing or proposed landfills. Furthermore, daily coverage of newly deposited sludge with a 20-30 cm layer of soil will minimize nuisance conditions such as odors and flies at the landfills.

63. Based on the results of the impact assessment, the following mitigation measures have been identified for the operations phase:

- (i) follow operational procedures properly and ensure plants and sludge disposal facilities are operated as designed;
- (ii) develop contingency plans for power failure, overflows, equipment malfunctioning and other conditions which may affect the proper functioning of the plants, resulting in discharge of raw wastewater into the receiving environment;
- (iii) water yields have been sufficiently studied and contracts have been drafted for raw water allocation for the water supply subprojects;
- (iv) hold regular consultations with residents in nearby communities and respond promptly to any concerns they may raise with regard to the operations of the wastewater treatment plants, pumping stations, and sludge disposal facilities; and
- (v) landscape project sites and include trees, lawns and community parks.

## **E. Resettlement**

64. People affected physically and economically by the Project include: (i) people affected by the acquisition of land; (ii) people affected by the temporary use of land for the water treatment plants, pumping stations, water pipelines and water distribution network, wastewater treatment plants, sewer construction, and pumping stations; and (iii) people whose livelihoods are impacted during construction activities. All project components were planned so as to minimize disruption to residential areas and villages and to maintain village cohesion.

65. The Project will require the permanent acquisition of 35.1 ha of land, the temporary acquisition of 90.5 ha of land, and the demolition of 180 m<sup>2</sup> of residential buildings, and 1,960 m<sup>2</sup> of nonresidential buildings. In total, 464 households, or 1,388 people, will be permanently affected by land acquisition and three households, or 11 people, by house demolition. In

addition, one enterprise and one farm will also be affected. No indigenous people or ethnic minorities will be adversely affected by the Project.

66. The total cost for both land acquisition and resettlement is estimated to be CNY42.36 million<sup>4</sup> at 2004 prices. Resettlement impacts have been identified and resettlement plans prepared in accordance with PRC land law and ADB's policy on involuntary resettlement. The resettlement plans provide a socioeconomic profile of affected persons and scope of impacts, and address issues related to compensation entitlement, the legal framework, public consultations, grievance procedures, environmental protection, rehabilitation measures, and budget and implementation milestones. Resettlement requirements have been carefully considered and incorporated into project design.

67. HPG (Henan Provincial Government) and implementing agencies (IAs) will implement ADB's full disclosure policy for the resettlement activities, including: (i) preparation of a summary resettlement plan; (ii) distribution of the resettlement information booklet to affected persons and village offices; and (iii) posting of the full resettlement plan in Chinese and English at village offices and resident committees, and on the ADB website upon its approval and/or endorsement by HPG. Each PMO will establish a specific project resettlement office to continue public information activities and respond to any questions or grievances.

68. All affected persons will be compensated and resettled in a timely and adequate manner in accordance with the resettlement plan, so that they will be at least as well off as they would have been without the Project. To ensure that affected persons have been adequately compensated and rehabilitated, the HPG and the IAs will keep ADB informed of the implementation of the resettlement plans through quarterly progress reports until resettlement is completed and will prepare a resettlement completion report. The Henan PMO and IAs will engage an independent agency for semi-annual monitoring and annual evaluation of land acquisition and resettlement until 2 years after the land acquisition, resettlement implementation, and completion of resettlement.

## VII. ECONOMIC ASSESSMENT

69. The project is based on controlling externalities (water pollution) and managing natural monopolies (water supply and wastewater treatment plants). Its economic rationale is sound. The justification for each wastewater subproject is the application of wastewater treatment to achieve the water quality class assigned to the reach into which the plant will discharge. The justification for each water supply project is the replacement of a polluted raw water source. Least-cost analysis will be applied to the subprojects to ensure that each has the optimal design, in terms of scale, timing, location, and technology. Demand analysis will play a significant role in determining the scale of each subproject and will be based on projected use charges and incorporate price and income elasticities. Each subproject will be subject to cost-benefit analysis following ADB's guidelines, and will have economic internal rates of return (EIRRs) of at least 12%. Initial analysis of the eight representative subprojects indicates that all will meet these standards.

70. Economic analysis consisted of a cost-benefit analysis of the eight representative subprojects. The cost-benefit analysis included, among other things, a least-cost analysis followed by benefit estimates, and estimates of the EIRRs.

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<sup>4</sup> \$5.12 million.

71. The least-cost analysis considered four types of alternative wastewater management and water supply subprojects: (i) alternative treatment processes, (ii) alternative sites for the WWTP or WTP, (iii) alternative wastewater collection or water distribution routes, and (iv) other city- or town-specific alternatives. For each subproject, a minimum of two and a maximum of four alternatives were assessed based on the options presented in the national feasibility studies, with a number of additions and variations by the project preparatory technical assistance. The results of the analysis confirm that the preferred options in the national feasibility studies are the least-cost alternatives.

72. The proposed projects will generate a wide range of benefits, including: (i) improving environmental quality in the towns and downstream areas, (ii) raising living standards and safeguarding public health, (iii) improving urban services, (iv) developing institutional capacity, (v) creating new employment opportunities, (vi) building public awareness of important environmental issues, (vii) providing a demonstration project that could be replicated in other regions of Henan Province and the PRC, and (viii) contributing to poverty alleviation in the urban and rural areas of the project counties.

73. The main quantifiable benefits are:

- (i) Wastewater management component: (a) willingness to pay by nonindustrial beneficiaries, (b) industrial wastewater treatment savings, (c) health benefits, and (d) recycled effluent (Anyang City only– for cooling at local power plant).
- (ii) Water supply component: willingness to pay for improved and expanded water delivery services.

74. The EIRR for each subproject is given in Table 6. The EIRR ranges from 13.9% to 18.1% for the wastewater management projects and from 17.0% to 19.5% for the water supply projects. Sensitivity tests on the main parameters indicate that the results are robust and the proposed investments are economically and environmentally justified.

**Table 6 Economic Internal Rates of Return**

<b>County Town</b>	<b>Wastewater (%)</b>	<b>Water Supply (%)</b>
Anyang (Zongcun) City	14.6	
Linzhou	18.1	
Puyang	16.5	19.5
Weihui	16.2	18.8
Boai	13.9	17.0

Source: Subproject's environmental impact assessments.

## **VIII. ENVIRONMENTAL MANAGEMENT PLAN**

### **A. Environmental Management**

75. The environmental management plan (EMP) covers all phases of the Project from preparation and construction to commissioning and operation, and aims to monitor environmental impacts and their mitigation. The EMP, which is attached in Appendix 2, has been incorporated into the design stage, and will be incorporated into the construction and operation management plans.

76. The EMP will ensure effective implementation of various identified mitigation measures. During project preparation and implementation, various organizations with different environmental management responsibilities, Henan Provincial Environmental Protection Bureau (HPEPB), Henan PMO, local environmental protection bureaus (LEPBs) including municipal and county-level EPBs, PMOs, IAs, design institutes, environmental management consultants (EMCs), water conservancy bureaus (WCBs), contractors and construction supervision companies (CSCs), have been involved and will be involved in the EMP. PMOs, contractors and IAs will each will nominate full-time dedicated, trained and qualified environmental specialists to undertake environmental management activities and ensure effective implementation of the EMP. Table A2.4 of the EMP shows the environmental responsibilities at different phases of the Project. In accordance with the EMP, IAs will establish an environmental management office that will generally have two employees. This office will be supported and supervised by the respective local EPBs and EMCs. Each PMO will have one environmental specialist.

77. Plans for public involvement during the design, construction and operation phases have been developed during the project preparation stage. These plans include public participation in: (i) monitoring impacts and mitigation measures during the construction and operation phases, (ii) evaluating environmental and economic benefits and social impacts, and (iii) interviews after the Project has been completed. There will be several types of public involvement, e.g., site visits, workshops, investigation of specific issues, interviews, and public hearings as presented in Table A2.3 of the EMP.

78. The PMO will ensure that the Project's progress and impacts are monitored and reported in line with ADB requirements. The effectiveness of mitigation measures and monitoring plans will be evaluated through the feedback reporting system. The measures required by the EMP will be adjusted if necessary. Local EPBs and PMOs play critical roles in this feedback and adjustment mechanism as shown in Figure A2.6 of the EMP.

79. Costs of all mitigation measures during the construction phase will be included in the tender and contract documents and will be borne by contractors. Costs related to mitigation measures for the operation phase will be borne by IAs. Costs of environmental management consultants and of training will be borne by the project as a whole. Corresponding cost estimates are presented in Table A2.1, Table A2.2 and Table A2.5 of the EMP.

## **B. Environmental Monitoring**

80. A detailed environmental monitoring program is presented in Table A2.2 of the EMP. Environmental monitoring programs will evaluate the: (i) extent and severity of environmental impacts as compared to the predicted impacts, (ii) performance of the environmental protection measures and compliance with related rules and regulations, (iii) trends of impacts, and (iv) overall effectiveness of the project EMP.

81. During the construction and operation phases, the IAs will be responsible for monitoring the performance of the facilities and the environmental impact of the project. Each IA will make appropriate arrangements for monitoring in consultation with their LEPB and monitoring reports will be made available to the LEPB on a monthly basis. LEPBs have qualified staff with monitoring equipment and technical capacity to monitor the aquatic, air, and physical environment (noise), soil and receiving water conditions, solid waste disposal, industrial pretreatment, water source pollution control and traffic conditions. When any complaints are received from the public, monitoring staff will immediately conduct additional inspections. The

laboratories of LEPBs are appropriately certified, assuring the accuracy of the analytical results and their legal standing.

82. Besides compliance monitoring, detailed internal environmental monitoring programs during the construction and operation phases with higher monitoring frequency will be prepared at the beginning of project implementation by PMOs, IAs, and EMCs. These monitoring programs and budgets will be included in the construction and operation contracts and program, with mitigation measures monitored by the CSCs and EMCs. At the beginning of project implementation, the PMOs, IAs and the project implementation consultants will develop comprehensive project performance monitoring system (PPMS) procedures to systematically generate data on inputs and outputs of the project components and develop detailed environmental and related socioeconomic indicators to be used to measure project impacts.

83. Results from the detailed internal environmental monitoring for both construction and operation phases will be submitted by the contractors and IAs to the LEPBs and PMOs monthly.

84. Environmental monitoring costs are included in Table A2.2 of the EMP. Compliance monitoring costs are borne by LEPBs. Internal monitoring costs are borne by the IAs, construction contractors and CSCs during the construction phase, and by the IAs during the operation phase. Before implementing the monitoring plan, responsible agencies will present a further detailed breakdown of the estimated budget. During project implementation, the budgets will be adjusted based on actual requirements.

### **C. Institutional Enhancement**

85. PMOs, contractors and IAs will each nominate full-time dedicated, trained and qualified environmental specialists to undertake environmental management activities and ensure effective implementation of the EMP.

86. Local governments will ensure that IAs will have financial and managerial autonomy to operate the project facilities. As IAs have been recently established, they have limited environmental management capacities. Their capacity will be strengthened by environmental management training provided by the Project as detailed in Table A2.5 of the EMP.

## **IX. PUBLIC INVOLVEMENT AND DISCLOSURE**

87. Two rounds of public consultation were held during the course of the environmental impact assessment. The primary objective of the first round was to gather information on public concerns about the project. The primary objective of the second round was to communicate the EIA findings and proposed mitigation measures and determine the degree of public acceptance. Both rounds focused on project-affected people and beneficiaries from different age groups, genders, educational backgrounds, and occupations, as well as other stakeholders from areas immediately adjacent to the project sites and from other parts of the project counties.

88. A concise project description for the first round of public consultation and a summary of main EIA findings and proposed mitigation measures for the second round, both in plain language, were prepared and distributed to the public before or at the time of the consultation. Before the second round, project information, a brief description of EIA results and mitigation, and the EIA team's contact hotlines were advertised in local media. The individual EIA reports were also placed in county libraries to provide easy access for public review.

89. At the public consultations the major opinions and concerns were as follows.
- (i) About 18% of the public considered the quality of the environment poor and 74% believed that irrigation and/or drinking water sources had been contaminated.
  - (ii) More than 80% expected community, environment, and quality of life improvements from project implementation, and 86% supported the project. The public generally wanted the water and wastewater construction to start soon.
  - (iii) The affected people expressed concerns about noise, airborne dust, and traffic congestion during construction and nuisance odor during operation of WWTPs. Of the public surveyed, 95% were willing to accept the temporary impacts and/or inconvenience arising from construction.
  - (iv) The public surveyed, particularly those who would be directly affected by the construction, demanded sound environmental management during construction to minimize impacts on the surrounding communities.
  - (v) The vast majority were willing to accept the land acquisition and resettlement plan in order to provide the required land for the water or wastewater treatment plants. However, those who would be affected wanted the compensation and land acquisition costs to be fair, in compliance with relevant state and provincial policies, and paid on time and in full to the head of the households in any houses that would be demolished.
  - (vi) The affected public also expected that the project construction and operation would bring employment or other income opportunities. The investment in the project would help the regional economic development.

90. It is considered that the issues and concerns raised at the public consultation program have been appropriately addressed during the EIA and mitigation planning. Specific mitigation measures have been designed to avoid or minimize the adverse impacts of most concern to the public, with specific implementing timetables and budgets.

## **X. CONCLUSIONS**

### **A. Project Risks**

91. The main project risk relates to the low level of capacity currently found at the city and county level. This lack of capacity manifests itself in a number of ways including: (i) immature IAs, (ii) a lack of awareness of policy and reform issues, (iii) largely unproven billing and collection of wastewater charges, (iv) a lack of existing operations and management capability in respect of WWTP, (v) limited IA awareness of ADB requirements, and (vi) low levels of financial management capability.

92. Comprehensive analysis of project risk identified appropriate risk mitigation measures which include: (i) use of contingencies in cost estimates; (ii) appointment of project implementation consultants, including EMCs; (iii) project implementation monitoring arrangements; (iv) support from higher levels of government (notably at the municipal and provincial levels); (v) environmental management training provided by the project; (vi) a series of specific assurances from Government; and (vii) project reviews by ADB.

93. Assurances related to the environmental aspects of the Project are required as follows:

- (i) HPG, each project municipal government and/or county government, and the project company will ensure that the project facilities are constructed, operated, maintained, and monitored in strict conformity with: (a) all applicable laws and regulations, including national and local regulations and standards for environmental protection, health, labor, and occupational safety; and (b) the environmental mitigation and monitoring measures detailed in the approved EIAs, SEIA, and EMP for the Project are carried out.
- (ii) Each project company will ensure that it engages an adequate number of full-time personnel, and sufficient resources to monitor the implementation of the EMP, under guidance of the relevant municipal EPB. Monitoring reports will be provided to HPMO who will coordinate the preparation of an annual environmental report in a format acceptable to ADB. These annual reports will be submitted to ADB, by 31 March each year, until loan closure.
- (iii) HPG and the project wastewater company will ensure that: (a) the detailed designs of the wastewater treatment plants adequately address potential effluent and sludge reuse issues; (b) before startup of the wastewater treatment plants, measures will be completed to assure collection of wastewater from major industrial and other dischargers; and (c) arrangements will be in place for sludge disposal in accordance with PRC regulations.
- (iv) Each municipal government and/or county government will prepare an industrial pollution control plan, including relevant monitoring and enforcement arrangements. These plans are to be prepared and submitted to ADB by the end of December 2006.

## **B. Benefits**

94. The Project will contribute to the reduction of pollution and improved water resources management in the HRB into which all of the rivers and canals in the project area drain. Downstream beneficiaries will be large segments of the populations living in Hebei Province, Shandong Province, Beijing and Tianjin, and around Bohai Bay. The Project will also reduce transboundary pollution between Henan Province and Hebei and Shandong provinces. The Project will significantly contribute to achieving surface water quality goals for the area, improve the quality of life for urban and rural communities, and provide protection to the SNWTP which will pass through the project area.

95. The Project is expected to achieve the following targets: (i) target water quality levels by 2010 will be met by water bodies in the project area, (ii) a total COD reduction of 33,500 tons/year will be achieved in the project cities by 2008, (iii) 80 % of urban wastewater in Anyang and 70% in other subproject cities/counties will be collected and treated by 2008, (iv) all project-related WWTPs will meet discharge standards from 2008, (v) all sludge will be used or disposed of in compliance with PRC regulations by 2010, (vi) security of water supply will have been improved by using protected/clean water sources, and (vii) all project-related WTPs will meet PRC water quality standards by 2008.

96. The project will promote integrated industrial and domestic wastewater management, as industries will discharge their wastewater into urban sewer systems. The Project will promote water conservation measures, including leakage management and water reuse, that will reduce future increases in water demand. The wastewater component will provide beneficial reuse of

treated effluent for industry and agriculture in Anyang City and the potential for effluent reuse elsewhere in future.

97. About 98% of urban residents in Puyang County, Boai County, and Weihui City will be provided with more secure and more potable water supplies that meet PRC quality standards. The improved quality and availability of treated water will bring economic, health and social benefits to the community. Inter alia, the project will reduce health costs associated with waterborne and water-related diseases by about 40%. Poorer people in particular will as currently they cannot afford to buy bottled potable water for domestic purposes. The inclusion of water supply subprojects creates an opportunity for the Project to promote the creation of joint water supply and wastewater utilities as an institutional reform under the Project, facilitating ongoing policy dialogue on integrated water resources management. The Project will promote sustainability of water and wastewater infrastructure to be supported by the Project through high standards of O&M and environmental mitigation and management.

### **C. Potential Negative Impacts and Associated Mitigation Measures**

98. The adverse impacts generated by the project will be avoided or reduced to acceptable levels by taking appropriate mitigation and compensation measures. The main measures include: (i) careful selection of water and wastewater treatment plant sites to avoid sensitive locations; (ii) control of noise, dust, and release of wastewater during construction; (iii) soil erosion control during earthworks; (iv) odor and noise control during operations; and (v) landscaping after project completion.

99. Some limited adverse impacts, while mitigated to acceptable levels, include a permanent loss of about 35.1 ha of land which will be appropriately compensated.

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7. Solid Waste Pollution Control Act of the PRC (October 30, 1995)
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9. Air Pollution Prevention Act of the PRC (April 29, 2000)
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11. Environmental Protection Management Directories for Construction Projects (No.9, [1999]), issued by SEPA
12. Notice to Strengthen the Environmental Impact Assessment and Management of Construction Projects Financed by Loan from International Financial Organizations, jointly issued by SEPA, the State Planning Commission, the Ministry of Finance and the People's Bank of China (June 21, 1993)
13. Ordinance of the Management of Environmental Protection for Construction Works<sup>1</sup>

### C. Standards

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6. Municipal Sewer Discharge Standard (CJ3082-1999)
7. Water Quality Standards for Agricultural Irrigation (GB5084-92)
8. Water Quality Standards for Fisheries (GB11607-89)
9. Standard of Environmental Noise of Urban Area (GB3096-93)
10. Integrated Emission Standard of Air Pollutants (GB16297-1996)

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<sup>1</sup> Item 19 ... the operation of facilities for environmental protection and the environmental impacts of construction works will be monitored by IAs.

11. Ambient Air Quality Standard of the PRC (GB3095-1996)
12. Emission Standard for Odor Pollutants of the PRC (GB14554-93)
13. The Control Standards of Pollutants in Sludge for Agricultural Use of the PRC (GB4284-84)

**SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT**

**HENAN PROVINCE WASTEWATER MANAGEMENT AND WATER SUPPLY PROJECT**

**IN THE**

**PEOPLE'S REPUBLIC OF CHINA**

**ENVIRONMENTAL MANAGEMENT PLAN**

February 2005

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Figure A2.3	Boai WW & WS Subprojects
Figure A2.4	Puyang WW & WS Subproject
Figure A2.5	Weihui WW & WS Subproject
Figure A2.6	Mechanism for Feedback and Adjustment of Environmental Management Plan

## ENVIRONMENTAL MANAGEMENT PLAN

### A. Introduction

1. The environmental management plan (EMP) covers all phases of the Project from preparation through commissioning and operation, and aims to ensure the monitoring of environmental impacts and the implementation of environmental mitigation measures. Maps of representative subprojects are given in Figure A2.1 to Figure A2.5.

2. Environmental monitoring programs will be carried out and the results will be used to evaluate: (i) the extent and severity of actual environmental impacts against the predicted impacts, (ii) the performance of environmental protection measures and compliance with related rules and regulations, (iii) trends of impacts, and (iv) the overall effectiveness of the project EMP.

3. Environmental protection measures will: (i) mitigate environmental impacts, (ii) ensure compliance with environmental regulations, (iii) provide compensation for lost environmental resources, and (iv) enhance environmental resources.

### B. Summary of Potential Impacts

4. Potential impacts of the Project during the construction and operation phases, as identified by the environmental impact assessment (EIA), as well as corresponding mitigation measures designed to minimize the impacts are summarized in Table A2.1.

### C. Mitigation Measures

5. The mitigation measures will be incorporated into tender documents (where appropriate), construction contracts and operational management plans, and will be implemented by contractors and implementing agencies (IAs) under supervision of the project management offices (PMOs). The effectiveness of these measures will be evaluated based on the results of the environmental monitoring to determine whether they should be continued or improvements should be made. Improvements need to be confirmed through stipulated environmental management procedures.

6. Resettlement plans were prepared to ensure proper resettlement of the affected persons to avoid deterioration of affected persons' quality of life. Details of required actions are given in the project resettlement plans.

**Table A2.1: Summary of Potential Impacts and Mitigation Measures**

Subject	Potential Impacts	Mitigation Measures <sup>a</sup>	Budget (CNY 10,000)								Total	Remarks
			An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo-ai WW	Pu-yang WS	Wei-hui WS	Bo-ai WS		
<b>Construction Stage</b>												
Water	Wastewater generated by site construction activities and construction workers, and runoff of silt-laden water.	Enclose construction sites by a temporary perimeter wall, build drainage ditches, and install temporary septic tanks for collection of wastewater	20	15	15	15	15	10	15	15	120	Construction budgets
Air	Dust suspension from construction activities and transportation	Enclose construction sites, cover or spray water at exposed storage sites, minimize on-site storage of materials, spray water at construction sites and on dusty roads, transport materials in covered vehicles or in closed containers, control vehicle speeds, and select transport routes	5	5	5	5	5	5	5	5	40	Construction budgets
	Pollution from emissions from vehicles and construction machinery	Operate with proper maintenance and in compliance with relevant emission standards	2	2	2	2	2	2	2	2	16	Construction budgets
Noise	Noise generated by vehicles and construction machinery	Reasonable construction arrangements, installation of on-site sound barriers, proper equipment and correct operation and maintenance	5	5	5	5	5	5	5	5	40	Construction budgets
Solid Waste	Refuse generated on construction site	Timely clean-up, transport in covered vehicles or in closed containers	2	2	2	2	2	2	2	2	16	Construction budgets
	Disposal of surplus excavated material from construction activities	Reuse surplus material for construction, landscaping or agriculture if suitable or dispose to sanitary landfills if testing shows material to be unsuitable	10	8	8	8	8	8	8	8	66	Construction budgets

Subject	Potential Impacts	Mitigation Measures <sup>a</sup>	Budget (CNY 10,000)								Total	Remarks
			An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo-ai WW	Pu-yang WS	Wei-hui WS	Bo-ai WS		
Land	Removal of vegetation	Replant vegetation on completion of construction	5	5	5	5	5	5	5	5	40	Resettlement plan budgets <sup>b</sup>
	Silt-laden runoff	See construction stage "water"	0	0	0	0	0	0	0	0	0	
Ecology	Removal or relocation of trees	Replant trees on completion of construction	5	5	5	5	5	5	5	5	40	Resettlement plan budgets <sup>b</sup>
Social	Resettlement	implement resettlement plan in compliance with ADB policies	-	-	-	-	-	-	-	-	-	Resettlement plan budgets <sup>b</sup>
Other	Traffic congestion including inconvenience to pedestrians and shop owners	Construct temporary roads, select transport routes, divert traffic at peak hours, repair disturbed roads shortly after construction, and make interim traffic arrangements	5	5	5	5	5	5	5	5	40	Construction budgets <sup>b</sup>
	Disturbance of existing utilities (pipelines, cables)	Consider other utilities at design stage and if necessary reinstate following construction	20	20	20	20	20	20	20	20	160	Construction budgets <sup>b</sup>
Environmental Risk	Interference of sewer or water supply construction with roads, buildings, inland rivers, and railways etc	Detailed coordination to be carried out during detailed design, including development of appropriate construction options and emergency plans	10	10	10	10	10	10	10	10	80	Construction budgets
<b>Operational Phase</b>												
Water	Overflow or bypassing of wastewater	Install standby equipment at pumping stations, use dual power source supply system, implement proper maintenance program, enhance operational monitoring,	20	20	20	20	20	0	0	0	100	Construction budgets or IA's O&M budgets

Subject	Potential Impacts	Mitigation Measures <sup>a</sup>	Budget (CNY 10,000)								Total	Remarks	
			An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo-ai WW	Pu-yang WS	Wei-hui WS	Bo-ai WS			
		and emergency measures											
	Wastewater discharge to watercourses	Intercept discharges, impose stringent environmental management and pollution control	20	20	20	20	20	0	0	0	100	IAs, LEPBs and Industry budgets	
	Contamination of raw water source	Implement and enforce water and land protection zones	0	0	0	0	0	0	10	10	20	WCB budgets	
	Water stress/ insufficient water allocation	Water yields sufficiently studied, allocation contract drafted and concluded	0	0	0	0	0	0	0	0	0	Completed by WCBs	
	Damage to sewers or wastewater treatment plant from corrosive industrial discharges	Adequate pretreatment of industrial wastewater, selection of appropriate construction materials, adequate process control of WWTPs	20	20	20	20	20	0	0	0	100	Industry, construction and IA budgets	
	Pollution of receiving water courses following upset of wastewater treatment process by industrial discharges	Adequate pretreatment of industrial wastewater	-	-	-	-	-	0	0	0	-	Industry budgets (cost not estimated)	
		Efficient monitoring and enforcement,	5	5	5	5	5	0	0	0	25	LEPB budgets	
	Pollution of receiving water courses following failure to operate WWTP correctly	Adequate process control of WWTPs	5	5	5	5	5	0	0	0	25	IA budgets	
Air	Odor	Cover potential odor sources, transport sludge and other residues in covered containers	5	5	5	5	5	0	0	0	25	IA budgets	
	Safety risk from toxic gases	Installation of inspection and control equipment, appropriate spacing of manholes, provide ventilation, monitoring atmospheric conditions, adopt safe working systems and	5	5	5	5	5	0	0	0	25	IAs	

Subject	Potential Impacts	Mitigation Measures <sup>a</sup>	Budget (CNY 10,000)								Total	Remarks
			An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo-ai WW	Pu-yang WS	Wei-hui WS	Bo-ai WS		
		emergency measures										
Noise	Noise generated by pumps and machinery	Select low noise machines, locate high noise equipment indoors, install noise enclosures or buffers, semi-underground setting of pump stations	10	10	10	10	10	0	10	10	70	DIs and construction budgets
Solid Waste	Pollution by sludge from water and wastewater treatment plants	Dispose of sludge at sanitary landfills if testing shows sludge to be unsuitable for beneficial reuse	20	10	10	10	10	0	0	0	60	IA's O&M budgets
	Sludge or silt from wastewater pumping stations and wastewater collection systems	Timely clean-up and transportation in covered containers	10	10	10	10	10	0	0	0	50	IA's O&M budgets
Environmental Risk	Sewer house connections not completed, resulting in discharge of untreated wastewater to watercourses and aquifers	Government assurance to implement house connections	-	-	-	-	-	0	0	0	-	Local government construction budgets (costs to be estimated)
	Collapse or leakage of sewers	Adequate design and construction, proper O&M	20	20	20	20	20	0	0	0	100	Construction budgets or IA's O&M budgets
	Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff	Implement appropriate water and soil conservation plan as well as environment management plan.	0	0	0	0	0	0	10	10	20	WCB budgets

IA= implementing agencies; LEPB =local environmental protection bureau; O&M= operations and maintenance; WCB= water conservancy bureau; WS= water supply; WW= wastewater; WWTP= wastewater treatment plant.

a. Responsible agencies – Implementation: IAs, Supervisory Agencies; LEPBs and PMOs; Review Agencies: HPEBP, HP MO and ADB.

b. Budget can only be determined following completion of surveys and detailed design.

c. While domestic and industrial solid waste management are not part of the project, the project will benefit from the Henan provincial government's program of construction of sanitary landfills in all counties of the province by 2007.

Sources: Individual Subproject EIAs, HP MO, HPEBP.e

## **D. Environmental Monitoring**

### **1. Monitoring Program**

7. The project monitoring program will focus on the environment within the project area. A detailed environmental monitoring program is presented in Table A2.2. This program considers the scope of monitoring, parameters and frequency of monitoring, data processing, and quality control requirements. For compliance monitoring, the monitoring will follow the methodology provided in the national standard methods for monitoring pollutants. Other associated standards include national environmental quality standards and pollutant discharge/emission standards. The Local Environmental Protection Bureaus (LEPBs) will be responsible for implementing this program of permitting and compliance monitoring.

8. As well as compliance monitoring, detailed and more frequent internal environmental monitoring programs during the construction and operation phases will be prepared at the beginning of project implementation by the PMOs, the IAs, the environmental management consultants (EMCs) and the construction supervision companies (CMCs). Internal monitoring will also be undertaken by WCBs of water source protection measures and by industry of their wastewater pre-treatment processes. These monitoring programs and budgets will be included in the construction and operation contracts. At the beginning of project implementation, PMOs, IAs and the EMCs will develop comprehensive project performance management system (PPMS) procedures to systematically generate data on inputs and outputs of the project components and develop detailed environmental and related social economic indicators to be used to measure project impacts.

9. The PPMS indicators for project impacts include service levels, treated wastewater quality, and other measures of operational performance, percentages of wastewater collected and treated, user satisfaction with the urban environment, and relevant economic and social data, such as data on income and health. Under the PPMS framework, baseline and progress data will be reported at assigned time intervals by the IAs. The IAs will be responsible for analyzing and consolidating the data using their management information system (MIS). The PPMS will be designed to permit adequate flexibility to adopt remedial action regarding project design, schedules, activities, and development impacts. The PMOs and IAs will refine the PPMS framework, confirm achievable goals, firm up monitoring and recording arrangements, and establish systems and procedures no later than 6 months after loan effectiveness.

### **2. Monitoring Management**

10. During the construction and operation phases, LEPBs will be responsible for environmental monitoring in the project area. LEPBs have qualified staff with monitoring equipment and the technical capability to monitor the aquatic environment, air, noise, soil and receiving water conditions, solid waste disposal, industrial pretreatment, water sources and traffic conditions. When complaints are received from the public, monitoring staff will immediately conduct additional inspections. The laboratories of LEPBs have been certified, assuring the accuracy of the analytical results and their legal standing.

**Table A2.2: Environmental Monitoring Program**

Item	Monitoring Details	Budget, CNY 10,000 (annually)								Total, CNY 10,000 (annually)
		An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo'ai WW	Pu-yang WS	Wei-hui WS	Bo'ai WS	
<b>Construction Phase</b>										
<b>Air Monitoring</b>										
Locations	Site boundary									
Parameters	TSP, PM10									
Compliance monitoring arranged by IA	4 times a year, 2 days' duration, 2 times a day	5	4	4	4	4	3	4	4	32
Internal monitoring by contractor	Weekly, 1 day's duration, 2 times a day	10	9	9	9	9	7	9	9	71
<b>Noise Monitoring</b>										
Locations	Sensitive areas within 150 m from construction site and buildings within 50 m from piling sites									
Parameters	Noise									
Compliance monitoring arranged by IA	4 times a year, 2 day's duration, 2 times a day	2	2	2	2	2	1	2	2	15
Internal monitoring by contractor	Weekly, 1 day's duration, 2 times a day	5	5	5	5	5	3	5	5	38
<b>Water Quality Monitoring</b>										
Locations	Construction site									
Parameters	BOD5, COD, SS, pH									
Compliance monitoring arranged by IA	4 times a year, 3 days' duration	2	2	2	2	2	2	2	2	16
Internal monitoring by contractor	Monthly, 1 day's duration	4	3	3	3	3	0	3	3	22
<b>Operation Phase</b>										

Item	Monitoring Details	Budget, CNY 10,000 (annually)								Total, CNY 10,000 (annually)
		An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo'ai WW	Pu-yang WS	Wei-hui WS	Bo'ai WS	
<b>Air Monitoring</b>										
Locations	Areas surrounding wastewater treatment plants and pumping stations									
Parameters	Odor									
Compliance monitoring arranged by IA	4 times a year, 5 days' duration, 2 times a day	2	1	1	1	1	0	0	0	6
Internal monitoring by IA	Weekly, 1 day's duration, 2 times a day	2	1	1	1	1	0	0	0	6
<b>Noise Monitoring</b>										
Locations	Outside areas within 2-5 m from pumping stations, water and wastewater treatment plants									
Parameters	Noise									
Compliance monitoring arranged by IA	4 times a year, 2 days' duration, 2 times a day	2	1	2	2	1	0	1	1	12
Internal monitoring by IA	Weekly, 1 day's duration, 1 times a day	2	1	2	2	1	0	1	1	12
<b>Surface Water Quality Monitoring</b>										
Locations	Surface water control sections									
Parameters	BOD <sub>5</sub> , COD, SS, O&G, heavy metals, pH, color, turbidity, organic substances, total P, total N									
Compliance monitoring arranged by IA	Various times and durations	5	5	5	5	5	0	5	5	35
Internal monitoring by IA	Not required	0	0	0	0	0	0	0	0	0
<b>Protection of Raw Water Sources</b>										
Location	Reservoir protection zones									
Parameters	Development and use									
Compliance monitoring by WCB	Various times	0	0	0	0	0	0	10	10	20

Item	Monitoring Details	Budget, CNY 10,000 (annually)								Total, CNY 10,000 (annually)
		An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo'ai WW	Pu-yang WS	Wei-hui WS	Bo'ai WS	
Internal monitoring by WCB	Not required	0	0	0	0	0	0	0	0	0
<b>Industrial Discharge Monitoring</b>										
Location	Effluent discharge point from industrial enterprises									
Parameters	Specific chemicals as identified by EPBs discharge permits relevant to the nature of industry									
Compliance monitoring arranged by IA	Various times and durations	10	10	10	10	10	0	0	0	50
Internal monitoring by enterprises	Various times and durations	20	20	20	20	20	0	0	0	100
<b>Wastewater Quality Monitoring</b>										
Locations	WWTP inlets, WWTP outlets									
Parameters	BOD <sub>5</sub> , COD, SS, O&G, Heavy metals, pH, color, turbidity, organic substances, total P, total N									
Compliance monitoring arranged by IA	Various times and durations	5	5	5	5	5	0	0	0	25
Internal monitoring by IA	Various times and durations	10	10	10	10	10	0	0	0	50
<b>Wastewater Treatment Processes</b>										
Locations	WWTP processes									
Parameters	BOD <sub>5</sub> , COD, SS, O&G, Heavy metals, pH, color, turbidity, organic substances, total P, total N									
Compliance monitoring arranged by IA	Not required	0	0	0	0	0	0	0	0	0
Internal monitoring by IA	Various times and durations	10	10	10	10	10	0	0	0	50
<b>Sludge Monitoring</b>										
Locations	Wastewater treatment plants and sanitary landfill sites									

Item	Monitoring Details	Budget, CNY 10,000 (annually)								Total, CNY 10,000 (annually)
		An-yang WW	Lin-zhou WW	Pu-yang WW	Wei-hui WW	Bo'ai WW	Pu-yang WS	Wei-hui WS	Bo'ai WS	
Parameters	Dry solids, heavy metals, etc.									
Compliance monitoring arranged by IA	Initial analysis of sludge for heavy metals and groundwater quality in the vicinity of sanitary landfill sites, followed by regular sampling afterwards	2	2	2	2	2	1	1	1	13
Internal monitoring by IA	Various times and durations as necessary for disposal purposes	4	4	4	4	4	2	2	2	26

BOD= biochemical oxygen demand; COD= chemical oxygen demand; EPB= environmental protection bureau; IA= implementing agencies; SS= suspended solids; WS= water supply; WW= wastewater.

Notes:

1. Detailed internal monitoring program during the construction and operation phases will be prepared at the beginning of project implementation by PMOs, IAs and EMCs.

2. In addition to regular compliance monitoring, other unannounced monitoring will be carried out to determine compliance.

Sources: Individual Subproject EIAs, HPMO, HPEPB.

## **E. Public Consultation**

### **1. Public Consultation during Project Preparation**

11. Direct public participation was conducted through two rounds of public consultations by EIA preparation agencies following PRC national guidelines and Environmental Impact Assessment Technical Guidelines, and by the project preparatory technical assistance (TA) consultants following ADB Guidelines Operations Manual (F1/OP issued on 29 October 2003).

### **2. Future Public Consultation Plan**

12. Plans for public involvement during the design, construction and operation phases were developed during project preparation. These plans include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages, (ii) evaluating environmental and economic benefits and social impacts, and (iii) interviewing the public after the Project is completed. They include several types of public involvement, e.g., site visits, workshops, investigation of specific issues, interviews, and public hearings (Table A2.3).

13. The public participation plans are part of the project implementation and management plan. IAs are responsible for ensuring there is public participation during project implementation. The contractors will be asked to communicate and consult with the communities near the construction site. An eye-catching public notice board will be erected at each construction site to notify the public of the main construction activities and the construction duration. The board will also provide contact names and telephone numbers to enable members of the public to express concerns and complaints about construction activities. Costs for public participation activities during project implementation are included in the project funding. The costs are estimated to be CNY22,000 for each expert workshop, CNY9,000 for each public investigation of a particular issue, CNY6,000 for each resettlement survey, CNY12,000 for each public workshop, and CNY5,000 for each press conference.

**Table A2.3: Public Participation Plan**

<b>Organizer</b>	<b>Approach</b>	<b>Times</b>	<b>Subject</b>	<b>Attendees</b>
<b>A. Project Preparation</b>				
IAs, EIA preparation Agencies, PPTA team	Public consultation	At least once	Project priorities, effects, attitudes to the project, and suggestions	Residents within construction area
	Expert workshop	At least once		Specialists from various sectors
PPTA team	Public workshop	At least twice	Comments and recommendations of the public	Affected residents and other stakeholders
<b>B. Construction Phase</b>				
IAs, PMOs	Public consultation and site visits	At least once a year	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Residents adjacent to treatment plants
IAs, PMOs	Expert workshop or press conference	At least once	Comments and suggestions on mitigation measures, public opinions	Experts from various sectors, media
IAs, PMOs	Public workshop	At least once a year	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Representatives of residents and social sectors
IAs, PMOs	Survey on resettlement	As required by relevant resettlement plan	Comments on resettlements, improvements to living conditions, livelihood and poverty reduction; comments and suggestions	Persons affected by resettlement and relocation
<b>C. Operation Phase</b>				
IAs, PMOs	Public consultation and site visits	At least once every two years	Effects of mitigation measures, impacts of operations, comments and suggestions	Residents adjacent to treatment plants Downstream beneficiaries
IAs, PMOs	Expert workshop or press conference	As needed based on public consultation	Comments and suggestions on operational impacts, public opinions	Experts from various sectors, media
IAs, PMOs	Public workshop	As needed based on public consultation	Effects of mitigation measures, impacts of operation, comments and suggestions	Representatives of residents and social sectors

Source: Individual Subproject EIAs, HPMO, HPEPB

## F. Responsibilities and Authorities

### 1. Environmental Responsibilities and Institutional Requirements

14. EMP will ensure effective implementation of mitigation measures.

15. During project preparation and implementation, various organizations with different environmental management responsibilities, HPEPB, Henan PMO, PMOs, LEPBs, WCBs, IAs, EMCs, CSCs design institutes, and contractors, have been involved and will be involved in the EMP. PMOs, contractors and IAs will each nominate full-time, trained and qualified environmental specialists to undertake environmental management activities and ensure effective implementation of the EMP. Table A2.4 shows the environmental responsibilities at different phases of the Project.

**Table A2.4: Environmental Responsibilities**

Phase	Responsible Agencies	Environmental Responsibilities
Preparation	Environmental Institutes	Preparation of EIAs and EMPs for subprojects.
Preparation	HPMO, HPEPB	Review and approval of the EIAs including EMPs
Preparation	HPMO, HPEPB	Review and approval of the SEIAs including EMPs
Design	Design Institutes	Incorporate mitigation measures in engineering designs and contracts
Design	PMOs, IAs	Review and approval of environmental measures
Tendering	Contractors, PMOs, IAs	Incorporate EMP clauses in the bids
Construction	EMCs, PMOs	Advise on implementation of mitigation measures
Construction	Contractors	Implementation of mitigation measures
Construction	LEPBs, EMCs, CSCs	Supervise implementation of mitigation measures
Construction	LEPBs, IAs, CSCs	Environmental monitoring and periodic environmental inspection
Operation	EMCs, PMOs	Advise on compliance monitoring and internal monitoring requirements
Operation	EMCs, WCBs	Supervise implementation of mitigation measures and compliance monitoring.
Operation	LEPBs	Supervise implementation of mitigation measures
Operation	IAs, WCBs	Internal monitoring, implementation of mitigation measures

CSC= construction supervision company; EIA= environmental impact assessment; EMC= environmental management consultant; EMP= environmental management plan; HPEPB= Henan provincial environmental protection bureau; HPMO= Henan project management office; IA= implementing agencies; LEPB= local environmental protection bureau; PMO= project management office; SEIA= summary environmental impact assessment; WCB= water conservancy bureau.

Note: EMCs appointed for project implementation will advise PMOs and IAs on carrying out their environmental responsibilities, budgeted inputs: 9 person-months.

Source: Individual Subproject EIAs, HPMO, HPEPB.

16. IAs will be responsible for environmental management and implementation of mitigation measures. They will ensure the EMP is carried out and will engage design institutes and professional consultants to help with environmental management during the preparation, design, construction and operation phases. The IAs will be responsible for arranging environmental monitoring reviews and for responding to any adverse impacts beyond those foreseen in the EIAs. IAs will also attend to EPB's and ADB's requests for mitigating measures.

17. Construction contractors and IAs will be responsible for actual implementation of mitigation measures during construction and operation, respectively.

18. In accordance with the EMP, the IAs will establish an environmental management office that will generally require two employees. During the project, this office will be responsible for (i) implementing the EMP and developing further implementation details; (ii) supervising implementation of mitigation measures during construction; (iii) implementing training programs; (iv) incorporating environmental management, monitoring, and mitigation measures into construction and operation management plans; (v) developing and implementing internal routine environmental monitoring; and (vi) reporting performance of the EMP to the responsible agencies. This office will be supported and supervised by the respective local environmental protection bureau (LEPBs) and environmental management consultant (EMCs). Each PMO will have one environmental specialist.

19. Local governments will ensure that IAs will have financial and managerial autonomy to operate the project facilities. As the IAs will have been recently established, they will have limited environmental management capacities, which will, however, be strengthened by environmental management training provided by the Project (Table A2.5). They will incorporate environmental management activities into construction and operation management plans. Local governments will ensure that local regulations for management of the wastewater and drainage systems are reviewed annually and that responsibilities of the agencies involved are clearly defined, appropriate penalties for non-compliance established, and the effectiveness of regulations reviewed annually and modified if necessary, in accordance with applicable legal procedures.

20. EMCs will advise PMOs and IAs on all aspects of environmental management and monitoring for the project components. The EMCs will (i) review project environmental practices and procedures; (ii) provide guidance in environmental standard-setting and assist in implementation procedures; (iii) review the start-up of the wastewater treatment plant (WWTPs); (iv) advise on mitigation during construction and operation phases in accordance with the EMP; (v) review procedures for the control of discharges of industrial waste and recommend improvements; and (vi) investigate and make recommendations on other environmental issues.

## **2. Institutional Strengthening and Training**

21. Environmental specialists of LEPBs and IAs will receive training in environmental management, monitoring and supervision, mitigation planning, emergency response, environmental policy-making, and other environmental management techniques. Funding for this training will be included in the project budget and in the operation and maintenance (O&M) budgets during the operational phase (Table A2.5).

22. HPEPB and LEPBs are capable of enforcing industrial pollution control. The relevant regulations and industrial pollution control measures are in place.

**Table A2.5: Institutional Strengthening and Training**

<b>Strengthening Activities</b>	<b>Agencies</b>	<b>Strengthening Plan</b>	<b>Timing</b>				
Capacity Building	IAs, LEPBs	Institutional organization, development of responsibilities for each position	During project preparation and implementation				
Monitoring	IAs, LEPBs	Procurement of related monitoring instruments and equipment	During project preparation and implementation				
<b>Training</b>	<b>Attendees</b>	<b>Contents</b>	<b>Number of times</b>	<b>Period (days)</b>	<b>Number of persons</b>	<b>Cost (CNY/ person/ day)</b>	<b>Total Cost (10,000 CNY)</b>
EMP implementation and adjustment, settlement of disputes	IAs, PMOs, LEPBs, contractors	Development and adjustment of EMP, emergency response, environmental laws and regulations, environmental management	1	6	40	300	7
Environmental processes	IAs, PMOs, LEPBs, contractors	Engineering technologies; pollution control; equipment selection and procurement; operation, control and maintenance of treatment processes	2	10	40	300	24
Water quality and quantity monitoring	IAs, PMOs, LEPBs, contractors	Monitoring methods, data collection and processing, reporting system	2	10	40	300	24
Water source protection	PMOs, WCBs	Development and monitoring of water source protection schemes	1	5	6	300	1
Industrial pollution control	PMOs, LEPBs, industry	Development, operation and monitoring of industrial wastewater pollution control facilities	1	5	40	300	6
Environmental policies and plans	IAs, PMOs, LEPBs, contractors	Environmental laws and regulations; environmental management; emergency response	1	5	40	300	6
<b>Total</b>							<b>68</b>

EMP= environmental management plan; IA= implementing agencies; LEPB= local environmental protection bureau; PMO= project management office; WCB= water conservancy bureau.  
Source: Individual Subproject EIAs, HPMO, HPEPB

## **G. Reporting and Supervision**

23. The compliance monitoring reports will include the project background, construction activities, environmental conditions, measurement or sampling locations, analytical results, interpretation and implication of the monitoring results, determination of the compliance status with regard to applicable regulations and standards, and recommendations for improvement. Henan PMO will submit compliance monitoring reports to ADB as appropriate.

24. During the construction period, results from the internal monitoring by contractors and CSCs will be reflected in the construction weekly reports. The reports will include environmental issues during construction, mitigation measures taken if any, and consequences of the impacts to the environment and/or surrounding communities.

25. The contractors will be trained to take immediate actions to correct unexpected adverse impacts or ineffective or insufficient mitigation measures, as required by the EMP. PMOs and IAs will also respond to these reports, to ensure contractors have taken appropriate and timely action. Additional measures may be taken if needed to ensure all issues raised by these monitoring reports will be appropriately addressed.

26. Results from the detailed internal environmental monitoring program and mitigation actions for both construction and operational phases will be submitted by the contractors and IAs to the LEPBs and PMOs monthly. HPEPB, and/or ADB may request that further environmental mitigation actions be taken, as they deem necessary, and may determine further mitigation measures for different stages, if necessary.

27. The Henan PMO will submit to ADB the EMP progress reports and information including project implementation, and environmental performance of the contractors, IAs, and EMCs. These reports will include: (i) semi-annual reports on EMP implementation, and (ii) a project completion report no later than 3 months after completion of the Project. Progress reports will emphasize progress made in the areas of water quality improvements, monitoring results, implementation of mitigation measures, environmental compliance, training and capacity building progress.

28. The PMOs, with the assistance of the project consultants, will monitor and assess overall project activities under the PPMS, including environmental targets. Henan PMO will report to ADB twice a year on the physical implementation, including environmental aspects of the project to ensure that its progress and impacts are monitored and reported in line with ADB requirements.

## **H. Workplan**

29. Before construction, IAs will develop detailed responsibilities and requirements for contractors and will provide detailed cost estimates of mitigation measures and environmental monitoring in the construction contracts. PMOs and IAs also will detail the responsibilities of their environmental management offices and prepare their work schedules.

30. Before operation, IAs will develop detailed work plans for environmental management and monitoring during operation based on the EMP. These work plans will be submitted to

LEPBs and PMOs to help them to supervise implementation.

#### **I. Procurement Plan and Cost Estimates**

31. IAs will develop detailed plans for procurement of equipment and materials and civil works for implementing mitigation measures and monitoring plans. These plans will be incorporated into the project contracts.

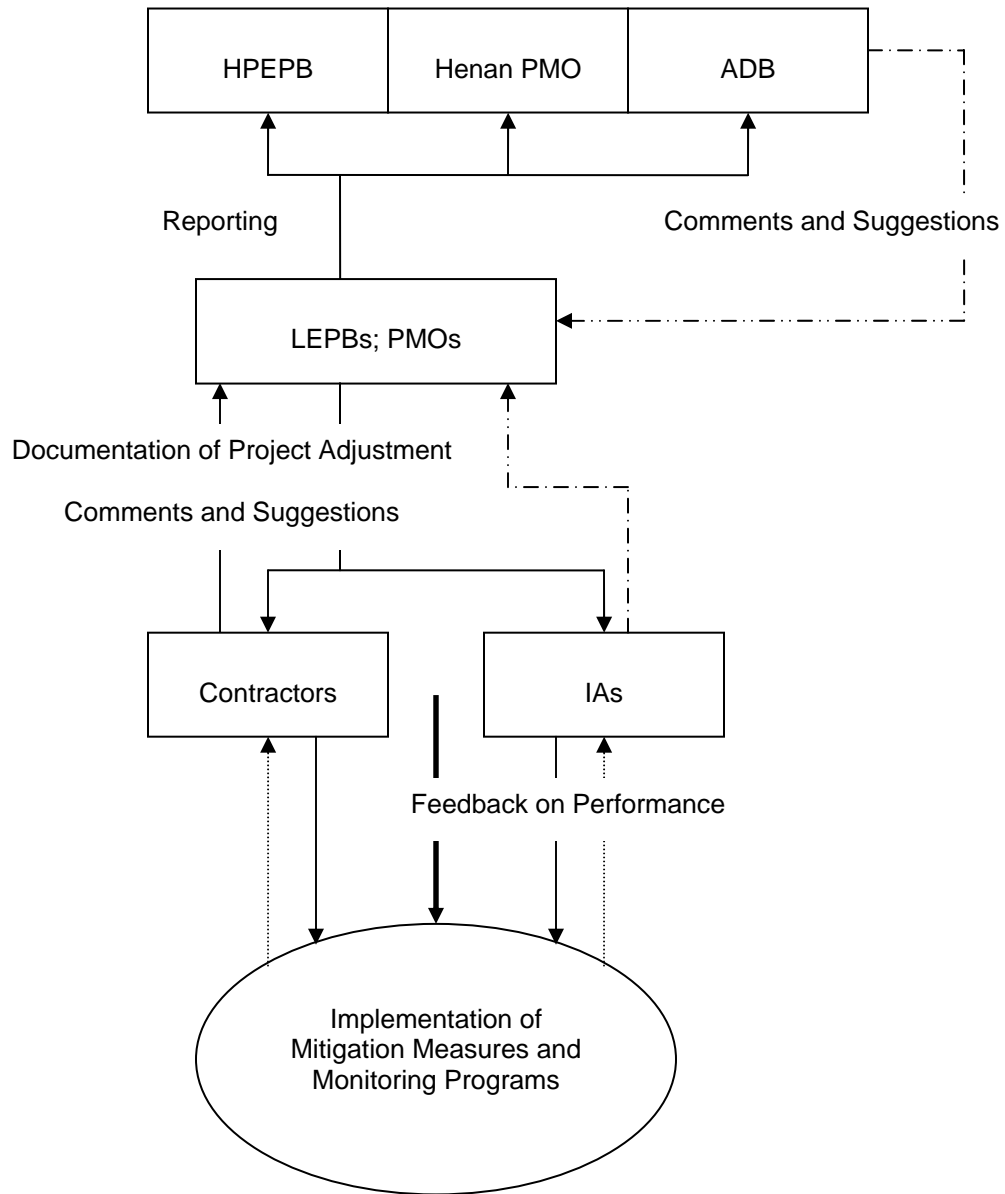
32. Cost estimates for mitigation measures and monitoring plans are summarized in Tables A2.1 and A2.2. Compliance monitoring costs will be borne by IAs, who will ensure the budgets are available. Internal monitoring costs will be borne by IAs, contractors, and CSCs during construction, and by IAs during operation. IAs will ensure the necessary budgets are available. Before implementing the monitoring plan, responsible agencies will present a further detailed breakdown of the estimated budget. During project implementation, the budgets will be adjusted, based on actual requirements. A detailed breakdown of internal monitoring cost estimates will be prepared by the design institutes. Costs for all mitigation measures during construction will be included in the tender and contract documents and borne by contractors. Costs related to mitigation measures during operation will be borne by IAs. The cost of the EMCs and the training will be borne by the Project as a whole.

#### **J. Mechanisms for Feedback and Adjustment**










33. The effectiveness of mitigation measures and monitoring plans will be evaluated through a feedback reporting system. Adjustments to the EMP will be made if necessary. LEPBs and PMOs will play critical roles in this feedback and adjustment mechanism (Figure A2.6).

34. There will be two tiers of feedback and adjustment. If EMP modification is requested by the contractors and/or IAs, LEPBs will review their proposals in detail. If the modifications are approved in principle, specific modifications will be submitted by contractors and IAs to LEPBs for further review. Comments and suggestions from HPEPB and ADB will also be considered by LEPBs and revisions to the EMP made if necessary. Contractors and IAs will then implement the modifications.

**Figure A2.6 Mechanism for Feedback and Adjustment of Environmental Management Plan**



ADB= Asian Development Bank  
 HPEPB= Henan provincial environmental protection bureau  
 HPMO= Henan project management office  
 IA= implementing agencies  
 LEPB= local environmental protection bureau  
 PMO= project management office

-  Urban Area
  -  Groundwater Source
  -  Reservoir
  -  Proposed Water Treatment Plant
  -  Proposed Wastewater Treatment Plant
  -  River/Canal
  -  South-North Water Transfer Project (SNWTP)
  -  County Boundary
  -  Provincial Boundary
- Boundaries are not necessarily authoritative.

- WW : Wastewater Management Subproject
- WS : Water Supply Subproject
- WWTP : Wastewater Treatment Plant
- WTP : Water Treatment Plant

