



Report and Recommendation of the President to the Board of Directors

Project Number: 37603
November 2006

Proposed Loan
People's Republic of China: Nanjing Qinhuai River
Environmental Improvement Project

CURRENCY EQUIVALENTS

(as of 15 November 2006)

Currency Unit – yuan (CNY)

CNY1.00 = \$0.127
\$1.00 = CNY7.86

ABBREVIATIONS

ADB	–	Asian Development Bank
CSPU	–	country strategy and program update
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
FMA	–	financial management assessment
IA	–	implementing agency
ICB	–	international competitive bidding
JPG	–	Jiangsu provincial government
NCIC	–	Nanjing Construction Investment Company
NDMD	–	Nanjing Drainage Management Department
NMECD	–	Nanjing Municipal Engineering Construction Department
NMG	–	Nanjing municipal government
NMWC	–	Nanjing Municipal Water Company
NPUC	–	Nanjing Public Utilities Company
NQRCC	–	Nanjing Qinhuai River Construction Company
NWUDP	–	Nanjing Water Utility Development Project
PMO	–	project management office
PPMS	–	project performance monitoring system
PRC	–	People's Republic of China
TA	–	technical assistance
WACC	–	weighted average cost of capital
WTP	–	Willingness to pay
WWTP	–	wastewater treatment plant
YRB	–	Yangtze River basin

WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
km ²	–	square kilometer
m	–	meter
m ³	–	cubic meter

NOTES

- (i) The fiscal year (FY) of the PRC Government ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

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LOAN AND PROJECT SUMMARY

Borrower	People's Republic of China (PRC)
Classification	Targeting Classification: Targeted intervention Sector: Water supply, sanitation, and waste management Subsectors: Integrated Themes: Environmental sustainability, inclusive social development, and capacity development Subthemes: Urban environmental improvement, human development, and organizational capacity development
Environment Assessment	Category A. A summary of the environmental impact assessment was circulated to the Asian Development Bank (ADB) Board along with the environmental management plan on 2 August 2006, and uploaded onto the ADB website on 3 August 2006.
Project Description	<p>The Project is a key urban infrastructure initiative of the Nanjing municipal government (NMG). It is classified as a targeted intervention because it contributes to achieving Millennium Development Goal 7, target 10, which calls for halving, by 2015, the proportion of people without access to safe drinking water and improved sanitation. The Project will help Nanjing, the capital city of Jiangsu Province, in (i) reducing water pollution; (ii) protecting water resources; (iii) reducing economic losses and disruption to livelihoods from frequent localized flooding; (iv) promoting sustainable economic development; (v) improving the environment, living conditions, and public health standards; (vi) developing an integrated wastewater and sludge management system; and (vii) improving service efficiency through increased competition and private sector participation.</p> <p>The Project includes 10 major activities grouped into six components: (i) Inner Qinhuai River sewerage and water replenishment, (ii) City East wastewater treatment plant (WWTP) and sewerage system, (iii) North He Xi District sewerage, river improvement, and water replenishment, (iv) stormwater drainage, (v) sludge treatment and disposal component, and (vi) institutional development. All components of the Project contribute to significantly improving water quality of the Qinhuai River, which empties into the Yangtze River. The Project supports the Government's 11th Five-Year Plan, which includes goals of improving living conditions and health in cities and promoting their sustainable economic development.</p> <p>The Project represents a comprehensive approach including close cooperation with ADB's private sector operations to support NMG's 11th Five-Year Plan, which includes expansion of the city's water and wastewater treatment capacity. NMG is planning to issue a water bond, one of the first in the PRC. In support, ADB is implementing a technical assistance (TA) for Nanjing Water Utility Long-Term Capital Finance in Commercial Markets. It is also processing the Nanjing Water Utility Development Project, which will provide a partial credit guarantee for up to 50% of a bond issue by Nanjing Public Utilities Company, a subsidiary of Nanjing Construction Investment Company Limited (NCIC). NCIC is the</p>

Implementing Agency (IA) for the wastewater treatment component under the proposed Project. Significant synergies have been derived from the public-private approach to improving Nanjing's urban environment. Policy dialogue and promotion of wastewater tariff reforms, rigorous assessment of safeguard issues, and capacity-building measures to be undertaken through the proposed Project will support the Nanjing Water Utility Development Project. The two projects are autonomous and not interdependent. The public-private sector approach to the wastewater treatment sector could be replicated elsewhere in the PRC, and in other developing member countries.

Rationale

Nanjing comprises 11 districts and two counties and is strategically located at the confluence of the Qinhuai and Changjiang rivers or Yangtze River basin (YRB), in eastern PRC. Nanjing municipality has a population of 6.4 million, and an urban center population of 4.5 million. Rapid economic growth in Nanjing over the past 20 years has placed increased pressure on the environment and city infrastructure. The Qinhuai River is 110 kilometers (km) long and flows through the urban districts of Nanjing before joining the YRB. Water quality in the lower 34 km of the Qinhuai River has deteriorated significantly in the past 10 years mainly due to wastewater discharge from the city; it currently fails to achieve class V of the PRC water quality standards.

The lack of sufficient wastewater collection and treatment facilities and the increasingly severe problems related to water pollution and urban drainage have resulted in serious water quality problems in the Qinhuai River. This has resulted in significant deterioration of water quality in the Nanjing section of the YRB. NMG is implementing the city's strategic wastewater master plan to meet national environmental targets and achieve a wastewater treatment rate of 85% by 2010. The proposed Project is an integrated part of the basin-wide Yangtze water resources management initiative, the Nanjing city urban development plan, the Nanjing municipal wastewater master plan, and the Nanjing stormwater drainage master plan. The Project will provide the 10% additional capacity critical to achieving the city's target for 2010 of treating 85% of the wastewater generated compared with the current rate of 75%.

The high intensity of rainfall in Nanjing places the urban drainage system under stress; sewers overflow and become major sources of water pollution. Flooding in urban areas is often serious because of the inadequately maintained drainage network and pumping stations with insufficient capacity. Nanjing does not have a consistent sludge treatment and disposal scheme. Historically, the Qinhuai River's tributaries were interconnected with sufficient flow capacity, but siltation has greatly reduced flows from these waterways. At some locations flow is completely blocked, aggravating flooding and water pollution. Augmentation of river flow, and improved flood control and water quality are urgently needed through (i) river dredging, (ii) river bank stabilization and erosion control, (iii) river water diversion and replenishment, and (iv) restoration of the degraded urban wetland area. By significantly improving the water quality in the Qinhuai River from the current class V to class IV by 2011, the

Project will complement the Wuhan Wastewater Management Project, Wuhan Wastewater and Stormwater Management Project, and Suzhou Creek Rehabilitation Project, which all contribute to reducing pollution in the YRB. Since the drinking water intakes of Nanjing and other major cities downstream are from the Yangtze River, the Project will also contribute to protecting the drinking water source.

Impact and Outcome

The impact of the Project is to improve the urban environment, public health, and quality of life of urban residents and businesses in Nanjing City. The outcome of the Project is improved management of surface water resources in Nanjing.

Cost Estimates

The investment cost of the Project is estimated at \$236.1 million, including taxes and duties.

Financing Plan

Source	Amount (\$ million)	Percent
Asian Development Bank	100.0	42
Nanjing Municipal Government	81.2	35
Cofinancing: China Development Bank	54.9	23
Total	236.1	100

Source: Asian Development Bank estimates.

A loan of \$100 million from ADB's ordinary capital resources will be provided under ADB's London interbank offered rate (LIBOR)-based lending facility. The loan will have a 25-year term including a grace period of 5 years, an interest rate determined in accordance with ADB's LIBOR-based lending facility, a commitment charge of 0.75% per annum, and such other terms and conditions as set forth in the draft loan agreement. The ADB loan will finance 42% of the project cost. NMG will finance 58% through a combination of wastewater tariffs (\$20 million), NMG budget sources, and a domestic loan from the China Development Bank.

Allocation and Relending Terms

The PRC Government will relend the loan proceeds to the Jiangsu provincial government, which will onlend the loan proceeds to NMG, the Executing Agency, on the same principle terms and conditions as those of the ADB loan, including the interest rate, tenor, and grace period. Part of the loan proceeds will be onlent to NCIC, the IA for the City East river improvement, wastewater treatment, and sewerage activities on the same terms and conditions as those of the ADB loan. The balance of the loan will be applied directly, on behalf of NMG, by Nanjing Drainage Management Department (NDMD), the IA for the stormwater activities, and Nanjing Municipal Engineering Construction Department (NMECD), the IA for Inner Qinhuai River sewerage and water replenishment, North He Xi District sewerage, river improvement and water replenishment, and the sludge treatment activities. The end-borrower for the revenue-generating components and NMG for the non-revenue-generating components will assume the foreign exchange and interest rate variation risks of the ADB loan.

Period of Utilization	Until 30 June 2012
Estimated Project Completion Date	31 December 2011
Implementation Arrangements	A project leading group has been established, headed by the vice mayor of NMG and with representatives from Nanjing's Municipal Development and Reform Commission, Construction Commission, Finance Bureau, Planning Bureau, Environmental Protection Bureau, Public Utilities Bureau, and Urban Construction Investment Holding (Group) Company. The project leading group will provide overall policy guidance, facilitate interagency coordination, and resolve institutional problems that could affect project implementation. A fully staffed Nanjing project management office, established for the Project, will act as the secretariat of the project leading group, and coordinate and monitor implementation activities of the three IAs.
Executing Agency	Nanjing Municipal Government
Procurement	ADB-financed equipment, materials and goods, works, and services will be procured in accordance with ADB's <i>Procurement Guidelines</i> (2006), as amended from time to time. Procurement will be coursed through international competitive bidding, national competitive bidding, or shopping procedures as determined by the particular circumstances of each contract package. In accordance with ADB's <i>Procurement Guidelines</i> , foreign contractors may participate in bidding for national competitive bidding contracts.
Consulting Services	About 31 person-months of international consulting and 100 person-months of national consulting, to be funded under the Project, will be required to support the project management office and IAs in project implementation and capacity building. Consulting services will be provided in the following specific areas: (i) development of a sludge management strategy for Nanjing, (ii) investigation and control of inflow and infiltration into the wastewater collection network, (iii) construction supervision and quality control, (iv) financial management, and (v) operation and maintenance improvements. The international consultants will also provide training and capacity building in wastewater management and treatment planning, water quality management, financial management, and environmental monitoring and management. Consultant recruitment will follow ADB's <i>Guidelines on the Use of Consultants</i> (2006), as amended from time to time.
Project Benefits and Beneficiaries	The Project will benefit about 2.7 million urban residents of Nanjing, whose living conditions and public health standards will improve as a result of (i) reduced pollution of Nanjing's surface water, (ii) protection from flooding and elimination of hazards associated with poor drainage, and (iii) reduction in the incidence of waterborne infectious diseases to below the 2005/06 level of 43 per 1,000 people. The Project will improve the management of surface water resources in Nanjing by (i) achieving

treatment of 85% of wastewater generated by 2010 and significantly reducing annual pollution loads in the Qinhuai River and thereby in the YRB; (ii) significantly reducing flooding in urban areas; (iii) increasing the efficiency and management capacity of the IAs; and (iv) improving cost recovery through a better tariff structure, with gradual increases to achieve full cost recovery. The water quality improvements in the Qinhuai River and subsequently in the Nanjing section of the YRB will contribute to integrated water resource management and pollution control, basin management, and transboundary pollution prevention and control. The stormwater management component will improve flood control in urban areas by (i) improving the drainage-sewerage network; and (ii) separating stormwater and wastewater flows into different systems, and rehabilitating defective pipes. This will minimize waterborne disease; accidents; injuries and loss of life; and damage to property, agriculture, and infrastructure.

The Project will create at least 450 full-time permanent jobs with NCIC, NDMD, and NMECD for the operation of the facilities; and 6,000 person-years of work during the 5 years of construction. More than 40% of the construction jobs are expected to be filled by the poor and vulnerable, including the unemployed, rural migrants, and women. Public health benefits will accrue through an estimated reduction in medical costs incurred as a result of decreasing waterborne diseases, amounting to approximately CNY142 per person per year. The financing of wastewater treatment infrastructure directly from wastewater tariff increases will have a demonstration impact on wastewater tariff reform in both the PRC and elsewhere in Asia. The Project is technically sound, affordable to beneficiaries, and financially and economically viable.

Risks and Assumptions

Potential institutional, financial, and policy risks related to the Project include failure of NMG to (i) implement institutional strengthening for effective project management, (ii) increase water and wastewater tariffs to meet cost-recovery targets, and (iii) meet the equity requirements to implement the Project. These risks have been mitigated by (i) obtaining assurances from the Jiangsu provincial government and NMG on the financial and managerial autonomy of the IAs, and institutional strengthening of the IAs; (ii) periodic water tariff reviews and adjustments following the national guidelines; and (iii) provision of counterpart funding. ADB review missions will monitor compliance with the financial and operational covenants to ensure the IAs are financially sustainable.

The Project does not have any unusual technical risks. The components will use standard technology that conforms to international standards. Specific construction risks will be mitigated by the use of experienced consultants to prepare designs and monitor project implementation.

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan to the People's Republic of China (PRC) for the Nanjing Qinhuai River Environmental Improvement Project. In line with its long-term goals for the urban sector of improving living conditions, minimizing flooding incidents, protecting water resources, and enhancing wastewater treatment coverage, the PRC Government asked for Asian Development Bank (ADB) assistance in implementing wastewater, stormwater, and sludge management, and river improvement projects in Nanjing. The Project is consistent with ADB's water policy¹ and will help the PRC achieve Millennium Development Goal 7, target 10, which calls for halving, by 2015, the proportion of people without access to safe drinking water and improved sanitation. This report is based on the loan Appraisal Mission and discussions with the central and local governments, relevant agencies, and community organizations. The design and monitoring framework is in Appendix 1.

II. RATIONALE: SECTOR PERFORMANCE, PROBLEMS, AND OPPORTUNITIES

A. Performance Indicators and Analysis

2. Annual economic growth in the PRC, which averaged 9% over the last 20 years, is projected to average 7% over the next 5 years. The urban population has grown from about 190 million in 1980 to about 543 million in 2004, about 42% of the total population, and is expected to increase to 700 million or 50% by 2030. The Government's Agenda for Economic Reform and Social Development in the New Century² aims to accelerate urbanization and the development of large, medium, and small cities and small towns. This urbanization process will continue to increase the demand for all urban services. In particular, it will place a strain on the physical and financial capacity of most cities to provide adequate urban infrastructure such as wastewater and sludge management, and stormwater facilities. Without significant infrastructure investment, the quality of life for urban residents and the urban environment will deteriorate, and economic development will be inefficient.

3. The PRC's urban areas face environmental threats from pollution of rivers, lakes, and underground aquifers from untreated water. In 2004, about 48.2 billion cubic meters (m³) of wastewater were generated: about 54% from municipal sources and 46% from industrial sources. Currently, about 90% of industrial wastewater is treated before discharge to a municipal sewer. Municipal wastewater is a major contributor to pollution of the PRC's rivers and lakes. As of 2004, only about 45.2% (34% in 1999) of urban wastewater was treated; the rest was discharged untreated to rivers and lakes. About 41.8% of the water in the seven major river basins³ does not meet the class III⁴ national water quality standard. Surface water sources serving municipal water supply systems are polluted to levels unacceptable under water quality standards. To address the pollution of lakes and rivers, the following actions are needed: (i) strengthen laws and enforcement, regulations, and institutions to address transjurisdictional pollution; (ii) adopt river basin management approaches for water resource management; (iii) reduce nonpoint source pollution; (iv) continue investment in municipal wastewater treatment plants (WWTP), sludge management, and stormwater drainage systems to mitigate the polluting effects of rapidly increasing urbanization; (v) diversify financing sources for environmental investments; and (vi)

¹ ADB. 2001. *Water for All: The Water Policy of the Asian Development Bank*. Manila.

² The Government's long-term vision for development was set out during the 16th Party Congress in November 2000 and reiterated during the 10th National People's Congress in March 2003.

³ Changjiang (Yangtze River), Haihe, Huaihe, Huanghe Liaohe, Songhuajiang, and Zhujiang.

⁴ The PRC water quality standards have five classes of quality covering about 40 pollution parameters. Class I is pristine, while class V is suitable only for industrial use. Class III is the minimum water quality required for municipal water supply.

continue with institutional and financial reforms to facilitate balanced economic growth and environmental sustainability. Significant investments are needed nationally to solve water shortage problems, supply clean drinking water, expand wastewater treatment capacity, and reduce flooding.

4. Recognizing that adequate environmental protection and pollution controls are essential for sustainable economic growth, the Government incorporated environmental protection as a national priority in its development strategy. In addition to enacting environmental protection laws and implementing regulations that emphasize preventive measures, the polluter pays principle, and decentralized environmental management, the Government has also undertaken numerous programs including those for wastewater management.⁵ Industries were ordered to treat wastewater to national wastewater discharge standards by the end of 2000; municipalities have been required under successive 5-year plans to address wastewater collection, treatment and disposal; and pollution control plans have been developed and partially implemented for the key river basins. Government policies require that urban environmental pollution and ecological damage be controlled by 2010; and recent state guidelines require that major cities, such as provincial capitals, have wastewater treatment rates of at least 80% by 2010 (Nanjing's target is 85%).⁶ The State Environmental Protection Administration requires that all new WWTPs provide at least secondary wastewater treatment. The treatment level required is also dependent on the water quality class of the receiving water.

5. The Government has accorded priority in the 11th Five-Year Plan (2006–2010) to addressing wastewater treatment issues through policy reform, increased investment, and improved urban infrastructure management. The Government's strategy focuses on (i) protecting drinking water sources by controlling industrial and other pollution in urban areas; (ii) introducing water efficient technologies and operations; and (iii) using appropriate pricing mechanisms to encourage conservation and generate necessary funds for operation, maintenance, and investment. The Government's ongoing economic and enterprise reform programs require that all wastewater projects be financially sustainable and capable of cost recovery. The sector analysis is given in Appendix 2.

B. Analysis of Key Problems and Opportunities

6. Traditional urban wastewater management practice in the PRC was based on the use of septic tanks. Rapidly increasing urbanization makes such an approach inadequate. Over the past decade a fundamental shift has been to an integrated approach to urban water management and use of centralized municipal wastewater treatment. Although much improvement has been made, the current status of wastewater management still provides numerous opportunities to reduce water pollution, protect water resources, and improve the living conditions and public health of urban and suburban residents. Key problems and opportunities in Nanjing include (i) worsening surface water quality, (ii) inadequate wastewater treatment capacity, (iii) lack of a sludge treatment facility and disposal site, (iv) inadequate stormwater discharge capacity resulting in frequent urban flooding, (v) high river siltation contributing to formation of organic substances that pollute rivers, and (vi) the need for ongoing financial and institutional reforms to make urban services sustainable.

⁵ The PRC Law on Prevention and Control of Water Pollution was first adopted in 1984 and amended in 1996. The law was enacted to prevent and control water pollution, protect and improve the environment, safeguard human health, and ensure effective utilization of water resources.

⁶ The national guidelines for construction of municipal wastewater treatment facilities require that all major cities have a wastewater treatment rate of at least 80% by 2010. National Development and Reform Commission, State Environmental Protection Administration, Ministry of Construction. 2005.

7. Nanjing, the capital of Jiangsu Province, is a rapidly developing city with a population of 6.4 million, of which 4.5 million is urban. Nanjing City comprises 11 districts and two counties that straddle the Yangtze River. It is located in the lower reaches of the Yangtze River, about 270 kilometers (km) to the northwest of Shanghai. Nanjing is the PRC pilot city for the ADB and United Nations-HABITAT jointly sponsored Water for Asian Cities program.⁷ Program initiatives piloted with success in Nanjing include (i) capacity building and institutional strengthening to improve service efficiency, and (ii) water education and awareness creation that could be replicable in other PRC cities. While the design of the proposed Project complements the objectives and initiatives of the Water for Asian Cities program, the initiatives will not be interdependent.

8. **Water Quality in the Yangtze River Basin.** The Yangtze River basin (YRB) is the largest river basin in the PRC. The Changjiang Water Resources Commission, which reports to the Ministry of Water Resources, has overall responsibility for managing water resources within the YRB. The commission has developed a basin management plan that provides a framework for managing water resources within the YRB. The plan cites the deteriorating water quality of Yangtze River, and sets out a number of general pollution control targets with specific targets to be developed by individual provinces and cities.

9. **Project Rationale.** Of the seven major rivers in the PRC, YRB receives the highest volume of total wastewater as it has several major cities along its riverbanks. Effects are felt throughout the downstream reaches and in the East China Sea. Despite the abundant water resources, rapid economic growth and continuing urbanization over the last 20 years in Nanjing have resulted in inadequate urban infrastructure, and placed pressure on overloaded facilities.

10. The Qinhuai River, referred to as the mother river of Nanjing, is 110 km long and flows through the urban districts of Nanjing before joining the YRB. Water quality in the lower 34 km of the Qinhuai River has deteriorated significantly in the past 10 years mainly due to wastewater discharge from the city, and currently fails to achieve class V of the PRC water quality standards. In 2004, the city generated 2.46 million m³/day of wastewater, including 1.29 million m³/day of industrial wastewater. The lack of sufficient wastewater collection and treatment facilities, and the increasingly severe problems related to water pollution and urban drainage have resulted in serious water quality problems in the Qinhuai River. This has resulted in significant deterioration of water quality in the Nanjing section of the YRB. Accordingly, NMG is implementing the city's strategic wastewater master plan to meet national environmental targets and achieve a wastewater treatment rate of 85% by 2010.

11. The proposed Project is an integrated part of the Yangtze Basin water resources management initiative being implemented by the Changjiang Water Resources Commission, Nanjing City urban development plan, Nanjing municipal wastewater master plan, and Nanjing stormwater drainage master plan. Accordingly, the Project is consistent with the thrusts of ADB's water policy and Urban Sector Strategy.⁸ The Project will provide the 10% additional capacity critical to achieving the city's target treating 85% of wastewater generated by 2010, compared with the current rate of 75%. The high intensity of rainfall in Nanjing places the urban drainage system under stress. Sewers overflow and become major sources of water pollution, and flooding in urban areas is often serious because of the inadequately maintained drainage network and inadequate capacity of pumping stations. Nanjing does not presently have a consistent sludge treatment and disposal scheme. Consequently, a sludge treatment and disposal facility is urgently

⁷ The program was launched at the Third World Water Forum on 18 March 2003, when a memorandum of understanding was signed between ADB and United Nations-Habitat.

⁸ ADB. 1999. *Urban Sector Strategy*. Manila.

needed to eliminate the potential of secondary pollution to the environment becoming even more serious. Historically, the Qinhuai River's tributaries were interconnected with sufficient flow capacity; but siltation has greatly reduced flows from these waterways. At some locations the flows are completely blocked, aggravating flooding and water pollution. River flow augmentation, flood control, and improved water quality are urgently needed through (i) river dredging, (ii) river bank stabilization and erosion control, (iii) river water diversion and replenishment, and (iv) restoration of the degraded urban wetland area. By significantly improving the water quality in the Qinhuai River from the current class V to class IV by 2011, the Project will complement the two ongoing Wuhan projects,⁹ and the completed Suzhou Creek Rehabilitation Project,¹⁰ which all contribute to reducing pollution in the YRB. Since the drinking water intakes of Nanjing and other major downstream cities are from the Yangtze River, the Project also contributes to protection of the vital drinking water source.

12. Policy Dialogue. The Project supports and strengthens ADB policy dialogue and initiatives with NMG in several key areas including (i) cost recovery and tariff reform, (ii) wastewater management, (iii) water conservation, (iv) corporate governance and enterprise reform, (v) safe and reliable arrangements for sludge disposal, (vi) transboundary pollution prevention and control, (vii) stormwater management arrangements, and (viii) private sector participation. ADB has supported the water tariff reform process through two water tariff study technical assistance (TA) projects¹¹ with the Ministry of Construction under which the market-oriented National Guidelines on Water Tariffs were developed, promulgated, and implemented. The water tariff TAs (i) strengthened the financial sustainability of municipal water supply companies; (ii) piloted implementation of the national guidelines in the selected case study cities of Chengdu, Fuzhou, and Zhangjiakou; and (iii) recommended financial regulations for water supply companies and designed nationwide training programs. The guidelines are being implemented nationally. Further, the ADB wastewater tariff study TAs¹² developed and recommended national guidelines for wastewater tariffs, including tariff calculation methodologies that allow for full cost recovery taking into consideration affordability and social constraints. Nanjing Price Bureau performed a cost audit of the current and projected water, wastewater, and water resource expenses; and held public hearing meetings on 28 August 2006 to obtain endorsement for wastewater tariff increases from the current CNY1.05 per m³, to CNY1.40 per m³ by December 2006, and CNY1.60 per m³ by 2010. This indicates Nanjing's progressiveness in adopting tariff reforms. The policy dialogue is in Appendix 3.

13. External Assistance. Since 1993, ADB has provided 15 loans (Appendix 4) totaling approximately \$1.5 billion for urban wastewater management and water supply projects. ADB has also provided about \$30 million for 42 TA studies to prepare these projects; and to review and study key issues in water resources, urban water supply, wastewater treatment, and pollution control. To help NMG develop and implement its strategic wastewater master plan, external assistance to date has been provided by ADB, World Bank, and the governments of Finland and Poland. ADB, World Bank, Japan Bank for International Cooperation, and several bilateral development partners have provided financial and TA to the PRC Government in the urban environmental protection and management subsector. The World Bank has provided financial

⁹ ADB. 2003. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the People's Republic of China for the Wuhan Wastewater Management Project*. Manila (Loan 1996-PRC); and ADB. 2006. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the People's Republic of China for the Wuhan Wastewater and Stormwater Management Project*. Manila (Loan 2240-PRC).

¹⁰ ADB. 1999. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the People's Republic of China for the Suzhou Creek Rehabilitation Project*. Manila (Loan 1692-PRC).

¹¹ ADB. 1997. *Technical Assistance to the People's Republic of China for the Water Supply Tariff Study*, Manila; and ADB. 1999. *Technical Assistance to the People's Republic of China for the Water Tariff Study II*. Manila.

¹² ADB. 2001. *Technical Assistance to the People's Republic of China for National Guidelines on the Urban Wastewater Tariffs and Management Study*. Manila.

assistance for 26 urban environmental improvement, water supply, and wastewater management projects.

14. **Lessons.** ADB's water supply loan projects in the PRC have generally been implemented well.¹³ The lessons identified from ADB's post-evaluation experience in water supply and sanitation highlight the importance of integrating both supply and demand concerns into project design. Encouraging broad reforms, such as commercial management, and introducing competition will promote efficient and responsive delivery of water supply and wastewater services. Appropriate pricing policies for water and sanitation services are also required. Other lessons include the need to (i) review technical designs thoroughly; (ii) consider local conditions and constraints; (iii) support financial reform, particularly in establishing autonomous wastewater entities and tariff increases to ensure sustainability; (iv) strengthen institutions, particularly by giving them managerial autonomy; (v) educate the public in environmental improvement; (vi) consult the public and involve the community; (vii) address resettlement issues early; and (viii) support public-private partnerships in water supply and wastewater treatment. A performance portfolio review of the water supply, sanitation, and waste management sector, recently completed by the PRC, identified successes and deficiencies, and lessons from portfolio performance.¹⁴ Among the major issues identified were (i) delays in the start-up of projects and in procurement, (ii) weak institutional arrangements for project implementation and sustainable operations, and (iii) a low proportion of civil works financing resulting in loan savings and cancellation of surplus loan amounts. These issues were reviewed in detail during project processing and the relevant lessons were incorporated in the project design. Lessons from the Suzhou Creek Rehabilitation Project include the need to (i) carefully design and establish project implementation arrangements to allow effective coordination with related agencies, (ii) assess capacity to implement resettlement activities, (iii) exercise caution in estimating water supply sales and forecasts, and (iv) increase flexibility in the percentage of ADB financing for civil works to prevent potential loan cancellations. These lessons have been incorporated in the design of the proposed Project.

III. THE PROPOSED PROJECT

A. Impact and Outcome

15. The impact of the Project is to improve the urban environment, public health, and quality of life of urban residents and businesses in Nanjing City. The outcome of the Project is improved management of surface water resources in Nanjing.

B. Outputs

16. The Project outputs include (i) improved and expanded wastewater services and sludge management in the urban area of Nanjing; (ii) improved water quality in the Qinhuai River and downstream reaches of the YRB; (iii) improved river management and reduced flooding in stormwater drainage areas in Bai Xia, Gulou, Qinhuai, Xiaguan, and Xuanwu in Nanjing; and (iv) more efficient and better managed implementing agencies (IAs). These outputs will be delivered through six components: (i) Inner Qinhuai River sewerage and water replenishment, (ii) City East WWTP and sewerage system, (iii) North He Xi District sewerage, river improvement, and water

¹³ In the project completion reports, the Dalian Water Supply Project was rated as generally successful; and the Anhui Environmental Improvement Project, Fuzhou Water Supply and Wastewater Treatment Project, and Suzhou Creek Rehabilitation Project were all rated as highly successful. The project performance audit report for the Dalian Water Supply Project rated it as highly successful.

¹⁴ ADB. 2005. *PRC: Water Supply, Sanitation and Waste Management Portfolio Performance Review. Final Report.* Manila.

replenishment, (iv) stormwater drainage, (v) sludge treatment and disposal component, and (vi) institutional development. All the components will contribute to significantly improving water quality in the Qinhuai River from the current class V and below, to at least class IV by 2011; and reducing pollution in the YRB. A detailed description of project components is in Supplementary Appendix A.

17. **Inner Qinhuai River Sewerage and Water Replenishment.** This component will (i) upgrade the Da Zhong Qiao pumping station and construct 9.6 km of sewer interceptors in the central and southern areas of the Inner Qinhuai River; and (ii) conduct river dredging, embankment works, and river water diversion and replenishment to improve the inner Qinhuai River and its tributaries. In addition to improving wastewater interception, this component will augment the river flow, improve water quality through flushing, and remove silt through dredging, thereby increasing the flood storage capacity of the Qinhuai River and its tributaries.

18. **City East Wastewater Treatment Plant and Sewerage System.** This component will (i) construct 23.2 km of sewer pipelines in the south and north districts of the Qinhuai River; (ii) add additional treatment capacity of 100,000 m³/day to the existing WWTP including a sludge dewatering facility, tertiary filtration and ultraviolet disinfection, and outlet pumping station equipment; (iii) improve the Upper Qinhuai River (18 km), a tributary of Qinhuai River, from Xi Bei village to the Yunliang River by strengthening the embankment foundation and water proofing, dredging, and providing water and soil conservation; (iv) improve the South River (9.8 km), a tributary of the Qinhuai River, by strengthening and waterproofing the embankment foundation, and dredging; and (v) restore the ecology of 1.5 km of the embankment for the Yunliang River, and construct an ecological wetland park (33 ha) at the confluence of the Yunliang and Outer Qinhuai rivers. This component will help to achieve Nanjing's wastewater treatment rate target of 85% by 2010. Further, it will improve the flushing, water quality, and flood storage capacity of the Qinhuai River and its tributaries. The wetland park subcomponent will restore a derelict site into a lowland wetland that was functional some 30 years ago. The wetland park (i) is part of Nanjing City's 11th Five-Year Plan targets for green space; (ii) reduces the adverse impacts of existing land use and would contribute to improvement of water quality, flood storage, and habitat conservation; and (iii) provides recreational and educational opportunities to demonstrate emerging conservation technologies.

19. **North He Xi District Sewerage, River Improvement, and Water Replenishment.** This component will (i) construct 28.7 km of sewer pipelines in the northern area of North He Xi; (ii) improve the Long Jiang River and Qing Jiang North Aqueduct by dredging and constructing 450 meters (m) of box culvert; (iii) improve the water balance in the Long Jiang area by (a) constructing diversion pipelines and two new gates on Zhong Bao River, and (b) upgrading gravity culverts for the Xiao Dou Men and Li Wei pumping stations; and (iv) replenish the central and south regions of North He Xi District by constructing a new South River pumping station with ultimate capacity of 5 m³ per second. This component will help achieve Nanjing's wastewater treatment rate target of 85% by 2010 and improve the flushing, water quality, and flood storage capacity of the Qinhuai River and its tributaries. For the above three components, as a result of increasing the wastewater treatment and collection capacity, adequate flushing and water exchange, strengthening the river embankment foundations, improving the river, and providing benefits of flood protection, significant improvement of water quality and ecological landscape will be achieved.

20. **Stormwater Drainage System.** This component will construct 29 storm drain outlets and 25 km of drainage pipelines, in the districts of Bai Xia, Gulou, Qinhuai, Xia Guan, and Xuanwu; thus contributing to Nanjing's stormwater master plan. The stormwater component will enhance the performance of the drainage system in flooded areas, reduce overflows from the combined

sewer network and polluted runoff into rivers, and significantly improve flood control in several urban areas of Nanjing.

21. **Sludge Treatment and Disposal.** This component will provide treatment and disposal of sewage sludge and municipal sludge from river dredging and maintenance of the pipeline network. It will construct the (i) Jiang Xin Zhou WWTP sludge treatment facility with a capacity of 80 tons/day (dry solid), and (ii) Mount Feng Huang sludge disposal facility with a capacity of 840 m³/day and the leachate collection and treatment system. Without this component, secondary pollution to the environment would become very serious.

22. **Institutional Development.** This component will (i) carry out a sludge management study; (ii) provide training to strengthen organizational structure and staff resources to implement, operate, and maintain the project components; (iii) strengthen management practices in human resources, finance, and corporate planning; and (iv) provide training programs for managers and staff responsible for service delivery to ensure efficient implementation and sustainability of project benefits. The Project will strengthen institutional capacity to facilitate the adoption of an integrated approach to water resource management including pollution and flood control.

C. Special Features

23. **Public-Private Participation.** The Project takes a comprehensive approach including close cooperation with ADB's private sector operations to support NMG's 11th Five-Year Plan for expansion of the city's water and wastewater treatment capacity. NMG is planning to issue a water bond, one of the first in the PRC. In support, ADB is implementing an advisory TA for Nanjing Water Utility Long-Term Capital Finance in Commercial Markets, and processing the Nanjing Water Utility Development Project, which will provide a partial credit guarantee¹⁵ for up to 50% of a bond issue by Nanjing Public Utilities Company (NPUC),¹⁶ a subsidiary of Nanjing Construction Investment Company (NCIC) (the IA for the wastewater treatment component under the proposed Project). The advisory TA supported NCIC and NPUC by (i) building capacity, including management structuring, and developing corporate governance best practices; (ii) developing accounting and auditing practice in line with best international practices; (iii) preparing the bond application; and (iv) providing a shadow bond rating and issuer rating exercise. NPUC plans to use the proceeds from the bond issue for capital expenditure requirements for seven new water and wastewater treatment projects in Nanjing. The structure, mechanics, and details of ADB's partial credit guarantee will be determined during the due diligence expected to be completed in November 2006, to be followed by the Credit Committee meeting scheduled for December 2006. The proposed partial credit guarantee is expected to be submitted to the ADB Board for consideration within the first quarter of 2007.

24. Significant synergies have been derived from the public-private approach to comprehensively improving the urban environment in Nanjing. The successful policy dialogue on wastewater tariff reforms, thorough examination of safeguard issues and compliance requirements, and capacity-building measures undertaken by the proposed Project will support the Nanjing Water Utility Development Project. NMG has confirmed the counterpart financing sources for the Project. However, NMG during implementation would have the option to replace some of the committed counterpart funds for the Project with funds generated from the potential bond issue. The Nanjing Water Utility Development Project and the proposed Project are autonomous but mutually supportive. The public-private approach in Nanjing could be replicated

¹⁵ The concept paper for the project was approved by Management on 9 October 2006.

¹⁶ Currently, the application for bond issuance is pending with the National Development and Reform Commission.

in the upcoming Jilin Urban Infrastructure Project¹⁷ in Jilin Province and elsewhere in the PRC. The bond issue represents a new avenue of financing, facilitated through the bond guarantee provided by the private sector, ensuring that the water utilities sector in the PRC will have access to finance the significant demand in water and wastewater treatment infrastructure investment needs.

25. **Tariff Reform.** NMG has committed to generate funds to finance the wastewater components of the Project from wastewater tariff increases estimated at \$20 million. This is a major reform in line with ADB's Water Policy (2001). NMG held public hearing meetings on 28 August 2006 to obtain endorsement for wastewater tariff increases, from the current CNY1.05 per m³, to CNY1.40 per m³ by December 2006, and CNY1.60 per m³ by 2010. These significant tariff reforms contribute to sustainability of the Project and to private sector participation initiatives.

26. **Environmental Aspects.** The Project includes (i) training in the operation and maintenance (O&M) of wastewater and stormwater facilities to ensure effective operation; (ii) monitoring of future performance of O&M of the wastewater and stormwater facilities using a number of indicators outlined in the design and monitoring framework; (iii) demonstration of the potential economic benefits of an integrated and strategic long-term approach to planning of wastewater, sludge treatment, and stormwater infrastructure facilities; and (iv) assistance in the development of Qinhuai River water quality modeling including ambient water monitoring to protect water resources, promote sustainable economic development, and improve the living conditions and public health of urban residents.

27. **Governance and Anticorruption.** The additional governance and anticorruption measures, including the requirement to enhance and develop the project website to contain information on project audited financial statements, the status of procurement and contract awards, tariff increases, and a schedule for public hearings, will contribute to the principle of transparency, accountability, and zero-tolerance for corruption. There are also obligations to conduct performance audits, and various forms of public disclosure, public hearing, and requirements to give reasons for administrative decisions.

28. **Pro-Poor Features.** NMG has agreed that prior to implementing any tariff increases, it will review and conduct research to determine the number of poor people likely to be affected by the wastewater tariff increases, and prepare a plan or scheme including price subsidies and lifeline tariffs to contribute to cushioning the impact of tariff increases on the poor. NMG will issue this as a decree.

29. **Optimum Design.** Through rigorous least-cost analysis and engineering consulting, the technical design of the Project was optimized. Consequently, the resettlement impact of the Project was reduced by 30%, resulting in a reduction of the resettlement cost.

30. **Employment, Labor, and Health.** The Project reflects assurances that the Government will ensure that (i) equal employment opportunities be provided for men and women, (ii) information be given to employees on sexually transmitted diseases and HIV/Aids, (iii) awareness is increased on the health impacts of wastewater, and (iv) child labor be prohibited.

¹⁷ The TA (ADB, 2006. *Technical Assistance to the People's Republic of China for the Jilin Urban Infrastructure Project*. Manila) is ongoing. The Government has expressed interest for a public-private participation approach based on the Nanjing experience.

D. Project Investment Plan

31. The project investment is estimated at \$236.1 million, including taxes and duties. The cost estimates are summarized in Table 1 and detailed in Appendix 5, and Supplementary Appendix B.

Table 1: Project Investment Plan
(\$ million)

Item	Amount
A. Base Costs	
1. Inner Qinhuai River Sewerage and Water Replenishment Component	12.7
a. Inner Qinhuai River sewerage subcomponent	3.9
b. Inner Qinhuai River water replenishment subcomponent	8.8
2. City East Wastewater Treatment Plant and Sewerage and River Improvement Component	123.6
a. City East sewerage subcomponent	11.9
b. City East WWTP subcomponent	19.5
c. City East river improvement subcomponent	92.2
3. North He Xi District Sewerage, River improvement, and Water Replenishment Component	14.0
a. North He Xi sewerage subcomponent	9.8
b. North He Xi River improvement and water replenishment subcomponent	4.2
4. Stormwater Drainage Component	7.9
5. Sludge Treatment and Disposal Component	29.4
a. Jiang Xin Zhou sludge treatment subcomponent	11.1
b. Mount Feng Huang sludge disposal subcomponent	18.3
6. Project Management Component (includes Institutional Development)	1.5
International consulting service and training	1.5
Subtotal (A)	189.1
B. Contingencies	
Physical ^a	18.8
Price ^b	12.1
Subtotal (B)	30.9
C. Financial Charges during Implementation^c	16.2
Total (A+B+C)	236.1

WWTP = wastewater treatment plant.

^a Computed at 10% for all civil works, land acquisition and resettlement, equipment, training, and consulting.

^b Computed on the basis of a foreign exchange inflation rate of 2.8% in 2006, and 1.9% from 2007 onward; and a local currency inflation rate of 2.3% in 2006, 3.0% in 2007, 3.2% in 2008, 2.7% in 2009, and 2.8 from 2010 and onward; and including a provision for potential exchange rate fluctuation, assuming a purchasing power parity exchange rate.

^c Includes interest and commitment charges. Interest during construction has been computed at the 5-year forward London interbank offered rate (LIBOR) plus a spread of 0.4%.

Source: Asian Development Bank estimates.

E. Financing Plan

32. The Government has requested a loan of \$100,000,000 from ADB's ordinary capital resources to help finance the Project. The loan will have a 25-year term, including a grace period of 5 years, an interest rate to be determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility for US dollar loans, a commitment charge of 0.75% per annum, and such other terms and conditions set forth in the draft loan agreement. The Government has provided ADB with (i) the reasons for its decision to borrow under ADB's LIBOR-based lending facility on the basis of these terms and conditions, and (ii) an undertaking that these choices were its own independent decision and not made in reliance on any communication or advice from ADB.

33. The ADB loan will finance 42% of the project cost. NMG will finance the contingencies and interest during construction. Local costs will be financed from wastewater treatment fees, (estimated at \$20 million), urban construction fees, and domestic loans from PRC banks. NMG

has issued a commitment letter confirming the counterpart funds including the equity injection. Further, the China Development Bank provided a commitment letter for the domestic bank loan cofinancing. The financing plan for the Project is summarized in Table 2.

Table 2: Financing Plan

Source	Total (\$ million)	Percent
A. Asian Development Bank	100.0	42
B. Nanjing Municipal Government	81.2	35
C. Local Bank	54.9	23
Total	236.1	100

Source: Asian Development Bank estimates.

34. The Government will relend the funds to the Jiangsu Provincial Government (JPG) and then to NMG. NMG will onlend a portion of the loan proceeds to NCIC, which will implement the City East river improvement, wastewater treatment, and sewerage component. NMG will onlend the balance of the loan proceeds to Nanjing Drainage Management Department (NDMD) and Nanjing Municipal Engineering Construction Department (NMECD), which will implement the sludge management, stormwater management, and river replenishment components. NMG will assume full financial responsibility for all the non-revenue-generating components. All onlending will be on the same terms and conditions as the ADB loan. The end-borrower for the revenue-generating components and NMG for the non-revenue-generating components will assume the foreign exchange and interest rate variation risks of the ADB loan. The flow of funds and onlending arrangements are in Appendix 6.

F. Implementation Arrangements

1. Project Management

35. NMG will be the Executing Agency. A project leading group has been established, headed by the vice mayor of NMG and comprising representatives from Nanjing Municipal Construction Commission, Municipal Development and Reform Commission, Planning Bureau, Finance Bureau, Environmental Protection Bureau, Public Utilities Bureau, and Urban Construction Investment Holding (Group) Co Ltd. The group will provide overall policy guidance, facilitate interagency coordination, and resolve any institutional problems affecting project implementation. A fully staffed Nanjing project management office (PMO) has been established for the Project. The PMO will also be the secretariat of the project leading group. The three IAs are

- (i) NCIC for the City East WWTP and sewerage component which includes sewer pipelines, wastewater treatment plant, and river improvement;
- (ii) NDMD for the stormwater drainage component and
- (iii) NMECD for the Inner Qinhuai River sewerage and water replenishment component; North He Xi District sewerage, river improvement, and water replenishment component; and sludge treatment and disposal component.

36. On completion of the Project, NCIC will be responsible for O&M of the City East river improvement works and wastewater treatment plant. The Municipal Facilities Management Department (Municipal Public Utilities Bureau) will be responsible for O&M of all other facilities.

37. The financial, technical, and institutional capacity of the three IAs was assessed. NCIC has received capacity-building support from the ADB private sector TA. NDMD and NMECD will need some training in relevant ADB procedures during project implementation. NCIC will directly

manage construction, NDMD and NMECD will outsource this activity to an experienced and qualified construction management company. Once the stormwater facilities are built, NDMD will pass them on to the district water bureau for O&M. The IAs will retain the services of design institutes and specialist procurement agencies to help with implementation. With the help of international consultants, the Nanjing PMO and the IAs will develop expertise in (i) efficient operation of the wastewater, stormwater, and sludge management facilities; and (ii) functional areas of administration, finance, accounting, and business planning. The institutional and capacity-building measures are detailed in Supplementary Appendix C. NCIC's internal controls and accounting and auditing procedures were reviewed through a financial management assessment (Appendix 7). This assessment confirms the adequacy of NCIC's financial management practices for both the construction and operational phase of the Project. But discussions concerning the financial management of stormwater and sludge management services indicate a need for improvement. On the basis of assessment of the IAs' financial and managerial capabilities, the Project is deemed sustainable as indicated in Appendix 8. The IAs' technical and institutional capacities were assessed and found to be adequate for project implementation.

2. Implementation Period

38. The Project will be implemented over 5 years, from 2007 to 2011 (Appendix 9). This schedule is considered realistic as the project implementation structure is already in place, and preparatory works are under way. ADB's successful experience with similar projects in the PRC and NMG, and the IAs' in-depth knowledge and experience in stormwater and wastewater indicate that this schedule is achievable.

3. Procurement

39. Equipment, materials and goods, civil works, and services financed under the loan will be procured in accordance with ADB's *Procurement Guidelines* (April 2006, as amended from time to time). Equipment, materials, goods, and services will follow ADB procedures for international competitive bidding (ICB) for packages each with a value greater than \$1 million. Equipment, materials, and goods with estimated contract value of \$100,000 or less will be procured using shopping procedures. Civil works contracts costing more than \$10 million will be procured using ICB. Civil works contracts valued at the equivalent of \$10 million or less can be procured using national competitive bidding procedures in accordance with the PRC's Tendering and Bidding Law (1999), subject to clarifications to the law that have been agreed with ADB for the purposes of ADB's *Procurement Guidelines*.¹⁸ The selection and engagement of contractors will be subject to ADB approval.¹⁹ The procurement plan is in Appendix 10. Major equipment will be purchased through ICB procedures and financed by the ADB loan. The internationally tendered equipment packages will include the necessary technical support for ensuring proper installation, testing, commissioning, and training of operations staff as part of the related contracts. In accordance with ADB requirements, foreign contractors may participate in bidding for national competitive bidding contracts.

¹⁸ ADB. 1997. *Technical Assistance to the People's Republic of China for Establishment of National Procurement Regulations for the Public Sector*. Manila; and ADB. 2000. *Technical Assistance to the People's Republic of China for Implementation of the Tendering and Bidding Law and Related Regulations*. Manila. Schedule 4 of the Loan Agreement.

¹⁹ ADB will require the PMO to use ADB-approved standard bidding documents (to be developed as necessary) to ensure high quality and consistency of the documents; this will facilitate ADB review. A draft project administration memorandum to this effect has been prepared and was discussed at loan appraisal.

4. Advance Contracting and Retroactive Financing

40. ADB approved the Government's request for advance contracting, which includes recruitment of consultants, and procurement of goods and civil works; and the request for retroactive financing of eligible expenditures up to \$20 million (equivalent to 20% of the ADB loan), incurred prior to loan effectiveness but not earlier than a maximum of 12 months before the signing of the loan.²⁰ Advance contracting will include (i) tendering and bid evaluation for civil works contract packages; (ii) preparation of tender documents for the procurement of materials, plant, equipment, and vehicles; (iii) award of contracts; and (iv) recruitment of consultants. The issuance of invitations to bid under advance procurement action will be subject to ADB approval. All advance procurement actions will be undertaken in accordance with ADB's *Procurement Guidelines* or *Guidelines on the Use of Consultants* (April 2006, as amended from time to time). NMG has requested retroactive financing for civil works and equipment for part of the Inner Qinhuai River water replenishment component, City East river improvement component, and North He Xi water replenishment and river improvement component. The Government has been advised that approval of advance contracting and retroactive financing does not commit ADB to finance the Project. Contracts proposed for retroactive financing will be undertaken in accordance with ADB's *Procurement Guidelines*.

5. Consulting Services

41. Provision has been made for 31 person-months of international and 100 person-months of national consulting services to be funded under the Project to support the Nanjing PMO and IAs in project implementation and capacity building. A consulting firm will be recruited in accordance with *Guidelines on the Use of Consultants* using the quality- and cost-based selection method and requesting full technical proposals. The scope and extent of consulting services takes account of the consulting support incorporated into the Nanjing Water Utility Long-Term Capital Finance in Commercial Markets TA for strengthening NCIC and the United Nations-Habitat capacity-building measures under the Water for Asian Cities program. Consulting services are required for (i) developing a sludge management strategy for Nanjing; (ii) investigating and controlling inflow and infiltration into the wastewater collection network; (iii) supervising construction, quality control, and related monitoring of progress during project implementation; (iv) monitoring resettlement; (v) improving stormwater and sewerage management; (vi) improving flood protection systems; (vii) helping with private sector participation initiatives; (viii) supporting financial management; and (ix) improving O&M. Capacity building for the IAs will be achieved through consultant inputs, hands-on training, and domestic and international training financed from the loan. The outline terms of reference for the consulting services and indicative budget is in Supplementary Appendix D.

6. Disbursement Arrangements

42. To facilitate funds flow and project implementation, Jiangsu Provincial Finance Bureau will establish an imprest account once the loan becomes effective, in accordance with the provisions of ADB's *Loan Disbursement Handbook* as amended from time to time. Disbursements from the imprest account must be supported by an appropriate withdrawal application and related documentation. The documentation will demonstrate that the goods or services (i) were produced in and procured from ADB member countries, and (ii) are eligible for ADB financing. The initial amount to be deposited in the imprest account will not exceed 6 months of estimated

²⁰ The advance action for the procurement and recruitment of consultants, and the uploading of the general procurement notice on the ADB website, will facilitate the start of the advance action process. ADB Management approved advanced contracting and retroactive financing on 26 September 2006.

expenditures for the Project or 10% of the loan amount, whichever is lower. The statement of expenditure procedure may be used for reimbursement or liquidation of eligible expenditures. Individual payments under the statement of expenditure procedure should not exceed \$200,000.²¹ Direct payment procedures will be used for large contracts.

7. Accounting, Auditing, and Reporting

43. The PMO will prepare semiannual progress reports indicating progress made, problems encountered during the period under review, steps taken or proposed to remedy the problems, proposed program of activities, and progress expected in the next half year. The IAs will keep records to identify goods and services financed from the loan proceeds, and follow accounting principles and practices prescribed by the PRC's Accounting Law. The law requires enterprises to prepare financial statements and generally follow internationally accepted accounting standards. The IAs will maintain separate project accounts and records. The financial statements of the project accounts and the annual corporate financial statements for the IAs will be subject to external audit by the NMG Audit Bureau, Jiangsu Provincial Audit Bureau, and State Audit Administration. The audits will be carried out in accordance with regulations for auditing approved by the State Council and will meet ADB requirements. A separate auditor's opinion on the use of the imprest account and statement of expenditure will be part of the audit reports. The IAs' annual audited financial statements and audited project accounts will be submitted to ADB no later than 6 months after the end of the fiscal year for the entire implementation period.²² The PRC Government, JPG, and NMG were informed of ADB's policy requiring the submission of audited financial statements on time. JPG, NMG, and the IAs will submit reports and information to ADB concerning the use of the loan proceeds, project implementation, and IA performance. These reports will include (i) semiannual progress reports on project implementation; (ii) annual reports; and (iii) a project completion report, not later than 12 months after the completion of the project facilities.

8. Project Performance Monitoring and Evaluation

44. The project performance monitoring system (PPMS) indicators include (i) service levels, (ii) treated wastewater quality and other measures of operational performance, (iii) percentage of wastewater collected and treated, (iv) composite incidence of infectious waterborne diseases, (v) user satisfaction with the urban environment, and (vi) relevant economic and health data to monitor project impact. The relevance and practicability of data collection for the indicators was confirmed with the PMO.

45. At the start of project implementation, the PMO and IAs, with the assistance of consultants, will develop comprehensive PPMS procedures to systematically generate data on the inputs and outputs of the project components; and the socioeconomic, health, and environmental indicators to be used to measure project impact. A set of indicators for the monitoring of the future performance of the WWTPs will be designed by the loan implementation consultants before the start of operations. The PMO and IAs will refine the PPMS, confirm achievable targets, finalize monitoring and recording arrangements, and establish systems and procedures no later than 6 months after project inception. Under the design and monitoring framework, baseline and progress data will be reported at the requisite time intervals, including semiannual reporting provided for in the environmental management plan. The PMO will be responsible for analyzing and consolidating the data through its management information system.

²¹ The limits for the imprest account and the statement of expenditure are in accordance with the recent review of ADB's PRC portfolio and were set to improve efficiency in loan disbursement.

²² The IAs now have three tiers of audit including (i) internal audit, (ii) municipal government audit, and (iii) provincial and state government audit.

The PPMS will be designed to permit adequate flexibility to adopt remedial action regarding project design, schedules, activities, and development impact. The PMO, with the assistance of the consultants, will monitor and assess activities, and provide semiannual reports to ADB on the physical implementation and financial aspects of the Project to ensure that its impact is monitored and reported in line with ADB requirements.

9. Governance and Anticorruption Measures

46. ADB's *Anticorruption Policy* (1998), as amended to date was explained to and discussed with NMG and the IAs, including the recent harmonized definitions of corrupt and fraudulent practices.²³ ADB's approval of the Second Governance and Anticorruption Action Plan was also indicated and discussed. The Project includes anticorruption and governance assurances in support of the principles of transparency, participation, accountability, zero-tolerance for corruption (para. 28 of the RRP), and requirement for performance audit. As part of its commitment to good governance, accountability, and transparency, ADB reserves the right to investigate, directly or through its agents, any alleged corrupt, fraudulent, collusive, or coercive practices relating to the Project. To support these efforts, relevant provisions of ADB's *Anticorruption Policy* are included in the loan regulations, the loan and project agreements, and the bidding documents for the Project. In particular, all contracts financed by ADB in connection with the Project will include provisions specifying the right of ADB to audit and examine the records and accounts of NMG and all contractors, suppliers, consultants, and other service providers as they relate to the Project. For the Project, NMG will undertake the following anticorruption actions: (i) involve full-time officials from Nanjing Discipline Investigation Bureau in bidding and construction; (ii) introduce a dual-signing system, in which the civil works contract winner also signs an anticorruption contract with the employer; and (iii) periodically inspect fund withdrawals and settlements by the contractor.

10. Project Review

47. In addition to joint project reviews carried out at least once a year, ADB, the JPG, and NMG will undertake a comprehensive midterm review one to 2 years after the start of project implementation. The review will include a detailed evaluation of the scope, implementation arrangements, resettlement, achievement of scheduled targets, and progress on the agenda for policy reform and capacity building measures. Feedback from the PPMS activities will be analyzed.

IV. PROJECT BENEFITS, IMPACTS, ASSUMPTIONS, AND RISKS

A. Benefits and Impacts

48. By 2010, the Project will benefit about 2.7 million urban residents in Nanjing whose living conditions and public health standards will improve as a result of (i) reduced pollution in Nanjing's surface water following the improvement of wastewater collection and the wastewater treatment rate, better sludge management, and renewal of degraded urban wetland; (ii) protection from flooding and elimination of hazards associated with inadequate stormwater drainage; and (iii) reduction of the incidence of waterborne infectious diseases below the 2005/06 level of 43 cases per 1,000 people. By 2010, the Project will improve the management of surface water resources in Nanjing by (i) achieving the goal of 85% wastewater treatment rate in Nanjing; (ii) reducing the annual pollution load in the Qinhuai River by 5,000 tons biochemical oxygen demand, 9,000 tons chemical oxygen demand, 6,800 tons suspended solids, 950 tons ammonia nitrogen, and 110

²³ ADB. 2006. *Anticorruption Policy: Harmonized Definitions of Corrupt and Fraudulent Practices*. Manila.

tons total phosphorus; (iii) significantly reducing flooding in urban areas; (iv) increasing the efficiency and management capacity of the IAs; and (v) improving cost recovery through a better tariff structure, with gradual increases to achieve cost recovery.

49. To achieve national wastewater treatment targets, NMG will build a new WWTP. Upon project completion, 100,000 m³/day treatment capacity will be added, and the four WWTPs will provide a total of 1,145,000 m³/day secondary treatment to the received wastewater to reach local standards of an 85% wastewater treatment rate by 2010. The Project will help increase the wastewater treatment rate in the main city of Nanjing from 75% to 85% by 2010. Associated sewer networks and pumping stations will be built to accommodate the growth in wastewater flows to year 2015 in the project areas. The significant water quality improvements in the Qinhuai River and in turn in the Nanjing section of the YRB will contribute to integrated water resource management and pollution control, basin management, and transboundary pollution prevention and control.

50. The stormwater management component will add 27 km to the 1,153 km of storm drain and combined system. To enhance flood control in the urban areas of Nanjing, this component will improve the drainage-sewerage network by separating stormwater and wastewater flows into different systems and rehabilitating defective pipes. Waterborne diseases; accidents; injuries and loss of life; and damage to property, agriculture, and infrastructure will be minimized.

B. Social Dimensions

1. Land Acquisition and Resettlement

51. Land acquisition and resettlement will involve people affected by (i) permanent acquisition of land for the wetland park, sludge disposal facility, and pumping stations; (ii) temporary use of land for rehabilitating river banks and installing trunk sewer pipelines; and (iii) demolition of houses or buildings. The resettlement requirements have been carefully considered and incorporated into the project design. Through the optimum engineering project design, the resettlement impacts were minimized. As a result, only one of the components will have significant land acquisition and resettlement impacts.

52. In total, the Project will require (i) the permanent acquisition of 63.5 hectares (ha), of which 33.5 ha is rural collective land; (ii) the temporary acquisition of 97.6 ha, of which 12 ha is classified as rural collective land; and (iii) the demolition of 50,899 square meters (m²) of residential housing and 48,895 m² of enterprises and shops. Accordingly, 803 people will be affected, of which 339 will be affected by permanent land acquisition, and 455 residents and 272 staff of enterprises and shops will be affected by house/building demolition. No indigenous people or ethnic minorities will be adversely affected by any of the project components. The cost estimate for land acquisition and resettlement is \$50.45 million, equivalent to CNY409.09 million, including contingencies, taxes, and fees for resettlement administration. All the land acquisition and resettlement costs will be included in the project cost.

53. Individual resettlement plans were prepared for the five components in accordance with PRC Land Administration Law (1998), State Council Decision to Deepen Reform and Strictly Enforce Land Administration (2004), ADB's *Involuntary Resettlement Policy* (1995), and associated operational procedures. The resettlement plans provide a socioeconomic profile of the people affected and scope of impacts; and address issues related to their entitlements for compensation, legal framework, public consultations, grievance procedures, rehabilitation measures, budget, and implementation milestones. The summary resettlement plan is in Appendix 11. NMG and the IAs have implemented ADB's *Public Communications Policy* (2005),

which requires full disclosure for the resettlement activities by (i) distributing copies of the resettlement information booklet to affected households and village offices on 1 September 2006, (ii) posting the draft resettlement plans in village offices or resident committees on 1 September 2006, and (iii) posting English versions of the draft resettlement plans on the ADB website following their endorsement by NMG and Environment and Social Safeguard Division (RSES) on 26 September 2006.²⁴ The final RPs were uploaded onto the ADB website on 13 November 2006.

54. All those affected will be compensated and resettled in a timely and adequate manner in accordance with the resettlement plans so that they will be at least as well off as they would have been without the Project. To ensure that they have been adequately compensated and rehabilitated, the PMO and IAs will (i) keep ADB informed of resettlement plan implementation through semiannual progress reports until resettlement is complete, and (ii) prepare resettlement completion reports and submit them to ADB.

2. Resettlement Monitoring

55. ADB requires internal and external monitoring of the implementation of land acquisition and resettlement for the Project. The PMO and IAs will recruit an independent agency for semiannual monitoring and annual evaluation of land acquisition and resettlement until 2 years after the completion of land acquisition and resettlement. An international social specialist under consulting services will help the PMO and IAs to facilitate internal monitoring and evaluation of resettlement, and prepare the progress reports. The monitors will conduct site visits, review resettlement progress, implement policy and income restoration for those affected, support the training programs, and make recommendations to resolve any issues. Monitoring and evaluation reports will be prepared and simultaneously submitted to ADB, PMO, and IAs. These reports will be uploaded onto the ADB website. In addition to the electronic copies, the monitors will provide hard copies of the report (both in English and Chinese). ADB requires three English copies and two Chinese copies.

3. Poverty Reduction

56. A poverty and social analysis was undertaken in line with ADB guidelines to collect detailed social information to inform project design; and identify poverty reduction and social development objectives, outcomes, and indicators. In addition to the socioeconomic survey, public consultations were conducted with different groups of stakeholders including consumer groups, business communities, government agencies, people affected by the Project, and civil society organizations. A participatory approach was adopted for project design and will continue during project implementation. The poverty and social analysis identified vulnerable groups and opportunities for pro-poor interventions; and recommended social action measures, and participation and mitigation plans to achieve positive social benefits. The summary poverty reduction and social development strategy is in Appendix 12.

57. The Project will contribute to achieving Millennium Development Goal 7 and target 10²⁵ through improved quality of life for approximately 2.7 million people by reducing the incidence of waterborne diseases and flood risk in urban Nanjing, and providing employment opportunities

²⁴ RPs were prepared for all five components. Based on subsequent review by RSES, it was decided that only three components required RPs, since two components had no impacts on people. The three components with resettlement impacts included the (i) Inner Qinhuai River Sewerage and Water Replenishment, (ii) City East Wastewater Treatment Plant, and (iii) Sludge Treatment. These will be monitored for compliance with ADB's *Involuntary Resettlement Policy (1995)*.

²⁵ This calls for halving, by 2015, the proportion of people without access to safe drinking water and improved sanitation.

during construction and operation of project facilities, with anticipated flow on effects to economic development. The poor,²⁶ who comprise 5% of total population, will disproportionately benefit from the Project through reductions in medical costs incurred as a result of contracting waterborne diseases valued at approximately CNY142 per person per year. Health benefits are expected to be felt disproportionately by women, who are more vulnerable to waterborne diseases due to higher contact with water from household responsibilities (especially cooking and washing), and are mainly responsible for care of the young and old when they are sick. A health impact analysis is in Supplementary Appendix E.

58. The Project will create a minimum of 6,000 full-time jobs during the 5 years of construction. The poor and women will fill about 50% of these jobs. Those temporarily employed in construction will benefit from additional training and experience that will provide them with opportunities in future planned infrastructure projects. The associated wages for workers translate to CNY543 million of project costs that will return to the local economy. Project operations will create 450 full-time permanent jobs directly and another 710 jobs through multiplier effects, corresponding to approximately CNY42 million in wages per year. The Project will provide employment opportunities to the floating population of migrant workers by assisting them to apply for temporary residence registration. In addition, the Project will require that all IAs comply with national and local labor laws and regulations for wages, and occupational and health safety.

C. Financial Aspects

59. The financial evaluation of the Project was undertaken in real terms using constant 2006 prices. The project cost estimates and financial projections in nominal terms were converted to real terms by adjusting for the projected effects of foreign and domestic inflation and currency fluctuation. Incremental benefits and costs were derived by evaluating the financial position of the IAs under the with- and without- project scenarios. The financial internal rate of return for the Project was computed on an after-tax basis of 6.20%, which compares favorably with the weighted average cost of capital in real terms of 2.79%. The financial analysis and projections are in Appendix 13.

60. The sensitivity analysis includes an examination of the risk that project costs will increase by 10%, or that revenues are delayed by 1 year; the resulting financial internal rates of return are 4.60% and 5.95%, respectively. A verification of the local financing plan reveals that the equity contributions from NMG are less than 1.5% of its annual revenue, indicating minimal risk. NMG has the financial resources to guarantee the loan repayments, and has provided assurances that it accepts this risk. An affordability analysis, based on proposed tariffs and household income data from the social survey, has been undertaken. Tariffs under the Project are considered affordable if the combined average water and wastewater charges are less than 5% of household income. The estimated tariffs on this basis are affordable to the average household (2.5% of income), and also affordable to the poorest 10% of households (less than 3.5%). NMG has a policy measure to decrease the impact of tariff increases on poor families through the Minimum Living Standard Scheme.²⁷ In addition, the Project includes pro-poor assurances that will protect the poor from wastewater tariff increases. The revenue-generating IA, NCIC, has agreed to minimum levels of financial performance, and these will be included as loan covenants covering capital structure (debt to equity ratio), debt service coverage ratio, and liquidity ratio. Financial projections estimate the tariffs required for an appropriate level of financial performance. Periodic tariff reviews will be required to overcome the risk of poor financial performance or of unexpected changes in tariff income. The Project is considered both financially viable and sustainable.

²⁶ The poverty line in Nanjing (urban) is CNY260 per capita per month.

²⁷ The households eligible for the Minimum Living Standard Scheme are cushioned from the increases in the cost of essential public services via a subsidy. In 2004, eligible families received CNY5 per month for 1 year to reflect increased water tariffs, and in 2005 received CNY70 as cushion for another increase in water tariffs.

D. Economic Aspects

61. The Project is an integral part of the ongoing provincial, municipal, and river basin environmental programs, contributing significantly to pollution control in the Qinhuai River and in turn to the environmental protection of the YRB. Public perceptions and preferences were also evaluated using household and business surveys. The analysis demonstrate that, when compared with a range of other public services, wastewater management, waterborne disease prevention, river cleaning, and flood damage control improvements rank highest in priority. A quantitative economic analysis also demonstrates the value of the Project. The economic analysis was conducted for 25 years including project construction, in accordance with ADB's *Guidelines for the Economic Analysis of Projects*. Project benefits and costs were estimated on a with- and without- project basis. Costs were divided into tradable and nontradable costs, and benefits were adjusted to account for nonincremental and incremental benefits. Incremental economic benefits were valued on the basis of willingness to pay; and in the case of flood prevention, the damages avoided. The economic internal rate of return for the components ranges from 15.1% to 28.2%, and for the whole Project 21.6%, which exceeds the economic opportunity cost of capital, assumed at 12%. The economic analysis is in Appendix 14.

E. Environmental Aspects

62. Extensive public consultations involving meetings with stakeholders, focus group discussions, and surveys were undertaken twice during preparation of the domestic environmental impact assessments (EIAs). The EIA summarizes the environmental impacts, mitigation measures, and monitoring plans. The environmental management plan (EMP), prepared as part of the EIA, will guide environmental mitigation and monitoring under the Project. The summary EIA was circulated to the ADB Board and posted on the ADB website on 3 August 2006. The Project will improve the urban environment and surface water quality in Nanjing and in the YRB. A major positive impact and environmental benefit is pollutant reduction (para. 48 of the RRP). The project preparatory TA consultants, based on detailed assessment, proposed innovative value-added engineering solutions (Supplementary Appendix F), which have been discussed with the design institutes for consideration and incorporation into the feasibility study reports.

63. The stormwater component will bring the stormwater network up-to-date to provide adequate capacity for flood control. The river improvement and replenishment component, by improving the flushing capacity of the watercourses, will improve the water quality and flood storage capacity in these rivers. The sludge management component will provide proper treatment and disposal for sewage sludge from five WWTPs, dredged materials from the rivers, and sludge from maintenance of the pipeline network. This will prevent secondary pollution of the Nanjing environment. The wetland park subcomponent will remove a degraded urban site from the city, and restore it into a wetland park with functions for outdoor recreation, water quality polishing, flood storage, wildlife habitats, and conservation education. All these will bring secondary public health and socioeconomic benefits to Nanjing and its citizens. Improvements of the water quality and the riverbanks will improve the living conditions of people along these rivers, beautify the culturally important Qinhuai River, and promote tourism and property development that will bring employment and other socioeconomic benefits. The Project will have an overwhelming positive environmental impact, and any environmental risks during construction and the life of the Project will be mitigated by implementing the measures identified by the EIA and the environmental management plan.

F. Risks and Mitigation Measures

64. Potential institutional, financial, and policy risks related to the Project include failure of NMG to (i) implement institutional strengthening for effective project management, (ii) increase water and wastewater tariffs to meet cost-recovery targets, and (iii) meet the equity requirements

to implement the Project. These risks have been mitigated by (i) obtaining assurances from JPG and NMG on the financial and managerial autonomy of the IAs, and institutional strengthening of the IAs; (ii) periodic water tariff reviews and adjustments following the national guidelines; and (iii) assurances from JPG and NMG that guarantee provision of counterpart funding for construction and O&M of the non-revenue generating project components. ADB review missions will monitor compliance with the financial and operational covenants to ensure the IAs are financially sustainable. The Project does not have any unusual technical risks. The stormwater, wastewater, and sludge management subcomponents under the Project use conventional engineering design and treatment processes that are robust and have proven records of reliable performance. The equipment packages to be procured through ICB will include technical support for installing, testing, and commissioning mechanical and electrical plant as recommended by the manufacturer. Given the performance of ADB's PRC portfolio, cost overruns and major implementation delays are not expected. Further, other risks including corruption and impact on the affordability of the very poor from rapid wastewater tariff increases are mitigated through appropriate assurances. Regarding affordability, subsidies provided by NMG under its Minimum Living Standard Scheme for the poor will also be a significant mitigating factor.

V. ASSURANCES

65. In addition to the standard assurances,²⁸ the Government and NMG have given the following assurances, which are incorporated in the legal documents:

- (i) NMG will ensure that the wastewater fees charged are set at a level that ensures full cost recovery of O&M, depreciation and financial costs including debt service obligations, and a reasonable profit margin for wastewater treatment.
- (ii) NMG will ensure that prior to the implementation of any tariff increases, Nanjing Municipal Price Bureau will (a) review and conduct research to determine the number of poor people, including those living at or below the poverty line, who would be affected by such tariff increase, and the impact of such wastewater adjustments on the poor; (b) prepare a plan or scheme to be provided to ADB for review, which may include price subsidies or other measures such as lifeline tariffs, to ensure that the livelihood or standard of living of the people affected allows them to be at least as well-off as before the tariff increase; (c) issue a decree before such tariff increase takes effect to ensure that all those affected are provided such subsidy or measures; and (d) monitor the effectiveness of the subsidy or other measures.
- (iii) In furtherance of the principles of transparency, participation, accountability, and zero-tolerance for corruption, NMG will establish a project website to provide the public with information on the Project including (a) a summary of the audited financial statements of the Project, (b) tracking of procurement contract awards, (c) any proposed tariff increases and associated scheduled public hearings, (d) relevant laws and regulations, and (e) any information relating to pro-poor subsidies or lifeline tariffs. NMG will periodically make such information available on radio and in newspapers.
- (iv) NMG shall ensure that qualified and independent auditors shall conduct performance/"value for money" audits during project implementation to determine the degree to which Project funds have been effectively and efficiently utilized to implement the Project, and achieve its objectives, outcomes and its performance indicators. Such performance audits may be conducted together with the financial

²⁸ The full list of assurances is included in the Loan Agreement and Project Agreement.

audit as part of the overall annual project audit, in accordance with the applicable Government's audit law, regulations and policy.

VI. RECOMMENDATION

66. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the loan of \$100,000,000 to the People's Republic of China for the Nanjing Qinhuai River Environmental Improvement Project from ADB's ordinary capital resources, with interest to be determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility; a term of 25 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan and Project Agreements presented to the Board.

Haruhiko Kuroda
President

24 November 2006

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>Impact</p> <p>Improved urban environment, public health, and quality of life for urban residents and businesses in Nanjing City</p>	<p>Water quality of the Yangtze River within the Nanjing section and downstream sustained at class III, beyond 2011</p> <p>Public satisfaction with government environmental and infrastructure improvement projects increased from 29% in 2006 to 50% in 2011</p> <p>Incidence of waterborne infectious diseases below the 2005/06 level of 43 cases per 1,000 people by 2011</p> <p>Satisfaction with wastewater services, stormwater drainage management, and control of flooding increased by 2011</p> <p>Minimum living standard scheme support for the poor offsets impact from water and wastewater tariff increases maintained through 2011</p> <p>Increased employment opportunities with the creation of 450 full-time permanent jobs by 2011</p>	<p>Environmental monitoring data of Nanjing Environment Protection Bureau and State Environment Protection Administration (surface water and tap water)</p> <p>Nanjing Health Bureau, and Nanjing Center for Disease Control data on drinking water quality, incidence of infectious diseases</p> <p>Annual socioeconomic surveys undertaken as part of the PPMS</p> <p>ADB review missions</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Nanjing master plan for infrastructure is effectively implemented. • All applicable local and national environmental laws in the PRC are effectively enforced. • Effective land acquisition and resettlement process minimizes grievances and improves standards of living for all affected people resettled. • Project design implemented effectively. • Timely provision of the project financing requirements, including ADB loan. <p>Risks</p> <ul style="list-style-type: none"> • River water quality monitoring data do not provide sufficient information to detect trends. • Enforcement of environmental laws and regulations is weak. • Urban growth including influx of migrants in Nanjing exceeds forecasts and exerts more pressure on available urban infrastructure.
<p>Outcome</p> <p>Improved management of surface water resources in Nanjing City (contributing to the achievement of Millennium Development Goal 7, target 10)</p>	<p>By 2011, water quality of the Qinhuai River improved from worse than class V in 2006 to class IV</p> <p>By 2011, annual wastewater effluent pollutant loading is reduced by 5,000 tons biochemical oxygen demand, 9,000 tons chemical oxygen demand, 6,800 tons suspended solids, 950 tons ammonia nitrogen,</p>	<p>Wastewater effluent quality and monitoring data</p> <p>Water supply data (rate of utilization and flow volumes)</p> <p>River flood-gauging station data and flood map and records</p> <p>Municipal sludge disposal records.</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Population growth continues. • Demand for water supply and wastewater services continues to grow to achieve full capacity utilization and generate revenue to finance investments. • Customers are willing to pay increased tariffs. • Infrastructure assets are properly maintained. • Nonresidential connection and pretreatment requirements are

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
	<p>and 110 tons total phosphorous.</p> <p>Frequency of disruption and damage due to local stormwater flooding reduced by more than 50% by 2011</p> <p>Wastewater treatment rate increased from the current level of 75% to 85% by 2011</p> <p>Municipal sludge treatment and disposal significantly improved by 2011</p> <p>Probability of flooding incidence for the Qinhuai River and its tributaries reduced from an average of every 30–50 years to every 50–100 years, and the ecological environment of the Qinhuai River and its tributaries improved through soil conservation, and river water replenishment by 2011</p>	<p>Nanjing statistical yearbook</p> <p>ADB review missions</p> <p>Government's project completion report</p>	<p>adequately enforced.</p> <ul style="list-style-type: none"> • Monitoring plan for local flooding is implemented. • Traffic management and restoration measures for temporary land occupation are adequate. <p>Risks</p> <ul style="list-style-type: none"> • Surface water runoff increases due to increasing the catchment and surface imperviousness. • Government does not support the reform process.
<p>Outputs</p> <p>1. Improved sewerage and water replenishment in the Inner Qinhuai River in urban areas of Nanjing</p>	<p>9.6 km of sewer pipelines connected to the existing Jiang Xin Zhou WWTP with capacity of 440,000 m³/day (will be upgraded by NMG to 640,000 m³/day) by 2009</p> <p>River water replenished by upgrading power supply of Dachong Bridge pumping station, and 2.4 km of pipelines connecting the Outer Qinhuai River to the Hu Cheng River by 2009</p> <p>Improved water gate system on the Ming Yu, East Yu Dai, and South Yu Dai rivers including two 100 m box culverts by 2009 for flushing of the Inner Qinhuai River to reduce pollution and improve flood control</p> <p>Water replenishment</p>	<p>WWTP records (rate of capacity utilization, influent and effluent flow volumes)</p> <p>River flow records of Nanjing Hydrological and Water Resources Management Bureau</p> <p>Site inspection and project implementation reports</p> <p>Water quality monitoring station data</p> <p>Follow-up socioeconomic impact survey</p> <p>WWTP and sludge disposal facility records</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Construction of new stormwater systems; and upgrading of WWTPs, pumping stations, and sewers is timely. • Counterpart funding is available. • New drains/sewers are maintained and cleaned on a regular basis. • Engagement of implementation consultants and local agencies for safeguards works is timely. • Works and equipment procurement are not delayed. • The environmental impact of the sludge disposal site is properly monitored. • The Environment Protection Bureau enforces environmental monitoring standards. • Effective stakeholder

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>2. Improved and expanded wastewater services in East City urban area of Nanjing</p> <p>3. Improved sewerage, river improvement, and water replenishment in the North He Xi District, in urban Nanjing</p>	<p>improved by installing control systems by 2009, effectively diverting water from the Qi Qiao Weng Pumping Station to the City East water system, and from Xiang Fang village pumping station to the southern and central parts of the Inner Qinhuai River</p> <p>Wastewater collected (23.3 km of sewer pipelines), and treated at City East WWTP, which is expanded by 100,000 m³/day from the existing 100,000 m³/day to 200,000 m³/day by 2010</p> <p>River widening and dredging, ecological restoration of revetment, and construction of access roads with landscaping on the river banks of 18 km of the Upper Qinhuai River and 9.8 km of the South River, by 2010</p> <p>Ecological restoration of easement of the Yun Liang River and 33 ha of an urban wetland park at the confluence of the Yunliang River and Outer Qinhuai rivers by 2010</p> <p>28.7 km of sewer pipelines connected to the existing Jiang Xin Zhou WWTP with capacity of 440,000 m³/day (to be upgraded by NMG to 640,000 m³/day) by 2009, and the South Lake pumping station expanded by 2010</p> <p>River widened and dredged and banks strengthened of the Long Jiang and Qing Jiang North Aqueduct and a 450 m long box culvert installed by 2010</p>	<p>Internal and external monitoring reports on resettlement plan and environmental management plan Monitoring of project implementation and progress by ADB review missions</p> <p>IA monthly reports on contract expenditure and works progress</p> <p>IA quarterly financial statements and annual audited financial reports</p> <p>Semiannual progress reports</p> <p>Annual reports</p> <p>Resettlement completion reports</p>	<p>participation and ownership is developed.</p> <ul style="list-style-type: none"> • The Jiangsu Provincial Government and NMG provide strong support. <p>Risks</p> <ul style="list-style-type: none"> • Water quality varies in different phases. • Water is contaminated from upstream. • Wastewater affected by overflow in severe storm events. • Tariff increases may be opposed by customers at public hearing meetings. • NMG provides weak coordination of the IAs. • Some stakeholders resist changes.

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
4. Reduced flooding in the stormwater drainage areas of the districts of Bai Xia, Gu Lou, Qinhuai, Xia Guan, and Xuan Wu, in urban Nanjing	<p>1.7 km pipeline diverts river water for the Long Jiang area and the South River pumping station constructed by 2010</p> <p>29 stormwater drain outlets and 25 km of drainage pipelines in the districts of Bai Xia, Gu Lou, Qinhuai, Xia Guan, and Xuan Wu by 2010, reduces the frequency of drainage overflow and local flooding in these areas by more than 50% by 2010</p> <p>Flood protection improved in urban area of Nanjing from 1 flood in 2 years to 1 in 5 years by 2010</p>		
5. Comprehensive improvement in sludge treatment and disposal	80 tons/day dry sludge treated at the Jiang Xin Zhou sludge treatment facility and 840 m ³ /day municipal sludge disposed of at Mount Feng Huang sludge disposal facility by 2011		
6. Institutional capacity building for project management	Efficiency of NMG, PMO, and the IAs increased by 2011		

Activities with Milestones	Inputs
<p>1. Sewerage and Water Replenishment Works in Inner Qinhuai River Area</p> <p>1.1 Complete detailed design of the facilities, procure equipment and materials, and recruit required permanent staff</p> <p>1.2 Undertake land acquisition and resettlement</p> <p>1.3 Construct 9.6 km of sewer pipelines (DN400- DN1,000) in the Inner Qinhuai River and upgrade the Dachong Bridge pumping station by 2009</p> <p>1.4 Construct the Qi Qiao Weng River intake pumping station with a capacity of 3 m³/second by 2009</p> <p>1.5 Construct 2.4 km (DN1500) pipelines from the Outer Qinhuai River to Hu Cheng River</p> <p>1.6 Restore the existing water gate and construct two new water gates for the Ming Yu, East, and South Yu Dai rivers, and two box culverts 3 m x 2 m, 100 m long each by 2009</p> <p>1.7 Install water diversion control system, diverting water from the Qi Qiao Weng pumping station to City East Water System, and from Xiang Fang village pumping station to the south and central parts of the Qinhuai River by 2009</p>	<ul style="list-style-type: none"> • ADB <ul style="list-style-type: none"> - \$100 million loan • NMG and IAs <ul style="list-style-type: none"> - Provide \$82.7 million equivalent in counterpart funds, of which \$20 million would be generated from wastewater tariffs - \$54.9 million equivalent local bank loans

<p>2. Sewerage and River Improvement Works in City East Area</p> <ul style="list-style-type: none"> 2.1 Complete detailed design of the facilities, procure equipment and materials, and recruit required permanent staff 2.2 Undertake land acquisition and resettlement 2.3 Construct 23.2 km (DN400-DN1200) of new sewer pipelines in the catchment of Xiao Xing Xi Bridge, Ningnan, Qing Hong Twin Bridge, Tie Xin Bridge, and Yue Ya Lake—Technology University—Chang Xiang, Ma Qun by 2010 2.4 Expand the capacity of the East City WWTP by 100,000 m³/day, from the current 100,000 m³/day, to 200,000 m³/day, by 2010 2.5 Complete river improvement works covering 18 km on the upper Qinhuai River (Yunliang River to Xi Bei village), including river dredging, embankment reconstruction, widening and reinforcement, and water and soil conservation and ecological restoration of revetment by 2010 2.6 Complete embankment works covering 9.8 km of the South River, a tributary of the Qinhuai River, including river dredging, water and soil conservation, ecological restoration, and river bank landscaping by 2010 2.7 Complete ecological restoration along 1.5 km of the Yunliang River, a tributary of the Qinhuai River, and construct and ecological urban wetland park covering an area of 33 ha by 2010 <p>3. Sewerage, River Improvement, and Water Replenishment Works in North He Xi North District</p> <ul style="list-style-type: none"> 3.1 Complete detailed design of the facilities, procure equipment and materials, and recruit required permanent staff 3.2 Undertake land acquisition and resettlement 3.3 Construct 28.7 km of new sewer pipelines and expand the capacity of the South Lake No. 1 sewage pumping station by 2010 3.4 Complete river improvement works and dredging in the Long Jiang and Qing Jiang North Aqueduct, and construct a box culvert (450 m length) by 2010 3.5 Complete the river water diversion works for Long Jiang area, including construction of 1.7 km of pipelines, upgrading culvert of Xiao Dou Men pumping station and Li Wei pumping station, construction of two controlling water gates, and construction of new South River pumping station, with a capacity of 5 m³/second by 2010 <p>4. Expansion of stormwater networks</p> <ul style="list-style-type: none"> 4.1 Complete detailed design of the facilities, procure equipment and materials, and recruit required permanent staff 4.2 Undertake land acquisition and resettlement 4.3 Construct 29 storm drain outlets by 2010 4.4 Replace 25 km of drainage pipelines in the districts of Bai Xia, Gu Lou, Qinhuai, Xia Guan, and Xuan Wu in urban Nanjing by 2010 <p>5. Improve the operational sludge treatment facility</p> <ul style="list-style-type: none"> 5.1 Complete detailed design of the facilities, procure equipment and materials, and recruit required permanent staff 5.2 Undertake land acquisition and resettlement 5.3 Construct the Jiang Xin Zhou WWTP sludge treatment facility with a capacity of 80 tons per day (dry solid) by 2010 5.4 Construct a municipal sludge disposal facility with a capacity of 840 m³ per day and a leachate collection and treatment system at Mount. Feng Huang by 2010 <p>6. Institutional Capacity Building for Project Management</p> <ul style="list-style-type: none"> 6.1 Complete organization arrangements for Nanjing PMO to be able to implement the Project by February 2007 	
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<p>6.2 Complete necessary organizational arrangements for IAs (hiring staff and improving financial, administrative, and human resource policies) by March 2007</p> <p>6.3 Develop plans, budgets, procedures for loan implementation and project control in the Nanjing PMO, and the three IAs by March 2007 (set up budgets, project accounts, reporting systems, disbursement procedures, budget tracking procedures, cost control, and inventory system)</p> <p>6.4 Undertake ongoing public education in hygiene; environmental awareness; and wastewater, sludge treatment and disposal, and stormwater management planning until December 2011</p> <p>6.5 Complete NMG, PMO, and IA staff training by 2011 (training in ADB procedures for procurement and loan disbursement, wastewater treatment and sludge treatment operations, stormwater management, pollution control, environmental monitoring and management, flood control and financial management)</p> <p>6.6 Complete review and adjustment of wastewater tariffs in the project area, annually until 2010 (set budgets, estimate full cost recovery tariffs, review existing tariffs, and propose adjustments as needed; hold public information and consultations; secure approvals)</p> <p>6.7 Develop comprehensive PPMS procedures to systematically generate data on the inputs and outputs of the project components, and the socioeconomic, health, and environmental indicators to be used to measure project impact by May 2007</p> <p>6.8 Nanjing PMO and the IAs will refine the PPMS and establish systems and procedures no later than 6 months after project inception by November 2007</p> <p>6.9 Project implementation consultants will develop a set of indicators for the monitoring of future performance of WWTPs before start of operations by 2010</p>	
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ADB = Asian Development Bank, ha = hectare, IA = implementing agency, km = kilometer, m = meter, m³/day = cubic meter per day, NMG = Nanjing municipal government, PMO = project management office, PPMS = project performance monitoring system, PRC = People's Republic of China, WWTP = wastewater treatment plant.

SECTOR ANALYSIS

1. Increased municipal and industrial wastewater has become a major contributor to river and lake pollution in the People's Republic of China (PRC). Surface and groundwater sources for urban water supply are frequently polluted to unacceptable levels. An important strategy in the Government's plan to control and reduce pollution is to focus on river basin activities, especially in the management of surface water quality. Currently Nanjing City has treatment works capacity in excess of 60% of the municipal wastewater (domestic and industrial) generated. The proportion of domestic wastewater is set to increase marginally as a result of increasing urbanization, reduced urban density, and improved efficiency in water use on the part of PRC industries. Government policy now requires that cost-recovery tariffs be adopted for the provision of wastewater treatment. In contrast, flood control and stormwater drainage is considered a non-revenue-generating activity, to be financed from local government revenues.

A. Basin Focus

2. This sector analysis is conducted in a river basin context. The water policy¹ of the Asian Development Bank (ADB) calls for ADB to support integrated water resource management; in this context, coordinated river basin activities to manage surface water quality. A sector perspective for the Project must relate to basin plans to manage surface water quality, evaluate plan implementation, and assess progress in managing water quality. Nanjing is located in the lower reaches of the Yangtze River basin (YRB), the largest river basin in the PRC covering a large part of the country. The Yangtze River is about 6,380 kilometers (km) long with a drainage basin of 1.2 million square kilometers (km²). The main trunk of the Yangtze flows in an easterly direction and eventually enters the East China Sea at Shanghai.

3. The YRB Commission, which the central Government established to manage YRB water resources, prepared the Yangtze River Water Resources Protection Plan (2002), which provides a broad framework for managing YRB water resources. In April 2005, the YRB Commission sponsored the First Yangtze Forum in Wuhan. The forum issued a formal Yangtze Declaration on Protection and Development, which calls "...for active participation of all stakeholders in collaborative efforts to concurrently protect and develop the Yangtze River and ensure a healthy Yangtze for our future generations." The declaration highlights the importance of integrated river basin management.

B. Country Strategy and Program

4. ADB's country strategy and program update (CSPU)² for the PRC aims to promote continued economic growth in the country as a primary means of reducing poverty. It recognizes, however, that the PRC's economic growth has come at the cost of serious environmental degradation, particularly increased water and air pollution. Environmental degradation threatens the prospect of sustaining the economic growth. Improving environmental protection is therefore a main strategic issue and one of the main thematic priorities of the CSPU. A complementary objective and a main focus of the CSPU is promoting the provision of adequate urban infrastructure to improve the livelihood of the rapidly increasing urban population. The Project is fully consistent with the CSPU, which calls for market-oriented reforms and attention to urban environmental problems. The market-oriented reforms include the principle of cost recovery through user charges, which is an important feature of the Project.

¹ ADB. 2001. *Water for All: The Water Policy of the Asian Development Bank*. Manila.

² ADB. 2005. *Country Strategy and Program Update (2006–2008): People's Republic of China*. Manila.

C. Nanjing Water Environment Improvement

5. In 2004, Nanjing Municipal Public Utilities Bureau arranged the preparation of a study and report: Nanjing City Water Environment Improvement Works Construction. This planning document contains medium-term targets to improve the quality of water bodies in and around Nanjing City given national legislation, guidelines on water quality, and the situation within Nanjing. After extensive consultations with all key stakeholders, the Nanjing municipal government (NMG) approved the planning document in early 2005; it has become the official guide for the planning and design of environmental improvement projects in Nanjing. In addition, two other documents provide supplementary targets: Flood Control Planning for Qinhuai River Basin, and Jiangsu Province Surface Water (Environment) Beneficial Use Classification.

6. The planning targets for major water bodies, flood control, and wastewater treatment are summarized as follows:

- (i) water quality of major rivers and lakes in Jiangsu: from worse than class V to class V in 2007, and improved to class IV in 2010;
- (ii) flood frequency of major tributaries of the Qinhuai River reduced to 1 in 100 years;
- (iii) local flooding frequency: from less than 1 in 1 year to 1 in 2 years; and
- (iv) wastewater treatment rate increased to 85% for major cities like Nanjing.

D. Nanjing Municipality and Qinhuai River Basin Flood Control Planning

7. In terms of river drainage, the Outer Qinhuai River is a right-bank tributary of the Yangtze River, originating at Lishui and Jurong conurbations. It is known as the Outer Qinhuai River because it lies outside the ancient city wall surrounding Nanjing City. The Outer Qinhuai River flows toward the Nanjing urban area via Dongshan town of Jiangning District. Its total length is 110 km and the catchment area is 2,631 km². Niushoushan, South, Xiangshui, Youyi, Yunliang, and Yuntaishan rivers join it on its path to the confluence of the Yangtze River at San Cha gate. Much of the city sits below the 100-year flood level of the Yangtze River predicted as 10.63 meters above datum and is therefore subject to flooding during the rainy season (April to September).

8. The lower 34 km of the river lies within Nanjing's main urban districts. Water quality in the lower Qinhuai River has deteriorated significantly in the past 15 years mainly due to wastewater discharge from the city, and currently fails to achieve class V of the PRC water quality standards. All seven rivers and three lakes in the Nanjing built-up area are polluted. The municipality is served by a mixture of wastewater, stormwater, and combined sewer networks. Due to lack of sufficient wastewater collection and treatment facilities, increasingly severe problems related to water pollution and urban drainage have resulted in serious water quality problems in the Qinhuai River within Nanjing. When the wastewater interception and wastewater treatment facilities under this Project are complete, Qinhuai River water quality is expected to be improved from below class V to class IV in line with the planning targets.

9. The main problems with Nanjing's stormwater drainage system are (i) continuing urbanization and new developments in the limited open space remaining within already congested areas, (ii) inadequate network coverage, (iii) old infrastructure with inadequate design standards, (iv) limitations of the combined drainage systems leading to wastewater overflows during storm and flood events, and (v) inadequate maintenance of the drainage network. The Project addresses these issues by providing storm-drain network extensions designed to new standards, and achieving better separation of the storm and sewage networks.

E. Nanjing Municipality: Wastewater

10. The key references for the master planning of wastewater infrastructure in Nanjing are (i) Nanjing City Water Environment Improvement Works Construction Planning (para. 5) (2004) and Nanjing City Trunk Sewers Planning (2005). These two wastewater master plans define the wastewater catchment boundaries, the strategic locations of wastewater treatment works, design assumptions, layout, and sizes of major sewers for Nanjing City.

11. In 2004, industrial sources were responsible for 52% of the 2.46 million cubic meters per day (m³/day) of wastewater produced by greater Nanjing. Nanjing Main City generated about 1.34 million m³/day of wastewater, including 0.17 million m³/day of industrial wastewater. Within Nanjing Main City, the four existing wastewater treatment plants (WWTPs) have capacity to treat about 70% of the domestic wastewater. NMG is currently implementing its wastewater master plan and will install additional WWTPs to raise the wastewater treatment rate to the required 85% target by 2010 as required by the state guidelines. The wastewater master plan includes phased and well-coordinated construction of WWTPs and sewer networks using local funds and assistance from ADB and other sources. To ensure that the WWTPs' expanded capacity is fully utilized, sewers leading to the WWTPs must be constructed and in service before 2010.

12. The wastewater interception works, additional sewerage network, and additional treatment capacity to be provided under the Project will reduce the pollution load discharged into the Qinhuai tributaries, and this in turn reduces pollution in the Qinhuai River itself as well as the Yangtze River, thus contributing to achievement of river quality targets.

F. Conclusions

13. Nanjing municipality has a well-constructed set of policies, targets, and plans for the wastewater and drainage sector. These instruments are themselves compatible with national policies and regulations. The relevant Nanjing sector plans are compatible with the overall development plan for the city and with the YRB water resources protection plan. The Project is part of the ongoing implementation of existing sector plans.

POLICY DIALOGUE

A. Overall Policy Framework

1. Discussions with the Nanjing project management office (PMO) and relevant municipal agencies, and reference to specific national policy documents of the People's Republic of China (PRC), reveal government policies in support of the Project and the establishment of institutional arrangements for project sustainability. These policies include (i) corporatization, instead of direct government provision, of public services; (ii) Government's role as enabler and regulator of services; (iii) separation between government and enterprise management; (iv) financing of utility services from user charges, with tariffs set in accordance with full cost-recovery principles; (v) joint billing of water and wastewater charges under the "one bill, two items" system; (vi) encouragement of appropriate competition and private sector participation for investment in infrastructure construction and operation and maintenance; (vii) adoption of the polluter pays principle; and (viii) promotion of social stability through poverty reduction and equal opportunities.

B. Cost Recovery and Tariff Reform

2. The Project will support the Government's ongoing economic and enterprise reform programs that require all wastewater management projects to be financially sustainable and capable of cost recovery. Drainage companies are required to improve their cost-recovery capability. Appropriate mechanisms for tariff setting are a critical factor in attracting the needed investment in the sector, ending drainage companies' reliance on government subsidies, and providing incentives to users to conserve water resources. The Asian Development Bank (ADB) is actively encouraging this transition in its policy dialogue and lending operations.

3. ADB has funded two water tariff studies and one wastewater tariff study in support of the Government's initiatives. The National Guidelines on Water Tariffs, prepared during the first water tariff study,¹ were promulgated by the National Development and Reform Commission and the Ministry of Construction in September 1998. Major features in the guidelines that reflect specific technical assistance (TA) recommendations include (i) selecting a tariff structure based on local conditions and priorities; (ii) adopting full cost recovery as the main objective in setting and approving tariffs; (iii) using public hearings to disseminate tariff increase plans to the public and obtain their feedback; (iv) adopting a simplified process for tariff regulation, requiring evaluation and approval by the municipal government, and supported by provincial and national review and monitoring; and (v) introducing lifeline tariffs for the poor. The guidelines improved the long-term financial viability of water supply companies and provided for operation and maintenance and service expansion to help increase private sector participation in the water and wastewater sector. NMG confirmed implementation of the guidelines. ADB's wastewater tariff study TA,² carried out between 2002 and 2003, contributed to wastewater tariff reform. Circular 1,192 of September 1999, amending the policy guidance on wastewater tariff setting, requires wastewater tariffs to be based on the principle of cost recovery but allows local governments flexibility in deciding when to implement the circular. NMG has been increasing water and wastewater tariffs in keeping with the state policy. Stormwater and sludge management, and river improvement are, however, viewed as a non-revenue-generating activity in the PRC.

4. The project financial analysis assumes that the wastewater tariffs are based on the principle of full cost recovery. Wastewater tariffs levied in the main urban area of Nanjing

¹ ADB. 1997. *Technical Assistance to the People's Republic of China for Water Supply Tariff Study*. Manila.

² ADB. 2001. *Technical Assistance to the People's Republic of China for the National Guidelines on Urban Wastewater Tariffs and Management Study*. Manila.

(currently CNY1.05 per cubic meter [m^3]) are already higher than those in other cities in the PRC. After conducting a cost audit of the current and projected water, wastewater, and water resource expenses, Nanjing Price Bureau proposes to increase the average wastewater tariff in Nanjing from the current CNY1.05/ m^3 , to CNY1.40/ m^3 by 2006, and CNY1.60/ m^3 by 2010, exceeding the estimated full cost-recovery requirements of CNY1.57/ m^3 in 2010. These water and wastewater tariff increases, initiated through extensive consultation by the Nanjing Price Bureau, are highly encouraging and will contribute significantly to financial sustainability of the water and wastewater companies. In Nanjing, the local water supply company collects water and wastewater tariffs through the “one bill, two items” approach, which has been shown in other countries to be the most effective way of collecting wastewater charges. Improved public awareness of the benefits of effective wastewater drainage and treatment can make them much more willing to pay wastewater charges. Socioeconomic surveys done during the project preparatory TA indicate a significantly high public willingness to pay, which is a very positive indicator of public support for the proposed project investments.

C. Private Sector Participation

5. The Project will demonstrate ADB’s comprehensive approach to addressing wastewater infrastructure needs, through its public and private sector operations. Implementation of the Private Sector Operations Department advisory TA³ in Nanjing, and the subsequent processing of the Nanjing Water Utility Development Project (NWUDP) is proceeding in parallel with the Nanjing Qinhuai River Environmental Improvement Project. The proposed assistance for the NWUDP is a partial credit guarantee for up to 50% of a CNY2 billion bond issue (with a duration of up to 15 years) by Nanjing Public Utilities Company, a subsidiary of Nanjing Construction Investment Company, which is the implementing agency for the wastewater treatment component under the proposed Project. While the NWUDP and the proposed Project are autonomous and not dependent on each other, significant synergies have been derived from the public-private approach to addressing water pollution and improving the urban environment in Nanjing. The successful policy dialogue on wastewater tariff reforms and the rigorous safeguards assessment for compliance undertaken through the proposed Project will support the NWUDP. Further, the processing and approval of the proposed Project will act as a catalyst for the NWUDP and further private sector initiatives. If the NWUDP is successful, it will through the guarantee of the bond issue ensure that the water utilities in the PRC have access to private sector funds to finance the enormous demand for water and wastewater infrastructure expenditures. The bond issue will also promote international standards of accounting, corporate governance, and public disclosure. The estimated timetable for the NWUDP is (i) due diligence in November 2006, (ii) Credit Committee meeting in December 2006, and (iii) Board consideration in the first quarter of 2007.

D. Water Quality in the Yangtze and Qinhuai River Basins

6. The Yangtze River basin (YRB) is the largest river basin in the PRC. The Changjiang Water Resources Commission, with overall responsibility for managing water resources within the YRB, has developed a basin management plan with a framework for managing YRB water resources. The plan cites the deteriorating water quality of the Yangtze River. Though the river is often seen as having high assimilative capacity, the cumulative effect of the numerous point and nonpoint discharges is deteriorating its water quality. Effects are felt throughout the downstream reaches and the East China Sea. The plan sets out several general pollution control targets with specific targets to be developed by individual provinces and cities.

³ ADB. 2005. *Technical Assistance to the People’s Republic of China for Nanjing Water Utility Long-Term Capital Finance in Commercial Markets*. Manila.

7. The Qinhuai River flows through the urban area before it joins the Yangtze River. The official water quality target for the lower Qinhuai River is class V, but currently the river fails to achieve that target by a significant margin. When the Project is completed, the river water quality will be improved to class IV. City East WWTP expansion alone will reduce chemical oxygen demand discharge by more than 90,000 tons per year once fully operational. This component together with others within this Project and being undertaken separately by NMG will contribute significantly to pollution control in the YRB. In addition, the ADB-funded Wuhan Wastewater Management Project (2003) and Wuhan Wastewater and Stormwater Management Project (June 2006) will contribute to pollution control in the YRB; as does the successfully completed ADB-supported Suzhou Creek Rehabilitation Project.

E. Regulatory Enforcement and Monitoring for Environmental Management

8. To build the necessary capacity for sound environmental management and strengthen the legal framework, ADB helped train staff of the Environment Protection Commission, and is assisting in drafting and revising some of the PRC's environmental laws.⁴ ADB is helping to promote a more effective legal and regulatory framework for environmental protection in light of the PRC's transition to a market economy and its adherence to international environmental protection agreements. ADB helped to upgrade the knowledge and skills of provincial legislative drafters in the review, amendment, and formulation of local legislation related to the protection and conservation of the environment and natural resources.⁵ In addition, ADB provided assistance in environmental management by improving the institutional capacity of the State Environment Protection Administration, and the local and provincial environmental protection bureaus to strengthen environmental standards and enforce environmental laws and policies.⁶

9. The Jiangsu Provincial Government and NMG have acknowledged their responsibilities to ensure that commitments given in the environmental impact assessment documentation are adhered to during project implementation. This responsibility will be discharged by the implementing agencies in conjunction with relevant NMG departments and a specific staff member will be designated to undertake a monitoring and coordination role. Establishment of appropriate monitoring procedures will be included in the implementation consulting services contract.

F. Wastewater Management and Urban Environmental Improvement

10. Policy dialogue on wastewater management focuses on integrated management of industrial and domestic wastewater including on-site treatment and public sewer connections. ADB has supported the Government's policies for wastewater management by providing a number of related environmental loans that include wastewater treatment components in Beijing, Chaozhou, Chengde, Fuzhou, Hefei, Qingdao, Shanghai, Tangshan, Tianjin, Wuhan, Changchun and along the Hai River system. The importance of wastewater treatment was also addressed under the Urban Environmental Improvement Planning Study⁷ that strengthened institutions responsible for environmental improvement in a number of cities, and identified future infrastructure requirements. The national guidelines drafted under the Urban Wastewater Tariffs

⁴ ADB. 1996. *Technical Assistance to the People's Republic of China for Capacity Building for National Resources Legislation*. Manila.

⁵ ADB. 1998. *Technical Assistance to the People's Republic of China for Provincial Legislation on Environmental Protection and Natural Resources Conservation*. Manila.

⁶ ADB. 1995. *Technical Assistance to the People's Republic of China for Strengthening the Environmental Standards and Enforcement Policies*. Manila.

⁷ ADB. 1993. *Technical Assistance to the People's Republic of China for Urban Environment Improvement Planning*. Manila.

and Management Study (para. 3) made specific proposals in relation to the financing and management of the wastewater sector. These ADB projects and related initiatives provide a solid basis for ongoing policy dialogue in wastewater management.

11. Discussions were held with NMG on the need to identify overall investment plans for the sector that will be in line with Nanjing's urban development and wastewater master plans. The incremental wastewater treatment capacity that will be added will exceed the incremental water supply in the project area.

12. NMG has almost completed its major investment in the lower reaches of the Outer Qinhuai River and provided both flood protection and riverine parkland. In conjunction with this is a stated policy to improve the urban environment within the Inner Qinhuai River system through water replenishment and dredging in accordance with the short-term construction plan for Nanjing City main town water environment improvement.

G. Flood and Stormwater Drainage Management:

13. The Project includes works to improve the upper reaches of the Qinhuai River (Yunliang confluence to Xibei village) to bring the existing embankments in line with national standards and provide flood protection levels as set out in *Flood Control Planning for Qinhuai River Basin*. Similar work is proposed for the South River to bring its service level in line with the city standard of flood protection for rivers of 1/100 year flood return event.

14. The existing stormwater drainage pipelines for Nanjing City (inclusive of the pipelines of the combined system) total 1,153.4 km. Since reconstruction has not been carried out in the whole zone, some built-up areas cannot meet the flood protection standard, and the pipe network is not yet complete. Some regions have below standard infrastructure, undersized pipes, and inadequate outlet arrangements. Some urban areas still have the combined system of sewage and rainwater. In many areas rainwater is drained through open channels; overflows result in serious river pollution. Therefore, reconstructing the stormwater drainage pipelines, upgrading the system standard, and thereby preventing further flooding problems are required.

15. One of the prime objectives of the Project is to improve stormwater drainage management in urban areas of Nanjing and to alleviate localized urban flooding due to the high intensity of rainfall during the short rainy season of June to August. NMG has prepared and approved a wastewater master plan and water environmental improvement plans that provide a strategy for separating wastewater and stormwater drainage. The proposed stormwater drainage pipeline works accords with the overall objectives of the water environment improvement determined in the short-term construction plan for Nanjing City main town water environment improvement. Completion of separation systems will help reduce the health risks created by urban flooding and also protect the WWTPs from hydraulic overload.

H. Urban Parkland Development Strategy

16. NMG's urban greening policy seeks to ensure a prescribed proportion of the developed urban area is urban parkland or areas under some form of plant cultivation. This was demonstrated by previous projects, which established a riverine park along 12.5 km of the Qinhuai River corridor through Nanjing City. Under the proposed Project, a 33 hectare (ha) park (Yunliang River park) at the confluence of the Yunliang and Outer Qinhuai rivers is proposed with design themes for recreation and conservation education. This park will meet the urgent need to

increase green space in Nanjing City. By reducing impermeable areas, stormwater runoff is reduced as well.

I. Sludge Management Strategy

17. Policy dialogue on sludge management focuses on integrated management of sludge generated from water treatment plants, wastewater treatment plants (WWTP), and municipal sludge comprising river dredging and cleansing of drainage pipelines. NMG recognizes that provision of increased water supply leads to an increase in the volume of wastewater generated and consequently an increase in sludge produced from both water treatment plants and WWTPs. Provision of adequate sludge handling, treatment, and disposal facilities is essential to public health. This must be taken in phases because of high costs involved. The success of sludge management policy will impact the sector objective of secondary pollution reduction and also the cost-effectiveness of sludge management and operation. An overall sludge management strategy including an action plan will be prepared as part of the Project.

J. Corporate Governance and Enterprise Reform

18. ADB's urban infrastructure projects are aimed to address various aspects of corporate governance reform: (i) structuring the utility companies along commercial lines, (ii) assisting these utilities to prepare business plans, (iii) strengthening the operation of the boards of directors for the companies, and (iv) implementing external and internal audit arrangements. This supports State Circular 1,192 (1999), jointly issued by the National Development Reform Commission, Ministry of Construction, and State Environment Protection Administration, which identified the establishment of enterprise companies as the preferred institutional model for urban infrastructure services.

19. Improved corporate governance and enterprise reforms under this Project also support the implementation of (i) tariff reforms for improved cost recovery through improved budgeting and improved financial management; (ii) appropriate use of private sector participation such as access to capital markets to finance wastewater infrastructure as being investigated under the Nanjing Water Utility Long-term Capital Finance in Commercial Markets TA (footnote 2); (iii) strengthened environmental management for compliance with environmental laws and policies; and (iv) more integrated wastewater management to focus on accountability and allocation of resources, and improvements in service standards.

EXTERNAL ASSISTANCE FUNDED BY THE ASIAN DEVELOPMENT BANK

No.	Name	Date of Approval	Amount (\$ million)
A. Loans			
1205	Qingdao Environmental Improvement Project	10 Dec 92	103.00
1270	Tangshan and Chengde Environmental Improvement Project	25 Nov 93	140.00
1313	Dalian Water Supply Project	20 Sep 94	160.00
1336	Beijing Environment Improvement Project	29 Nov 94	157.00
1490	Anhui Environmental Improvement Project	26 Nov 96	28.00
1491	Anhui Environmental Improvement Project (Industrial Component)	26 Nov 96	112.00
1543	Xian-Xianyang-Tongchuan Environmental Improvement Project	24 Sep 97	156.00
1544	Zhejiang-Shanxi Water Supply (Phase I) Project	24 Sep 97	100.00
1636	Fuzhou Water Supply and Wastewater Treatment	30 Sep 98	102.00
1692	Suzhou Creek Rehabilitation Project	29 Jun 99	300.00
1797	Tianjin Wastewater Treatment and Water Resources Protection	11 Dec 00	130.00
1985	Hebei Province Wastewater Management Project	19 Dec 02	82.36
1995	Harbin Water Supply Project	11 Mar 03	100.00
1996	Wuhan Wastewater Management Project	25 Apr 03	83.00
2175	Jilin Water Supply and Sewerage Development	27 Jun 05	100.00
2176	Fuzhou Environmental Improvement	8 Jul 05	55.80
2207	Henan Wastewater Management and Water Supply	18 Nov 05	100.00
2237	Shandong Hai River Basin Pollution Control Project	31 May 06	80.00
2239	Guangxi Nanning Urban Environmental Upgrading Project	5 Jun 06	100.00
2240	Wuhan Wastewater and Stormwater Management Project	5 Jun 06	100.00
Total for Loans			2,289.16
B. Advisory Technical Assistance			
987	Institutional Strengthening of National Environmental Protection Agency	10 Jun 88	0.34
1436	Environmental Impact Assessment and Training	10 Dec 90	0.60
1464	Management of Environment and Natural Resources in Hainan	11 Jan 91	0.60
1772	Institutional Strengthening of the Qingdao Environmental Protection	30 Oct 92	0.60
1835	Haihe Basin Environmental Management and Planning Study	31 Dec 92	1.24
1916	Institutional Strengthening of the Environmental Protection Bureau	28 Jul 93	0.45
1988	Environmental Impact Assessment and Training Phase II	18 Nov 93	0.90
2015	Urban Environmental Improvement Planning	14 Dec 93	0.48
2090	Legislative Reform for Protecting the Environment and Natural Resources	18 May 94	0.50
2210	Capacity Building of the Beijing Municipal Environmental Protection Bureau	29 Nov 94	0.60
2398	Improving Environmental Monitoring and Enforcement in Henan	15 Sep 95	0.09
2456	Pilot Environmental Plans for Selected Medium-Size Cities	4 Dec 95	0.60
2504	Seminar on BOT in Water Supply Sector	22 Dec 95	0.10
2505	Strengthening the Environmental Standards and Enforcement	22 Dec 95	0.60
2693	Formulation of Integrated Environmental Management Plans for the Chao Lake Basin	26 Nov 96	0.80
2726	Water Quality Management for Suzhou Creek	23 Dec 96	0.60
2726	Water Quality Management for Suzhou Creek (Supplementary)	13 Feb 98	0.40
2751	Capacity Building of Wastewater Treatment Operations in Anhui	27 Jan 97	0.20
2773	Water Supply Tariff Study	24 Mar 97	0.60
2804	BOT Chengdu Water Supply Project	2 Jun 97	0.60
2817	Strategic Operations for the Water Sector	26 Jun 97	1.18
2873	Improvement of Environmental Management in Shanxi Province	24 Sep 97	0.94
2906	Leadership Training on Urban Environmental Management in Key Cities	3 Nov 97	0.60
2951	Promotion of Market-Based Instruments for Environmental Management	16 Dec 97	0.70
2975	Environmental Impact Assessment Training and Curriculum Development	31 Dec 97	0.60
3079	TA Cluster to the PRC for the Promotion of Clean Technology	29 Sep 98	3.50
3095	Hai River Basin Wastewater Management and Pollution Control	10 Nov 98	0.57
3211	Improving Environmental Management in Suzhou Creek	29 Jun 99	0.84
3250	Water Tariff Study II	3 Sep 99	0.95
3377	Urban Poverty Study	27 Dec 99	0.41
3447	Strengthening Urban Solid Waste Management	25 May 00	0.60

No.	Name	Date of Approval	Amount (\$ million)
3588	Transjurisdiction Environment Management (TA Cluster)	11 Dec 00	2.10
3749	National Guidelines for Urban Wastewater Tariffs and Management Study	25 Oct 01	0.90
4061	Songhua River Water Quality and Pollution Control	10 Jan 03	1.00
4095	Policy Reform Support	11 April 03	0.15
4215	Safe Drinking Water and Sanitation for the Rural Poor	12 Nov 03	0.40
4335	Town-Based Urbanization Strategy Study	06 May 04	0.75
4694	Urban Poverty Strategy Study II	23 Nov 05	0.30
4702	Study on Sustainable Urbanization in Metropolitan Regions	28 Nov 05	0.50
	Subtotal (B)		27.89
C.	Project Preparatory Technical Assistance		
1549	Qingdao Environmental Improvement Project	18 Jun 91	0.10
1831	Tangshan and Chengde Environmental Improvement Project	31 Dec 92	0.10
1852	Dalian Water Supply Project	10 Mar 93	0.10
1917	Beijing Environment Improvement Project	28 Jul 93	0.60
2187	Anhui Environmental Improvement Project for Wastewater Component	19 Oct 94	0.28
2445	Xian-Xianyang-Tongchuan Environmental Improvement Project	16 Nov 95	0.50
2770	Fuzhou Water Supply and Wastewater Treatment	14 Mar 97	0.60
2901	Shanxi Environment Improvement Project	21 Oct 97	0.59
3049	Zhejiang-Shanxi Water Supply (Phase II)	21 Jul 98	0.54
3095	Hai River Basin Wastewater Management and Pollution Control	10 Nov 98	0.57
3215	Heilongjiang Water Supply	1 Jul 99	1.00
3216	Tianjin Wastewater Treatment and Water Resources Protection	2 Jul 99	0.80
3488	Hebei Province Wastewater Management Project	30 Aug 00	0.85
3571	Harbin Water Supply	12 Dec 00	0.72
3638	Wuhan Wastewater Treatment	19 Mar 01	0.50
4014	Fuzhou Environmental Improvement Project	5 Dec 02	0.60
4223	Shandong Hai River Basin Pollution Control Project	21 Nov 03	0.60
4227	Jilin Water Supply and Sewerage Development	26 Nov 03	0.65
4233	Henan Wastewater Treatment	3 Dec 03	0.80
4385	Guangxi Nanning Urban Infrastructure Development Project	3 Sep 04	0.56
4436	Wuhan Wastewater and Storm-Water Management	18 Nov 04	0.70
4617	Nanjing Qinhuai River Environmental Improvement	27 Jul 05	0.60
4628	Hefei Urban Environment Improvement	15 Aug 05	0.75
4804	Jilin Urban Infrastructure Project	29 Jun 06	0.50
4805	Xinjiang Municipal Infrastructure and Environmental Improvement Project	30 Jun 06	0.80
4808	Kunming Qingshuihai Water Supply Project	1 Aug 06	0.60
4818	Gansu Baiyin Urban Development Project	25 Jul 06	0.50
	Subtotal (C)		15.51
	Total for Technical Assistance (B+C)		43.40

ADB = Asian Development Bank, BOT = build-operate-transfer, TA = technical assistance.

Source: Asian Development Bank.

Components Project Cost Summary

Item	(CNY Million)			(\$ Million)			%	% Total
	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange	Base Costs
A. Inner Qinhuai River								
1. Inner Qinhuai River Sewerage	12.6	18.9	31.5	1.6	2.4	3.9	60	2
2. Inner Qinhuai River Water Replenishment	18.0	52.5	70.5	2.3	6.6	8.8	74	4
Subtotal Inner Qinhuai River	30.6	71.4	102.0	3.8	8.9	12.7	70	5
B. City East								
1. City East Sewerage	32.4	62.6	95.0	4.0	7.8	11.9	66	5
2. City East WWTP Expansion, Stage 2	38.1	118.0	156.1	4.8	14.7	19.5	76	8
3. City East River Improvement								
a. Upper Qinhuai River	110.1	146.1	256.2	13.8	18.3	32.0	57	14
b. South River	16.1	21.3	37.4	2.0	2.7	4.7	57	2
c. City East Yun Liang River	331.3	113.0	444.3	41.4	14.1	55.5	25	24
Subtotal City East River Improvement	457.5	280.4	737.9	57.2	35.1	92.2	38	39
Subtotal City East	528.0	461.0	989.0	66.0	57.6	123.6	47	52
C. HeXi North District								
1. He Xi Sewerage	28.9	49.5	78.4	3.6	6.2	9.8	63	4
2. He Xi River Improvement and Water Replenishing	13.2	20.1	33.3	1.6	2.5	4.2	60	2
Subtotal He Xi North District	42.1	69.6	111.7	5.3	8.7	14.0	62	6
D. Stormwater Drainage								
1. Stormwater Drainage	20.2	42.8	63.0	2.5	5.3	7.9	68	3
Subtotal Stormwater Drainage	20.2	42.8	63.0	2.5	5.3	7.9	68	3
E. Sludge Treatment and Disposal								
1. Jiang Xin Zhou Sludge Treatment Facility	12.6	75.8	88.4	1.6	9.5	11.1	86	5
2. Mt. Feng Huang Sludge Disposal Facility	79.1	67.4	146.5	9.9	8.4	18.3	46	8
Subtotal Sludge Treatment and Disposal	91.7	143.2	234.9	11.5	17.9	29.4	61	12
F. Project Management								
1. Project Management	0.0	12.0	12.0	0.0	1.5	1.5	100	1
Subtotal Project Management	0.0	12.0	12.0	0.0	1.5	1.5	100	1
Physical Contingencies	712.6	800.0	1,512.6	89.1	100.0	189.1	53	80
Price Contingencies	150.5	0.0	150.5	18.8	0.0	18.8	0.0	8
	96.6	0.0	96.6	12.1	0.0	12.1	0.0	5
	959.7	800.0	1,759.6	120.0	100.0	220.0	45	93
Interest During Implementation	117.5	0.0	117.5	14.7	0.0	14.7	0.0	6
Commitment Charges	12.0	0.0	12.0	1.5	0.0	1.5	0.0	1
	1,089.2	800.0	1,889.1	136.1	100.0	236.1	42	100

WWTP = wastewater treatment plant

Source: Asian Development Bank estimates.

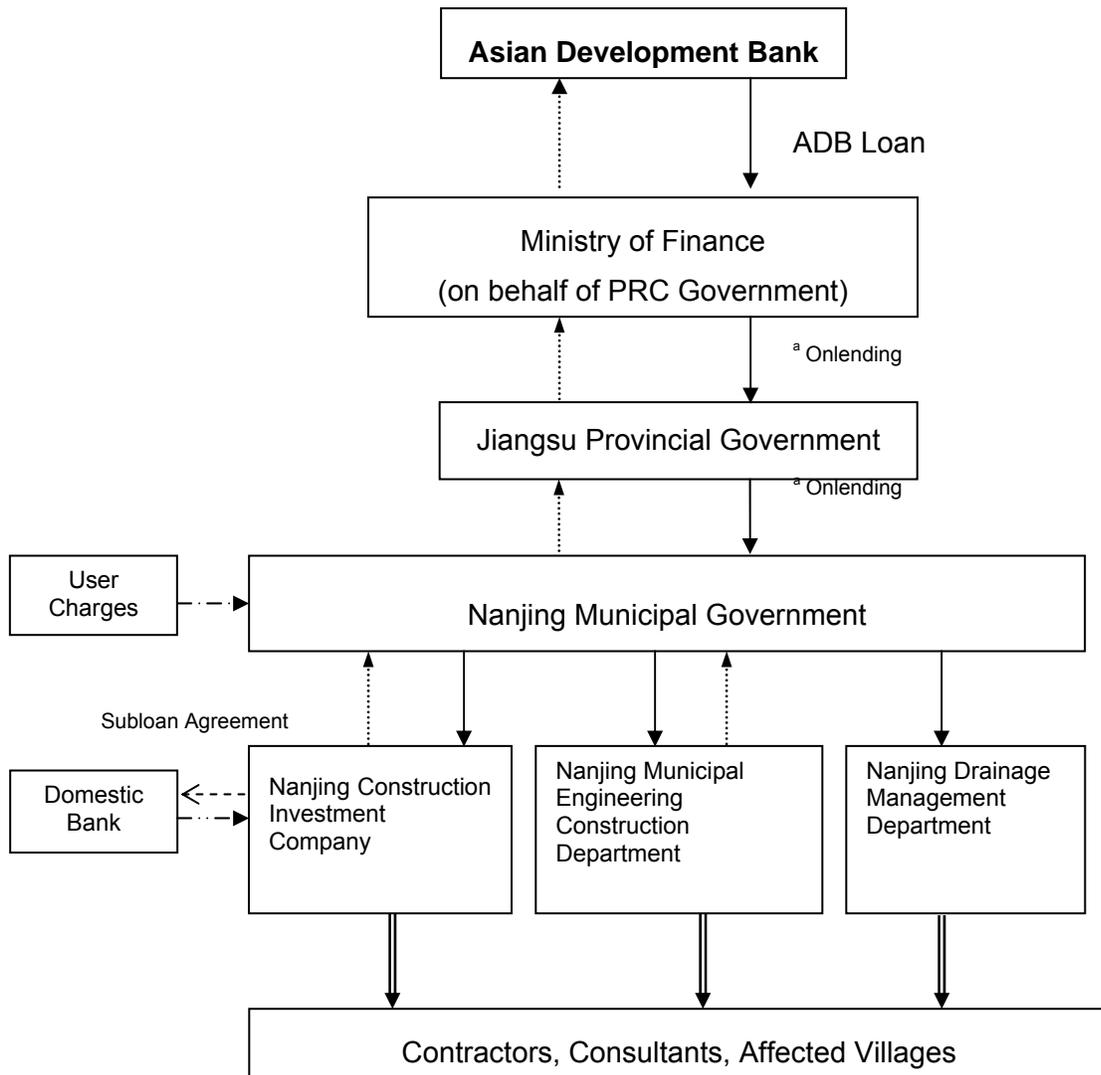
Components by Financiers
(\$ million)

Item	Asian Development Bank		Domestic Bank Loan		Government of China		Total	
	Amount	%	Amount	%	Amount	%	Amount	%
A. Inner Qinhuai River								
1. Inner Qinhuai River Sewerage	2.4	52	0.8	18	4.1	30	4.5	2
2. Inner Qinhuai River Water Replenishment	6.5	65	0.9	8	2.7	27	10.2	4
Subtotal Inner Qinhuai River	8.9	61	1.7	11	4.1	28	14.7	6
B. City East								
1. City East Sewerage	7.8	57	1.1	8	4.9	35	13.8	6
2. City East WWTP Expansion, Stage 2	14.7	65	0.0	0	7.9	35	22.6	10
3. City East River Improvement								
a. Upper Qinhuai River	18.3	49	15.4	41	3.6	10	37.3	16
b. South River	2.7	51	2.2	41	0.5	8	5.4	2
c. City East Yun Liang River	14.1	22	25.0	38	25.7	40	64.8	27
Subtotal City East River Improvement	35.1	32	42.6	40	29.8	28	107.5	46
Subtotal City East	57.6	40	43.7	30	42.6	30	143.9	61
C. He Xi North District								
1. He Xi Sewerage	6.2	55	1.9	17	3.3	28	11.4	5
2. He Xi River Improvement and Water Replenishing	2.5	53	0.9	19	1.4	28	4.8	2
Subtotal He Xi North District	8.7	54	2.8	17	4.7	29	16.2	7
D. Stormwater Drainage								
1. Stormwater Drainage	5.3	58	1.3	14	2.7	28	9.4	4
E. Sludge Treatment and Disposal								
1. Jiang Xin Zhou Sludge Treatment Facility	9.5	74	0.0	0	3.3	26	12.8	5
2. Mt. Feng Huang Sludge Disposal Facility	8.4	40	5.4	25	7.5	35	21.3	9
Subtotal Sludge Treatment and Disposal	17.9	53	5.4	16	10.8	32	34.1	14
F. Project Management								
1. Project Management	1.5	91	0.0	0	0.2	9	1.7	1
Total Project Cost	100.0	45	54.9	25	65.1	30	219.9	93
Interest During Implementation	0.0	0	0.0	0	14.7	100	14.7	6
Commitment Charges	0.0	0	0.0	0	1.5	100	1.5	1
Total Disbursement	100.0	42	54.9	23	81.2	35	236.1	100

WWTP = wastewater treatment plant

Source: Asian Development Bank estimates.

FLOW OF FUNDS AND ONLENDING ARRANGEMENTS



- > ADB Loan
-> ADB Repayments
- - -> User Charges
- - - -> Domestic Bank Repayments
- . . .> Domestic Bank Loan
- ====> Project Disbursements

ADB = Asian Development Bank, PRC = People's Republic of China

^a The ADB loan will be onlent on the same terms and conditions as those received by the Ministry of Finance.

FINANCIAL MANAGEMENT ASSESSMENT

1. The financial management skills of the implementing agencies (IAs)—Nanjing Construction Investment Company (NCIC), Nanjing Drainage Management Department (NDMD), and Nanjing Municipal Engineering Construction Department (NMECD)—were assessed with the use of the Asian Development Bank (ADB) financial management assessment questionnaire. The financial management assessment (FMA) assessed institutional capacity, funds flow arrangements, staffing, accounting policies and procedures, internal and external auditing arrangements, reporting and monitoring aspects, and information systems of the three IAs. Issues or risks associated with their financial management systems were identified, and appropriate risk mitigation measures proposed to improve project design and implementation. NCIC is responsible for the wastewater treatment component. NMECD and NDMD are responsible for the non-revenue-generating components including stormwater management, sludge management, and river improvement.

A. FMA for Nanjing Construction Investment Company Limited

2. NCIC, a fully state-owned company, is also the IA for the ongoing ADB advisory TA, Nanjing Water Utility Long-Term Capital Finance in Commercial Markets. Under the TA, NCIC's financial management capacity and its accounting practices have been strengthened. NCIC is the IA for the (i) City East wastewater treatment plant and (ii) sewerage components.

3. **Accounting Standards and Auditing Standards.** Through its new accounting and auditing standards, the People's Republic of China (PRC) seeks to conform to international standards and practices while taking into account the special conditions in the PRC. These new national accounting standards must be consistently followed to ensure accurate and timely interpretation of the financial position and performance of the IA, and the proper use of project expenditures according to the loan agreement, while taking economy and efficiency into account. Certified public accountants carry out general-purpose audits to give their opinion on whether financial statements are presented fairly in all material respects, according to the PRC's accounting standards and other regulations, and consistently with the preceding year's statements.

4. **Audit.** The project preparatory technical assistance (TA) included a review of the audit reports and audited financial statements of NCIC for 2003, 2004, and 2005, audited by Nanjing Municipal Audit Bureau. NCIC employs experienced internal auditors, reporting directly to the NCIC board of directors, to audit its subsidiaries and branches. The current NCIC audit arrangements, including internal audit and external government audit satisfy ADB's audit requirements. Overall, the audited financial statements appear to be of acceptable quality with detailed notes to the statements. The internal control system is adequate.

5. **Conclusion.** The overall financial management arrangements of NCIC are satisfactory and reliable. ADB's financial due-diligence requirements, especially the audit and reporting requirements normally included in the ADB memorandum of understanding and report and recommendation of the President, were reemphasized to NCIC during the ADB Fact-Finding Mission.

B. FMA for Nanjing Municipal Engineering Construction Department

6. NMECD is an independent legal entity with legal person status, supervised by NMG. NMECD is mainly responsible for construction and reconstruction of municipal infrastructure including roads and bridges, tunnels, lake and river environmental improvement projects, water

replenishment schemes, and wastewater networks. NMECD has 33 staff. NMECD is the IA for three components: (i) Inner Qinhuai River sewerage and water replenishment; (ii) North He Xi District sewerage, river improvement, and water replenishment; and (iii) sludge treatment and disposal.

7. **Financial Management Assessment.** NMECD uses accrual basis of accounting, and follows the PRC accounting systems for institutional entities and state-owned construction enterprises. These are generally adequate for project accounting. NMECD has adequate internal control systems. The financial management system is computerized and can produce the necessary project financial reports. Qualified internal auditors report to the NMECD director general. The NMECD financial statements are subject to audit by Nanjing Municipal Audit Bureau. The overall audit arrangements, including internal audit and external government audit, meet ADB's audit requirements.

8. NMECD's financial division is adequately staffed. NMECD has indicated that it will assign a qualified officer-in-charge, an accountant, and a cashier to the Project, and maintain special project accounts for the project components it is responsible for.

9. **Conclusion.** Training for NMECD staff in ADB loan processing policies, and procurement arrangement and disbursement procedures, among others, is planned under the Project.

C. FMA for the Nanjing Drainage Management Department

10. NDMD is an independent legal entity with legal person status supervised by NMG. NDMD is responsible for construction of drainage engineering works, and operation and maintenance of drainage facilities. NDMD is the IA for the stormwater component.

11. **Financial Management Assessment.** NDMD has adopted the accrual basis of accounting, and follows the PRC accounting systems for institutional entities and state-owned construction enterprises. These are generally adequate for project accounting. NDMD also has adequate internal control systems. The financial management system is computerized and can produce the necessary project financial reports. Qualified internal auditors report to the NDMD director general. NDMD financial statements are subject to audit by Nanjing Municipal Audit Bureau. The overall audit arrangements, including internal audit and external government audit meet ADB's audit requirements. The financial division of NDMD is adequately staffed. NDMD has indicated that it will assign a qualified officer-in-charge, an accountant, and a cashier to the Project, and maintain special project accounts for the project components it is responsible for.

12. **Conclusion.** Training for NDMD staff in ADB loan processing policies, and procurement arrangement and disbursement procedures, among others, is planned under the Project.

PROJECT SUSTAINABILITY

1. The sustainability of project assets and the benefits derived from them is a key indicator of project success. The sustainability of the Project will depend on the viability of the operating authorities for the wastewater, sludge treatment and disposal, river improvement, and stormwater components; and the quality of their construction, maintenance, and repair efforts.

A. Nanjing Urban Construction and Investment Company Limited

2. Nanjing Urban Construction Investment Company Limited (NCIC) is the implementing agency (IA) for the City East river improvement, wastewater treatment, and sewerage component. It will manage both the construction and operation. NCIC is a properly constituted enterprise company established under People's Republic of China (PRC) law, and largely has managerial and financial autonomy. NCIC has a board of directors, a valid business license, and a company charter.

3. **Project Construction Management Capacity.** NCIC is one of the largest city infrastructure state-owned enterprises in the PRC. NCIC is the parent company of Nanjing Municipal Water Company (NMWC) and Nanjing Qinhuai River Construction Company (NQRCC). NMWC will be responsible for construction of the City East wastewater treatment plant (WWTP) expansion subcomponent. NQRCC will be responsible for construction of the City East river improvement subcomponent. NMWC and NQRCC have extensive expertise and experience in implementing similar subcomponents. NMWC constructed the City North WWTP, while NQRCC constructed stage 1 of the improvement of the Qinghuai River, which was completed entirely with domestic funds (CNY3 billion). The proven implementation capacity of NMWC and NQRCC provides a high level of assurance of project success. Further, NCIC will delegate responsibility for construction of the City East sewerage networks to NMECD, whose mainstream responsibility includes (para. 9) construction of sewerage networks. NCIC has committed to assign qualified finance and accounts staff to the Project for effective control, management, and reporting. In addition, project budgets include a provision for project audit.

4. **Operations Management Capacity.** NMWC currently operates the City North and City East WWTPs. The City North WWTP has been operational since 2003. The City East, stage 1 WWTP was commissioned in 2005.

5. **Financial Management Capacity.** Overall, NCIC's financial management arrangements are satisfactory and can be relied on to support effective project management and decision making. Key features of the current arrangements are (i) use of an accrual basis of accounting and adherence to relevant national accounting standards, (ii) adequate internal controls, (iii) adequately trained and qualified accounting staff, (iv) computerized accounting records with the capacity to produce the necessary project financial reports, and (v) internal auditors to audit NCIC subsidiaries and branches and report to the NCIC director general. Internal auditors report directly to the board of directors. Current NCIC audit arrangements, including internal audit and external government audit, meet ADB's audit requirements and standards. Audited financial statements for fiscal years 2003, 2004, and 2005 are generally of adequate quality, and provide detailed notes to allow users to gain a reasonable understanding of NCIC's financial performance.

6. **Capacity-Building Support.** NCIC received capacity-building assistance, including institutional and financial management strengthening, and accounting system strengthening under the advisory TA, Nanjing Water Utility Long-Term Capital Finance in Commercial

Markets. NCIC is improving its oversight and control of operations through capacity building and ADB's own supervision of the Project. NCIC is competent in project implementation but will benefit from assistance in certain aspects of wastewater operations, such as the management of sewer connections, detection and prevention of water inflow and infiltration into wastewater collectors, and sludge management.

7. **Future Financial Performance.** Consolidated pro-forma financial statements for NCIC are given in Supplementary Appendix G. The cost-recovery ratio exceeds 1.0 throughout the projection period and a debt service coverage ratio of 1.2 can be reached by 2012. These are satisfactory results. The planned increase of wastewater tariffs from the current CNY1.05/m³, to CNY1.40/m³ by December 2006, and CNY1.60/m³ by 2010, exceeding the estimated full cost-recovery requirements of CNY1.57/m³ in 2010, will contribute significantly to the financial sustainability of NCIC and the Project.

B. Nanjing Municipal Engineering Construction Department

8. Nanjing Municipal Engineering Construction Department (NMECD) is the IA for three components: (i) Inner Qinhuai River sewerage and water replenishment; (ii) North He Xi District sewerage, river improvement, and water replenishment; and (iii) sludge treatment and disposal. NMECD is a government agency that implements public sector construction projects that are not commercially viable.

9. **Construction Project Management Capacity.** NMECD's main responsibility is to construct and reconstruct municipal infrastructure including roads and bridges, lake and river environmental improvement, water replenishment schemes, and wastewater networks. NMECD has successfully completed construction of projects for a total of CNY3.0 billion.

10. **Operational Management Capacity.** NMECD will not be involved in future operation and maintenance. The new assets, once commissioned, will be handed over to the Municipal Facilities Management Department of the Municipal Public Utilities Bureau, which is responsible for providing operation and maintenance for these facilities.

11. **Financial Management Capacity.** Overall, the financial management arrangements of NMECD are satisfactory and can be relied on to support effective project management. Key features of the current arrangements are (i) use of an accrual basis of accounting and adherence to relevant national accounting standards, (ii) use of appropriate internal controls, (iii) adequately trained and qualified staff, (iv) use of computerized accounting records, and (v) use of internal auditors reporting to the NMECD director general. Current audit arrangements, including internal audit and external government audit, meet ADB's audit requirements. NMECD staff will be trained in ADB loan processing policies and procedures.

12. **Capacity-Building Support.** The capacity-building initiatives for NMECD under the Project will focus on (i) training in relevant ADB project funding procedures; and (ii) review of organizational structure, operation, and maintenance to identify ways to improve efficiency.

13. **Future Financial Performance.** NMECD is a non-revenue-generating legal entity and a government department within Nanjing Municipal Public Utilities Bureau. NMG provides the funds for constructing the approved projects; the service is funded from the local government budget. Annual operation and maintenance costs for the Project are much less than 1% of government revenues. Funding has therefore been generally adequate and should continue to be adequate to assure sustainable benefits from project improvements.

C. Nanjing Drainage Management Department

14. Nanjing Drainage Management Department (NDMD) is the IA for the stormwater drainage component.

15. **Construction Project Management Capacity.** NDMD's main responsibilities are to construct drainage engineering works, and operate and maintain drainage facilities and flood pumping stations within Nanjing. NDMD has considerable expertise in drainage engineering, maintenance of drainage networks including pumping stations, and water and effluents testing.

16. **Operational Management Capacity.** Currently, NDMD's Network Management Unit maintains 193 km of sewers (of 1,100 km in Nanjing), 495 km of combined storm drains (of 1,700 km in Nanjing), and 28 km of intercepting channels. Its experience is adequate to maintain the additional stormwater network.

17. **Financial Management Capacity.** Overall, the financial management arrangements of NDMD are satisfactory and can be relied on to support effective project management. Key features of the current arrangements are (i) use of an accrual basis of accounting and adherence to relevant national accounting standards, (ii) use of appropriate internal controls, (iii) adequately trained and qualified staff, (iv) use of computerized accounting records, and (v) use of internal auditors reporting to the NDMD director general. Current audit arrangements, including internal audit and external government audit, meet ADB's audit requirements. NDMD staff will be trained in ADB loan processing policies and procedures.

18. **Capacity-Building Support.** The capacity-building initiatives for NDMD under the Project will focus on (i) training in relevant ADB project funding procedures; and (ii) review of organizational structure, and operations and maintenance to identify ways to improve efficiency.

19. **Future Financial Performance.** NDMD is a non-revenue-generating legal entity and a government department within Nanjing Municipal Public Utilities Bureau. NMG provides the funds for constructing approved projects. The service is funded from the local government budget. Annual operation and maintenance costs for the Project are much less than 1% of government revenues. Funding has therefore been generally adequate and should continue to be adequate to assure sustainable benefits from project improvements.

D. Conclusion

20. The assessment of sustainability covers both the construction and operational phases of the Project and considers financial and managerial capabilities. In light of the resources and experience of the IAs and the arrangements planned for project construction and operation, the Project is considered likely to be sustainable. Certain deficiencies and risks have been identified and mitigation measures for these are in place or are proposed in the form of project assurances and provisions for capacity building. The tariff reforms undertaken by NMG, including the generation of project construction funds (\$20.0 million) directly from wastewater tariffs, will contribute significantly to project sustainability. Further, the tariff reforms (para. 7) demonstrate that NMG is highly progressive in adopting tariff reforms.

IMPLEMENTATION SCHEDULE

Components	2006				2007				2008				2009				2010				2011			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Inner Qinhuai River Sewerage and Water Replenishment Component																								
A. Inner Qinhuai River Sewerage																								
Design and Tender Documentation																								
Tendering																								
Construction and Installation																								
Testing and Commissioning																								
B. Inner Qinhuai River Water Replenishment																								
Design and Tender Documentation and Start-Up Work																								
Tendering																								
Construction and Installation																								
Testing and Commissioning																								
City East WWTP, Sewerage, and River Improvement Component																								
A. City East Sewerage																								
Design and Tender Documentation																								
Tendering																								
Construction and Testing																								
B. City East WWTP Expansion																								
Design and Tender Documentation																								
Tendering																								
Civil Works Construction																								
E&M Equipment Installation																								
Testing and Commissioning																								
C. City East River Improvement																								
Design and Tender Documentation																								
Tendering																								
Construction																								
North He Xi District Sewerage, River, and Water Replenishment Component																								
A. Sewerage																								
Design and Tender Documentation																								
Tendering																								
Construction																								
Testing and Commissioning																								
Construction and Testing																								

Components	2006				2007				2008				2009				2010				2011			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
B. River Improvement and Water Replenishment																								
Design and Tender Documentation																								
Tendering																								
Construction and Testing																								
C. River Water Diversion																								
Design and Tender Documentation																								
Tendering																								
Construction and Installation																								
Testing and Commissioning																								
Stormwater Drainage Component																								
Design and Tender Documentation, and Start-Up Works																								
Tendering																								
Construction and Testing																								
Sludge Treatment and Disposal Component																								
A. Jiang Xin Zhou WWTP Sludge Treatment Facility																								
Preliminary Design																								
Tender Documentation and Tendering																								
Construction and Installation																								
Testing and Commissioning																								
B. Mount. Feng Huang Municipal Sludge Disposal Facility																								
Preliminary Design																								
Design, Tender, and Land Acquisition																								
Construction and Installation																								
Testing and Commissioning																								

E&M = electrical and mechanical, WWTP = wastewater treatment plant.

PROCUREMENT PLAN

Table A10.1: Project Information

Country	People's Republic of China (PRC)
Name of Borrower	PRC
Project Name	Nanjing Qinhuai River Environmental Improvement Project
TA Reference	TA 4617
Date of Effectiveness	
Amount	\$100,000,000
Of which committed	
Executing Agency	Nanjing Municipal Government
Approval Date of Original Procurement Plan	
Approval of most recent Procurement Plan	
Media for Publication for Local Advertisements	
Period Covered by this Plan	November 2006–June 2007

Table A10.2 Procurement Thresholds, Goods and Related Services, Works, and Supply and Install

Procurement Method	Threshold (Value \$)
International Competitive Bidding (ICB) Works ^a	> 10,000,000
ICB Goods	> 1,000,000
National Competitive Bidding (NCB) Works ^b	> 100,000
NCB Goods	> 100,000
Shopping (SH) Works	≤ 100,000
Shopping (SH) Goods	≤ 100,000
Exceptional Methods	None anticipated

^a For ICB, prior review and approval by ADB of procurement documents, bid evaluation reports, and proposed awards of contracts is required.

^b For NCB, the first draft English language version of the NCB procurement documents should be submitted for ADB review and approval regardless of the estimated contract amount. Remaining procurement documents under NCB are subject to post review. ADB will review the bid evaluation report and award of contract on a retroactive basis.

Source: Nanjing project management office.

Table A10.3: Procurement Thresholds, Consultant Services

Procurement Method	Threshold (Value \$)
Quality- and Cost-Based Selection (QCBS)	> 200,000
Consultants Qualifications Selection (CQS)	> 100,000
Least-Cost Selection (LCS)	≤ 100,000
Alternative Methods	No alternative methods are proposed

Table A10.4: List of Contract Packages

Ref.	Contract Description	Procurement Method	Expected Date of Advertisement	ADB Review
A1.1	Inner Qinhuai River sewerage			
A1.1.1	Sewer pipelines and Dazhong Qiao PS (electrical expansion)	NCB	Late Jun 07	Post
A1.1.2-1.1.4	Sewer pipelines	SH	Late Jun 07	Post
A1.2	Inner Qinhuai River Water Replenishment			
A1.2.1 ^a	Qi Qiaoweng water intake PS and water transfer pipeline, culvert and water gates for river water intake, installation of water diversion control system	NCB	Nov–Dec 06	Prior
A2.1	City East Sewerage			
A2.1.1 & 2.1.3	Sewer pipelines	NCB	Apr 07–May 07	Post
A2.1.2	Sewer pipelines (Yueya Lake Nanjing University of Science and Technology Changxiang area)	NCB	Nov 06–Dec 07	Post
A2.2	City East WWTP	NCB	Nov 06–Jan 07	Post
2.2.1	Installation of equipment	NCB	Jun 07–Oct 07	Post
A2.3	City East River Improvement Project			
A2.3.1-2.3.2 ^a	Yunliang River Improvement Project	NCB	Dec 06	Post
A2.3.3-2.3.5	Upper Qinhuai River Improvement and South River improvement and revetment	NCB	Jul 07	Post
A3.1	North He Xi North District Sewerage			
A3.1.1	Sewerage pipeline and Expansion of No. 1 sewerage upgrading PS	NCB	Apr 07–Jun 07	Post
A3.1.2-3.1.4	Residential area sewerage pipeline reconstruction (1–4)	SH	Apr 07–Jun 07	Post
A3.1.6-3.1.11	Residential area sewerage pipeline reconstruction (5–10)	NCB	Apr 07–Jun 07	Post
A3.2	North He Xi North District River Improvement			
A3.2.1 ^a	Longjiang River and Qingjiang North Ditch	NCB	Dec 06–Jan 07	Post
A3.2.2	Water intake pipeline, adjustment and control gate, South River Water Intake PS, gravity culvert reconstruction	NCB	Aug 07–Oct 07	Post
A4.1	Stormwater Drainage			
A4.1.1-1.1.6	Pipeline laying and pipejacking works	NCB	Aug 07–Oct 07	Post
A5.1	Jiang Xin Zhou Wastewater and Sludge Treatment Facility			
A5.1.1	Sludge treatment facility	NCB	Dec 06–Jan 07	Post
A5.1.2	Installation of equipment	NCB	Aug 07–Oct 07	Post
A5.2	Mount. Feng Huang Municipal Sludge Disposal Facility			
A5.2.1	Disposal field	NCB	Dec 06–Jan 07	Post
A5.2.2-5.2.3	Installation of equipment (1–2)	NCB	Aug 07–Oct 07	Post
B1.1	Inner Qinhuai River sewerage			
B1.1.1	Sewer pipelines	NCB	Early Jun 07	Post
B1.1.2	Dazhong Qiao PS (electrical expansion)	SH	Early Jun 07	Post
B1.2	Inner Qinhuai River Water Replenishment			
B1.2.1-1.2.5	Pipeline , water intake PS, electric actuator	NCB	Dec 06–Jan 07	Post
B1.2.6-1.2.8	Pipeline accessories, associated equipment for PS and other accessories	SH	Dec 06–Jan 07	Post

Ref.	Contract Description	Procurement Method	Expected Date of Advertisement	ADB Review
B2.1	City East Sewerage			
B2.1.1, 2.1.3 & 2.1.6	Sewer pipelines and other associated facilities	NCB	Jan 07–Mar 07	Post
B2.1.2	Sewer pipelines (Yueya Lake Nanjing University of Science & Technology Changxiang area)	NCB	Sept 07–Nov 07	Post
B2.1.4-2.1.5	Sewer pipelines (pipeline accessories)	SH	Jan 07–Mar 07	Post
B2.2	City East WWTP			
B2.2.1	Pumps and other equipment	ICB	Nov 06–May 07	Prior
B2.2.2	Condensed dewatering machine	ICB	Nov 06–May 07	Prior
B2.2.3	Sand sucker	NCB	Jun 07–Oct 07	Post
B2.2.4	Mechanical fine grid and other equipment	NCB	Jun 07–Oct 07	Post
B2.2.5	Centrifugal blower	ICB	Jun 07–Oct 07	Prior
B2.2.6-2.2.12	UV disinfection system, electric system, automatic control system and various equipment	NCB	Jun 07–Oct 07	Post
B2.3	City East River Improvement Project			
B2.3.1 ^a	Yunliang River - rainmaker, counterpart facilities, street and scenery lighting, equipment for water circulation treatment system, solar-power energy saving equipment, administrative control center equipment (9 nos. packages)	NCB	Mar 07	Post
B2.3.2 ^a	Material and equipment for Ecological Science Center (4 nos. packages)	NCB	Dec 06	Post
B2.3.3	Equipment for river management	NCB	Jun 08	Post
B3.1	North He Xi District Sewerage			
B3.1.1 & 3.1.5	Sewerage pipeline	NCB	Apr 07–Jun 07	Post
B3.1.2-3.1.4	Expansion of No. 1 Sewage PS (1-3	SH	Apr 07–Jun 07	Post
B4.1	Stormwater Drainage			
B4.1.1-4.1.5	Pipelines for Gulou District, Xuanwu District, Bai Xia District, Qinhuai District, and Xiaquan District	NCB	Apr 07–Oct 07	Post
B4.1.6	Pipelines and equipment for pipejacking	NCB	Apr 07–Oct 07	Post
B5.1	Jiang Xin Zhou Wastewater and Sludge Treatment Facility			
B5.1.1	Anhydration and transfer system (sludge anhydration equipment, plunger pump, sludge stock bin)	ICB	Dec 06–Jan 07	Prior
B5.1.2-5.1.4	Heat resource system and power transformation and distribution	SH	Aug 07–Oct 07	Prior
B5.1.5-5.1.9	Anhydration and transfer system and heat resource system an power transformation equipment	SH	Dec 06–Jan 07	Post
B5.2	Mount. Feng Huang Municipal Sludge Disposal Facility			
B5.2.1	Lining material	ICB	Dec 06–Jan 07	Prior
B5.2.2	Disposal field (clay and gravel)	NCB	Dec 06–Jan 07	Post
B5.2.3-5.2.8 & 5.2.10	Disposal field equipment	NCB	Aug 07–Oct 07	Post
B5.2.9 & 5.2.11-5.2.12	Disposal field equipment and accessories for leachate treatment	SH	Aug 07–Oct 07	Post
B5.2.12	Equipment and accessories for water treatment of present mine; accessories for improved workshop, vehicles, gas station, and leachate collection in the field, and discharge pipeline	SH	Dec 06–Jan 07	Post

Ref.	Contract Description	Procurement Method	Expected Date of Advertisement	ADB Review
C1.1	Consulting services: Project implementation, management, and related capacity building and training	FTP under QCBS	Jan 2007	Prior

ADB = Asian Development Bank, PS = pumping station, UV = ultra-violet, WWTP = wastewater treatment plant.

^a These packages will be under retroactive financing. ADB has approved the advance contracting and retroactive financing.

Source: Nanjing Project Management Office.

SUMMARY RESETTLEMENT PLAN

1. The Project comprises five components. The individual resettlement plans of five subprojects have been prepared in accordance with the People's Republic of China (PRC) Land Administration Law and involuntary resettlement policy¹ of the Asian Development Bank (ADB). The resettlement plans provide a socioeconomic profile of the people affected and scope of impacts, and address issues related to entitlements: compensation, legal framework, public consultations, grievance procedures, rehabilitation measures, budget, and implementation milestones. Resettlement planning and implementation is designed to ensure that all those affected will be better-off or at least not worse-off as a result of the Project.

A. Resettlement Impacts

2. Impacts related to land acquisition and resettlement include people affected by (i) permanent acquisition of land for the wetland park, sludge disposal facility, and pumping stations; (ii) temporary use of land for the rehabilitation of river banks and installation of trunk sewer pipelines, and (iii) demolition of houses or buildings. The resettlement requirements have been carefully considered and incorporated into project design. Through the optimum engineering project design, the resettlement impacts were significantly reduced. As a result, only one component will have significant land acquisition and resettlement impacts.

3. In total, the Project will require (i) permanent acquisition of 63.5 hectares (ha) of land, of which 33.5 ha is rural collective land; (ii) temporary acquisition of 97.6 ha, of which 12 ha is classified as rural collective land; and (iii) demolition of 50,899 square meters (m²) of residential housing and 48,895 m² of enterprises and shops. Accordingly, 803 people will be affected, of which 339 will be affected by permanent land acquisition, and 455 residents and 272 staff of enterprises and shops affected by house/building demolition. In addition, some public infrastructures and facilities will be affected, including roads, culverts, fiber cables, electric poles, and transformers. No indigenous people or ethnic minorities will be adversely affected by the Project. The project impacts of the five components are summarized in Table A11.1.

B. Policy and Legal Framework

4. As well as complying with the laws and regulations of the PRC and ADB's involuntary resettlement policy, the resettlement plans are based on the provisions of the Land Administrative Law of the PRC (1999), and the State Council Decision to Deepen Reform and Strictly Enforce Land Administration (2004). In addition, the following associated laws and regulations are applied to resettlement under the Project: (i) Jiangsu Provincial Land Administration Regulation (2001), (ii) Nanjing Municipal Land Acquisition and House Demolition Administration Regulation (2004), and (iii) Nanjing Municipal Land Expropriated Farmers' Basic Living Security Regulation (2004).

Table A11.1: Summary of Land Acquisition and Resettlement Impacts

Item	Unit	C01 ^a	C02	C03	C04	C05	Total
A. Permanent Land Acquisition	ha	0.6	33	0.18	0	29.73	63.51
Cultivated Land	ha	0.54	33	0	0	0	33.54
State-Owned Land	ha	0.06	0	0.18	0	29.73	29.97
B. Temporary Land Occupation	ha	5.37	68.54	14.03	9.67	0	97.6
Cultivated Land	ha	0	12.06	0	0	0	12.06
State-Owned Land	ha	5.37	56.48	14.03	9.67	0	85.54
C. Building Demolition	m ²	0	99,394	0	0	400	99,794

¹ ADB. 1995. *Involuntary Resettlement*. Manila.

Item	Unit	C01 ^a	C02	C03	C04	C05	Total
House	m ²	0	50,899	0	0	0	50,899
Enterprise	m ²	0	47,165	0	0	400	47,565
Shop	m ²	0	1,330	0	0	0	1,330
D. Affected Population	No.	30	773 ^b	0	0	0	803
Permanent Land Acquisition	No.	30	309	0	0	0	339
House Demolition	No.	0	455	0	0	0	455
Enterprise	No.	0	219	0	0	0	219
Shop	No.	0	53	0	0	0	53

ha = hectares, m² = square meters, No. = number.

^a CO1 refers to the first component.

^b Different impacts have some overlap, include house demolition and permanent land acquisition in Qiqiaoweng village.
Source: Asian Development Bank estimates.

5. Based on consultations with local governments, those affected, and replacement cost, a set of compensation standards will be adopted by the project implementing agencies (IAs). The resettlement principles established for the Project are (i) land acquisition and involuntary resettlement should be avoided or minimized where feasible by developing and comparing a series of design alternatives; (ii) compensation and entitlements provided are based on market value or replacement value and must be adequate to allow those affected to at least maintain their pre-project standard of living with the prospect of improvement; (iii) land temporarily occupied should be adequately compensated for and periods of disruption are to be kept to a minimum; (iv) farmers losing working opportunities on the land have their registration changed to take advantage of registration as urban residents; (v) a preferential policy will be provided to vulnerable groups in such things as compensation, housing assignment, transfer, and employment; (vi) all those affected will be adequately informed about eligibility, compensation rates and standards, livelihood and income restoration plans, and project timing; and (vii) close monitoring and timely actions will be carried out to identify and resolve any problems.

6. Seventy percent of the land compensation fee and entire resettlement subsidy will be disbursed directly to the personal account of those affected to join a special pension system (Land Expropriated Farmers' Basic Living Security), which was established for land loss farmers with the subsidy from the Nanjing municipal government. The remaining 30% of land compensation will be managed by the village committee for public purposes. For residential houses, enterprises, and commercial shops, compensation will be paid to owners directly. The payment will be made in cash according to the replaced value of the property. Households that have to relocate will also receive a special subsidy for purchasing a new apartment, and a transfer and transportation allowance. Compensation for standing crops, auxiliaries, and other assets will be paid directly to affected farmers. All infrastructure, facilities, and other assets will be compensated at replacement rates to allow full reconstruction by the owners.

C. Resettlement and Rehabilitation

7. The resettlement strategy encompasses the restoration of livelihood and income. People losing housing in rural areas have two resettlement options: receive cash compensation or apply for economical affordable housing provided by the NMG. The new apartment housing will have better infrastructure, e.g., water, sewer, road, sanitary facilities, school, and supermarkets. The respective IAs and local governments will provide necessary assistance for relocation during resettlement and implementation.

8. The economic rehabilitation measures include (i) provision of employment opportunities during the project construction and operation phases; (ii) arrangements for those affected to benefit from Land Expropriated Farmers' Basic Living Security, and the individuals can choose the standard payment of basic living security; (iii) provision of skill training and employment information; (iv) provision of monthly living subsidy for affected farmers who are unemployed for a fixed time; (v) provision of microcredit loans for business, subsidy for social insurance, and other preferential employment policies; (vi) provision of the information of the vacant workshop or shop sites for affected enterprises or shops.

9. To ensure maximum protection of vulnerable households during the land acquisition and resettlement process, the following special provisions are made. First, vulnerable groups will be given priority for employment opportunities with the Project. Second, incorporation of the needs and interests of vulnerable groups in resettlement planning and implementation will be ensured through focused consultation and participation programs. Third, vulnerable groups living below the municipal poverty line can benefit from the minimum standard of living system for rural residents and get some allowance each month.

D. Resettlement Cost and Fund Management

10. The cost estimate for land acquisition and resettlement is CNY409.09 million, equivalent to \$50.45 million, including contingencies, taxes, and fees for resettlement administration. This cost will be included in the total project cost. According to the compensation policies and standards defined in the resettlement plan, the payment and use of resettlement funds will be carried out under the supervision of internal monitors with regular review by the external monitoring agency.

E. Information Disclosure, Participation, and Grievance

11. People affected were notified about the key elements of the resettlement plans prior to ADB loan appraisal. On various occasions during meetings, interviews, focus group discussions, public consultation workshops, and community consultation meetings, local representatives have participated in the planning, and concerns have been integrated into the resettlement plans. The resettlement information booklets or the draft resettlement plans were disseminated to affected households and village offices on 1 September 2006. The information booklet contains the resettlement scope, project schedule, compensation rates for land and other assets, relocation and economic rehabilitation strategies, and grievance redress mechanisms. The draft resettlement plans were uploaded onto the ADB website on 26 September 2006.² The final resettlement plans were uploaded onto the ADB website on 13 November 2006. The respective project IAs will establish project resettlement units for supervising implementation, continuing public consultation, monitoring progress, and responding to grievances.

F. Institutional Responsibilities

12. The Nanjing project management office will coordinate the overall planning, implementation, internal monitoring and evaluation, financing, and reporting of land acquisition and resettlement. Each IA will have concerned full-time staff responsible for land acquisition and resettlement. They will work closely with relevant municipal and district land administration bureaus, house demolition

² Resettlement plans (RP) were prepared for all five components. Based on subsequent review by Environment and Social Safeguard Division (RSES), it was decided that only three components required RPs, since two components had no impacts on people. The three components with resettlement impacts included the (i) Inner Qinhuai River Sewerage and Water Replenishment, (ii) City East Wastewater Treatment Plant, and (iii) Sludge Treatment. These will be monitored for compliance with ADB's *Involuntary Resettlement Policy (1995)*.

offices, and village/street officials; and will be responsible for delivering entitlements, distributing economical affordable housing, and implementing the economic measures for those affected.

G. Monitoring and Evaluation

13. The Nanjing municipal government and the IAs will take full responsibility for the internal monitoring to ensure that the Project complies with requirements described in the resettlement plans. The project management office and IAs will engage an independent agency for semiannual monitoring and annual evaluation of land acquisition and resettlement until 2 years after the completion of land acquisition and resettlement. External monitoring reports will be submitted directly to both the project management office and ADB.

H. Resettlement Implementation

14. Resettlement implementation will be scheduled to precede subproject construction. Given the asynchronous schedule for different components, land acquisition and resettlement activities will commence from December 2006 to August 2008. Construction will not take place before those affected are fully compensated. Detailed measurement surveys will be conducted in each village, neighborhood, and enterprise; and the compensation contacts will be negotiated and signed with village committees, households, and enterprises.

SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

A. Linkages to the Country Poverty Analysis

Is the sector identified as a national priority in country poverty analysis?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Is the sector identified as a national priority in country poverty partnership agreement?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p>Contribution of the sector or subsector to reduce poverty in the People's Republic of China (PRC):</p> <p>The Nanjing Qinhuai River Environmental Improvement Project has potential to benefit 2.9 million inhabitants through improvements to the disposal of wastewater and flushing of the canal system. The Project will contribute to poverty reduction through increased quality of life by reducing the incidence of waterborne disease and flood risk in urban Nanjing, and providing employment opportunities during construction and operation of the project facilities, with anticipated effects on economic development.</p> <p>The Project will assist with the country's progress in meeting Millennium Development Goal (MDG) 7, target 10 to halve by 2015 the proportion of people without access to basic sanitation by increasing coverage of the Nanjing wastewater system to serve an additional 2.7 million people by 2010. It will contribute to estimated reductions in medical costs incurred as a result of contracting waterborne disease in Nanjing amounting to approximately CNY142 per person, or CNY824 million total. Health benefits are expected to be felt disproportionately by women since they are more vulnerable to waterborne diseases due to greater contact with water from household responsibilities (especially cooking and washing), and are most responsible for care of the young and old when they are sick.</p> <p>The Project will create approximately 60,000 person-years of work or an average of about 30,000 full-time equivalent jobs during construction. Follow-on multiplier effects are expected to create an additional 78,000 full-time jobs. Three quarters of the construction jobs are assumed to be unskilled and are likely to be filled by the currently unemployed. Since unemployment is a cause of poverty in the project area, the poor will benefit disproportionately from this job creation. Those temporarily employed in construction will benefit from additional training and experience that will provide them with opportunities in future planned infrastructure projects. The associated wages for workers translate to CNY543 million of project costs that will return to the local economy. Project operations will create 450 full-time permanent jobs directly and another 710 jobs through multiplier effects, corresponding to approximately CNY42 million in wages per year.</p>			

B. Poverty Analysis

Targeting Classification: Targeted intervention

<p>What type of poverty analysis is needed?</p> <p>A poverty and social analysis was undertaken in line with Asian Development Bank (ADB) guidelines to collect detailed social information necessary to inform project design, and identify poverty reduction and social development objectives, outcomes, and indicators. The analysis identifies vulnerable groups and opportunities for pro-poor interventions; and recommends social action measures, participation, and mitigation plans to achieve positive social benefits.</p> <p>Nanjing City has a population of 6.24 million people or 1.912 million households. Approximately 5% of households live in poverty. The poverty line in Nanjing (urban) is CNY260 per capita per month. The project socioeconomic analysis identified that Nanjing's poor, defined as those living at or only just above the poverty line are 100% Han Chinese and have an average age of 47. Most are retired (22.6%), casual laborers (17%), own their own business (16%), or unemployed (15%). They are most likely to live in a family of two people, in Bai Xia or Gulou districts in an apartment (most likely ground floor or above the 7th floor) of one or two rooms, with a living area of 24.5 square meters per person. Fifty-two percent of the poor own their dwelling. One third of the poor are either illiterate or have only a primary education. Twenty-one percent of the poor have one child, and a further 6% have two children. Almost half (47%) of the poor are unmarried/widowed or live without a partner (61% female, 39% male—the difference attributable to many more female senior citizens). Of these poor single adult households, 48% of households headed by women are in the 25–60 year age group (prime working and most likely married age group), and 42% of households headed by men are in the same age group. Twenty-three percent of poor single adult families are supporting a child (78% female, 22% male).</p> <p>The average poor household uses 7.8 tons of water per month based on their last water bill, 5 tons per month less than the average Nanjing household. Seventy-one percent of the poor pay the tap water company for their water and wastewater, 2% pay a factory, 2% pay a neighbor, and 7% do not pay at all. Ninety-one percent of the poor are</p>
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connected to the public sewer for disposal of wastewater, a further 4% discharge to an open drain, and 5% to a septic tank. The poor are disproportionately affected by wastewater system constraints. Forty-one percent of the poor reported a major problem with wastewater overflows in their neighborhood (compared with 26% for the nonpoor), and 34% reported a major problem with bad smells from the wastewater system (compared with 27% for the nonpoor). The poor are also more likely to suffer from problems associated with stormwater drainage (42% compared with 29% for the nonpoor) and surface flooding occurring two or more times a year (49% compared with 17% for the nonpoor). Despite this however, the poor and nonpoor have no significant differences with regard to incidence of disease linked with a poor sanitary environment and others. Apart from the elderly, the other two groups overrepresented among the poor are those with relatively low education and the unemployed. Both these groups will benefit from employment opportunities generated by the Project, where approximately two thirds of jobs are low- or unskilled.

C. Participation Process

Is there a stakeholder analysis? Yes No

The poverty and social assessment utilized a number of participation processes to solicit the input of a cross section of stakeholders. In addition to the socioeconomic survey of 655 households, a range of community meetings were held with both women and men in different parts of the city to discuss, in an open-ended manner, topics related to the Project but not specifically covered in the socioeconomic survey. A number of key informant interviews were held with various bureaus, nongovernment organizations, women's federation, past and ongoing projects in complementary areas, etc. to inform project design. Formulation of resettlement plans used separate socioeconomic surveys, community meetings, opinion surveys, and impact studies from April to June 2006, involving more than 500 people.

Is there a participation strategy? Yes No

Targeted analysis reveals that public awareness of the Project is high and generally very positive. Development of the environmental management plan and environmental impact assessment involved two rounds of public consultations in late May and early June 2006, shortly after beginning environmental impact assessment preparation. The purpose was to introduce the Project and the relevant components and subcomponents to a range of stakeholders, and to solicit their views on the Project and its potential environmental implications, so that the environmental impact assessment could take these into account. Most stakeholders already had good knowledge of the Project due to the preparation work undertaken by design institutes and the project management office (PMO). Both the resettlement plan and environmental management plan set out detailed ongoing public participation plans. Public participation is also planned for project monitoring and evaluation.

D. Gender Development

Strategy to maximize impacts on women:

An assurance is included that men and women will have equal employment opportunity in the operation and maintenance of infrastructure. Men stand to benefit more than women from the unskilled construction jobs that will be created through the Project, due to the requirement for physically demanding labor. However women's participation in the skilled operation and maintenance work will be encouraged as a number of women are already working in these sectors and an equal number of male and female graduates have technical qualifications. Consultation with women will be required for the resettlement plans. The socioeconomic analysis shows that women are equally likely to be living in poverty as men, however are slightly overrepresented among the elderly poor, who are more likely to be female than male, and assumed to be a product of longer female life expectancy. Women in focus groups noted that the improvement to riverside areas would benefit them disproportionately, providing safe, clean, well-lit areas for them to walk and meet friends. Older women in recently improved areas reported much use of improved urban areas in their neighborhoods for exercise and recreation.

Has an output been prepared? Yes No

E. Social Safeguards and Other Social Risks			
Item	Significant/ Not Significant/ None	Strategy to Address Issues	Plan Required
Resettlement	<input checked="" type="checkbox"/> Significant <input type="checkbox"/> Not significant <input type="checkbox"/> None	Five resettlement plans address permanent and temporary land acquisition affecting 260 households, 18 enterprises, 19 shops, and 11 shop-front houses; plus impacts to a range of public infrastructure including roads, culverts, cables, power poles, and transformers.	<input checked="" type="checkbox"/> Full <input type="checkbox"/> Short <input type="checkbox"/> None
Affordability	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Not significant <input type="checkbox"/> None	Willingness to pay and affordability analyses both returned positive results and indicate scope for the water price to increase. This increase is affordable even to the poorest income group. The poor will spend about 1.6% of household income for proposed 50% increase in the cost of water and wastewater. This is within the international threshold of 3%. Furthermore, the minimum living standard guarantee is adjusted frequently to reflect the increase of basic needs of the poor such as electricity, water, health, education, and transport services.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Labor	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input checked="" type="checkbox"/> None	No jobs will be lost. The Project will generate many employment opportunities for local beneficiaries during construction and operation. The implementing agencies have complied with national and local labor laws and regulations for wage, occupational, and health safety.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Indigenous Peoples	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input checked="" type="checkbox"/> None	The dominant ethnic group in Nanjing is Han, comprising 98.5% of the population. The remaining 1.5% consists of 50 other ethnic groups, the main one being Hui followed by Man then Zhuang (533). Ethnic minorities in Nanjing are not characterized by any marked difference in income or occupational group from the Han majority. As such, no ethnic minority development plan will be required for this Project.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Other Risks and/or Vulnerabilities	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Not significant <input type="checkbox"/> None	Nanjing has a large floating population (temporary rural-to-urban migrants) that may be considered a vulnerable group under this Project, although they stand to gain from employment opportunities, being concentrated in the unskilled job sectors. The source of their vulnerability, apart from a generally lower education, comes from the lack of benefits (housing, social, medical) associated with residence registration. The PMO will ensure contractors appraise and guide workers on the application procedure for temporary residence registration to ensure the safeguards of all members of the floating population employed in project construction, operation, and maintenance.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

FINANCIAL ANALYSIS

1. The financial analysis of the Project involves benefit-cost analysis and computation of the Project's financial internal rate of return (FIRR). The FIRR was computed only for project components that are revenue generating. The implementation agencies (IAs) and the associated project components are identified in Table A13.1.

Table A13.1 Implementing Agencies and Project Components for Evaluation Analysis

Project Component Implementing Agency	Project Subcomponent	Revenue Generating	Scope of Analysis
Nanjing Municipal Engineering Construction Department	Inner Qinhuai River Sewerage System	Yes	FIRR
	Inner Qinhuai River Water Replenishment	No	—
	North He Xi Sewerage Network	Yes	FIRR
	North He Xi River Improvement and Water Replenishment	No	—
	Jiang Xin Zhou WWTP Sludge Treatment Facility	Yes	FIRR
Nanjing Construction Investment Company	Mount. Feng Huang Sludge Disposal Facility	Yes	FIRR
	City East Wastewater Sewerage System	Yes	FIRR
	Treatment Plant	Yes	FIRR
Nanjing Municipal Drainage Department	River Improvement	No	—
	Stormwater Pipeline	No	—

— = not available, FIRR = financial internal rate of return.

Source: Asian Development Bank Project Preparatory Technical Assistance staff estimates.

2. **Financial Management Assessment.** By May 2006, financial management assessment questionnaires provided to the three IAs were complete. The project team met with the IAs' accounting divisions to review the responses, and found that the IAs have experience implementing projects of a similar size to the proposed Project and their financial management is capable of properly handling the Project.

3. **Financial Performance Assessment.** The financial performance assessment is based on an analysis of standard financial performance ratios. Nanjing Municipal Engineering Construction Department (NMECD) and Nanjing Municipal Drainage Department (NDMD) are legal entities within Nanjing Municipal Public Utilities Bureau, which is a part of the Nanjing municipal government. The financial performance assessment for Nanjing Construction Investment Company (NCIC) is based on the financial ratios calculated from the company's 2003, 2004, and 2005 audited financial statements.

4. The financial performance assessment of NCIC is based on annual pro-forma financial statements encompassing 20 years, commencing with the commissioning of the project components (Supplementary Appendix G). NCIC is expected to achieve the covenanted financial and capital structure ratios once project operation commences.

5. **Financial Assessment of Project Subcomponents.** The FIRR calculations of the six revenue-generating subcomponents are based on constant 2006 prices using incremental annual cash flows over 20 years of operations following commissioning of the civil works.

6. **Weighted Average Cost of Capital.** The weighted average cost of capital (WACC) is calculated in real terms for all project components based on nominal interest rates, income tax rate of 33%, and international and domestic rates of inflation (Table A13.2).

Table A13.2: Weighted Average Cost of Capital

Item	Financing Component			Total
	ADB Loan	Domestic Bank Loan	NMG Funds	
A. Amount (\$'000,000)	100.0	54.9	81.2	236.1
B. Weighting (%)	42	23	35	100
C. Nominal Cost (%)	5.65	6.39	8.00	
D. Tax Rate (%)	33	33	0	
E. Tax Adjusted Nominal Cost (%)	3.79	4.28	8.00	
F. Inflation Rate (%)	1.90	2.90	2.90	
G. Real Cost (%)	1.85	1.21	4.96	
H. Weighted Component (%)	0.78	0.31	1.70	2.79

ADB = Asian Development Bank.

Source: Asian Development Bank Project Preparatory Technical Assistance staff estimates.

7. **Financial Internal Rate of Return.** The FIRR is calculated for each project subcomponent and ranges from 5.13% to 8.11%. The after-tax FIRR for the overall Project is estimated to be 6.20% for the base case scenario. These results compare favorably with the WACC of 2.79%.

8. **Sensitivity Analysis.** The project team tested the following four scenarios in the sensitivity analysis, in addition to the base case:

- (i) project investment cost increases by 10%,
- (ii) project operating costs increase by 10%,
- (iii) currency exchange rate increases by 10%, and
- (iv) construction delayed by 1 year for wastewater projects.

9. **Conclusion.** The sensitivity analysis shows robust results. Even if the worse case situations occur, the FIRR exceeds the real WACC. Therefore, the Project is financially viable and sustainable. Nanjing municipal government is highly progressive on tariff reforms and has committed to raise CNY162 million (\$20.0 million) directly from wastewater tariff increases for the Project. Nanjing Price Bureau successfully held public hearing meetings on 28 August 2006 to discuss and seek public support for the proposed wastewater tariff increase from the current level of CNY1.05/m³ to CNY1.40/m³ by December 2006 and CNY1.60/m³ by 2010, exceeding the estimated full cost-recovery requirement of CNY1.57/m³ in 2010. The water and wastewater tariff reforms in Nanjing will contribute significantly to the financial sustainability of the Project.

ECONOMIC ANALYSIS

1. This economic analysis of the proposed Nanjing Qinhuai River Environmental Improvement Project covers project justification, general parameters for economic analysis, benefits and costs, least-cost analysis, and calculations of the economic internal rate of return (EIRR). The EIRR is calculated for each of the Project's 10 activities or subcomponents (Table A14.1) and the Project as a whole.

Table A14.1. Served Districts and Primary Benefits of Project Subcomponents

Subcomponent/Activities	Districts Served	Nature of Benefits
I.1 Inner Qinhuai River Construct sewer interceptors	Bai Xia, Qinhuai	Manage wastewater, reduce health costs
I. 2+3+4 Inner Qinhuai River Water replenishment	Bai Xia, Qinhuai	Reduce flood impact, reduce health costs
II.1 City East Construct new sewer pipelines	Bai Xia, Qinhuai, Xuanwu	Manage wastewater, reduce health costs
II.2 City East Expand wastewater treatment plant (WWTP) stage 2 by 100,000 m ³ /day or 36.5 million m ³ /year	Eastern half of Nanjing City	Treat wastewater, reduce health costs
II. 3+4+5 City East Upper Qinhuai River, South River, Yunliang River	Bai Xia, Gulou, Jiangning, Lishui County, Qinhuai, Xuanwu, and Yuhua Tai	Reduce flood damage in southern areas and peripheral urban areas
III.1 North He Xi District Expand sewerage network by 28.7 km	Gulou, Xiaguan	Manage wastewater, reduce health costs
III. 2+3 North He Xi District River improvement	Gulou, Xiaguan	Reduce flood impact, reduce health costs
IV.1 Stormwater Pipeline Construct drainage pipelines	Bai Xia, Gulou, Qinhuai, Xiaguan, Xuanwu	Reduce flood damage
V.1 Sludge Treatment and Disposal Jiang Xin Zhou WWTP sludge treatment facility to treat approximately 50,000 tons/year of sludge resulting from new WWTP processing 233.6 million m ³ /year	Western half of Nanjing City	Add sludge treatment facility to newly built wastewater treatment facility
V.2 Sludge Treatment and Disposal Mount Fenghuang sludge disposal facility, to dispose of 1,120 m ³ /day or 0.41 million m ³ /year	Bai Xia, Gaochun County, Gulou, Jiangning, Jianye, Lishui County, Luhe, Puko, Qinhuai, Xiaguan, Xixia, Xuanwu, and Yuhua Tai	Dispose of sludge in former quarry, reduce health costs

m³ = cubic meter, km = kilometer, WWTP = wastewater treatment plant

Source: Asian Development Bank Project Preparatory Technical Assistance staff estimates.

A. Project Justification

2. The review of policy and planning documents and regulations shows that the Project is consistent with the municipal pollution control and water management plans, and also with local infrastructure development plans. Public perceptions and preferences were evaluated using a household survey. The results demonstrate that the public gives high priority to wastewater management, waterborne disease prevention, river cleaning, and flood-damage control. The Project will benefit more than 2.7 million urban residents of Nanjing whose living conditions and public health standards will be improved. In addition, another 0.7 million unregistered floating people (temporary rural-to-urban migrants) will benefit from the Project.

B. General Parameters

3. The economic analysis was conducted by comparing situations with- and without-Project. The study period covers 25 years including 5 years of construction from 2007 to 2011. Economic benefits and costs are denominated in domestic price numeraire and expressed in constant 2006 prices. Tradable components are converted to economic prices using a shadow exchange rate factor of 1.013, and nontraded components are valued at domestic market prices. A shadow wage rate factor of 0.67 was applied to the wage of unskilled labor to account for unemployment and underemployment.

C. Costs

4. Project costs include capital investment costs and operation and maintenance costs. Costs were allocated to tradable, nontradable, skilled, and unskilled labor. Appropriate conversion factors, e.g., shadow exchange rate and shadow wage rate, were applied accordingly. Transfer payments, including taxes and interests, are excluded from the economic costs, while physical contingencies are included.

D. Benefits

5. Floods affect, on average, about 7% of the population in the project area each year. The four subcomponents with a flood-reduction impact (I.2+3+4; II.3+4+5; III.2+3; IV.1) will have direct benefits for 100,000 households, equivalent to about 281,000 people. According to the household survey, as the Project is expected to reduce the probability of flooding in the project area by 90%, the value of annual flood losses avoided would be CNY523 per household likely to experience a flood loss. The total benefits to the 100,000 households would thus be around CNY52.3 million. Such benefits, however, only account for direct losses of the households without considering direct losses and indirect losses to other sectors in the economy. To address this issue, an area-based total flood damage estimate was used to make the benefit forecast. According to the Dartmouth College flood database, which is based on the historical data in the project province from 1989 to 2005, a typical flood in the project area causes total damage of \$91,042 per square kilometer (km^2), which includes direct, indirect, and induced economic losses to households, commerce, industry, and agriculture. Applying such an area-based estimate to the Project is a conservative estimate because it is an average over a combined urban and rural area, and actual losses of agricultural production in rural areas are lower than losses experienced by commerce and industry in urban areas on a per km^2 basis. The Project is expected to reduce flood damage by 90% in a total area of about 311.05 km^2 .

6. Wastewater management subcomponents (II.2; V.1) include a new wastewater treatment facility with a capacity of 100,000 cubic meters (m^3) per day (i.e., 36.5 million m^3 per year) at the City East site, and a new sludge treatment facility with a capacity of 50,000 tons at the Jiang Xin Zhou site, which currently has a wastewater treatment capacity of 233.6 million m^3 per year. According to the household survey, which was based on the previous projects' successful survey methodology and questionnaire design, an average household in the project area is willing to pay CNY0.164 per ton of water consumed for the increased wastewater treatment capacity. A recent study sponsored by the United Nations indicates that the unit cost for small- to medium-sized industrial plants to treat industrial wastewater is CNY1.46 per m^3 . Given that the Project will increase the city's wastewater treatment ratio from 75% to 85%, the industrial willingness to pay (WTP) for the Project is assumed to be 10% of the unit cost of industrial wastewater treatment, i.e., CNY0.146 per m^3 . Water consumption data were collected from the Public Utility Bureau. Given the competing forces of the increased population (including rural in-migrants) that will

increase the water demand versus the increased water tariff that may lower the demand, the future water consumption was forecast by assuming a minor annual growth rate of 0.5%.

7. The lack of proper sewers and stagnant waters in clogged drains, canals, and moats are believed to be a major cause of waterborne disease. Six subcomponents (I.1, I.2+3+4; II.1; III.1; III.2+3; V.2) will have a health cost-reduction benefit: (i) Inner Qinhuai River sewer interceptors with a capacity of processing 149 million m³ of wastewater per year, (ii) Inner Qinhuai River water replenishment, (iii) City East 23 km of new sewers, (iv) North He Xi District 28.7 km of new sewers, (v) Hexi District river improvement and (vi) sludge disposal facility at Mount Fenghuang. The health cost reductions will directly benefit 19.9% of the households living in the project area, which has a total of 112,000 beneficiary households (about 314,720 people). The economic value of the annual health cost savings (40% reduction in annual costs) is expected to be CNY400 per household. Thus, the total benefits to the 112,000 beneficiary households will be CNY44.8 million. If the WTP is used, health benefits should be removed from the benefits part to avoid double counting, unless the WTP does not cover positive externality effects of the health benefits. To be conservative, this analysis did not include health benefits because the WTP was used in all the components whenever it is applicable.

8. In addition, the Project is likely to improve tourism and increase property values in the project area. Also, the public-private partnership used in this Project will provide a practical model for future urban infrastructure financing and have the potential to improve the efficiency of the public capital market. To avoid double counting and be conservative in the analysis, these potential benefits were not included in the benefit-cost analysis. Also, the benefits from the Project's economic multiplier effects were not considered as they are difficult to quantify.

E. Distribution of Project Costs and Benefits

9. The direct beneficiaries include the estimated 87,000 registered residents living below the official poverty line and many of the approximately 700,000 nonregistered migrants in search of work in the city. The urban poor will derive disproportionately greater benefits from the Project since they generally live in poorly served neighborhoods; while project costs are relatively heavier on enterprises and the better-off households given government's progressive taxation, user fees, and poverty reduction policies.

F. Least-Cost Analysis

10. The least-cost analysis of alternative technologies and materials to be used in subcomponents was based on the incremental economic costs over the alternatives' economic lives. A discount rate of 12% was used to calculate the present value of economic costs and average incremental economic costs. The present value of economic cost approach was adopted for the sewerage network subproject and river improvement subproject where a measurable output is not available. The average incremental economic cost approach was used for components with a measurable output, such as the City East wastewater treatment plant (WWTP). All costs and outputs are estimated by comparing situations with and without the Project.

- (i) For the sewerage network, using high density polyethylene pipes was found to be cost-effective compared to using reinforced concrete (RC) pipes.
- (ii) For the WWTP, using the anaerobic anoxic oxidation (A²O) process was found to be less costly than using the Orbal oxidation process.

- (iii) For the river improvement components, using lump stone for lining of river banks was found to be less costly than using reinforced concrete.

G. Economic Internal Rate of Return

11. The expected EIRR of the four subcomponents with flood-reduction benefits (Table A14.2) ranges from 15.1% for the North He Xi District river improvement subcomponent, to 28.2% for the City East Upper Qinhuai River improvement subcomponent. The EIRR of the six subcomponents with health cost-reduction benefits ranges from 15.1% for the City East new sewer pipelines subcomponent to 16.5% for the Inner Qinhuai sewer interceptors subcomponent (Table A14.3). The EIRR of the two subcomponents with wastewater and sludge treatment are 16.3% for the new City East 100,000 m³ per day WWTP and 16.7% for the Jiang Xin Zhou sludge treatment plant (Table A14.4). The EIRR for the whole Project, including all 10 subcomponents or activities, is 21.6%; the Project's economic net present value discounted at 12% is CNY855.6 million. The sensitivity analysis shows that increasing capital investment costs by 15%, or increasing operation and maintenance costs by 20%, or delaying total benefits by 1 year will not result in an EIRR lower than the cutoff rate of 12%. Thus, the results of the economic analysis are robust and the Project is economically viable.

Table A14. 2. EIRR of Subcomponents with Flood Reduction Impact

Subcomponent	NPV (CNY million)	EIRR (%)
I. 2+3+4 Inner Qinhuai River Water Replenishment	15.0	16.5
II. 3+4+5 City East, Upper Qinhuai River, South River, Yunliang River	592.9	28.2
III. 2+3 North He Xi District, River Improvement Longjiangqing	6.0	15.1
IV.1 Stormwater Drainage Pipelines	17.4	15.7

EIRR = economic internal rate of return, NPV = net present value.

Source: Asian Development Bank Project Preparatory Technical Assistance staff estimates.

Table A14.3. EIRR of Subcomponents with Health Impact

Subcomponent	NPV (CNY million)	EIRR (%)
I.1 Inner Qinhuai River Construct Sewer Interceptors	6.6	15.5
I. 2+3+4 Inner Qinhuai River Water Replenishment	15.0	16.5
II.1 City East Construction of New Sewer Pipelines	30.7	15.1
III.1 North He Xi District Sewerage Network	15.6	15.8
III. 2+3 North He Xi District River Improvement	6.0	15.1
V.2 Mount Fenghuang Sludge Disposal Facility	31.4	15.7

EIRR = economic internal rate of return, NPV = net present value.

Source: Asian Development Bank Project Preparatory Technical Assistance staff estimates.

Table A14.4. EIRR of Subcomponents with Wastewater and Sludge Treatment

Subcomponent	NPV (CNY million)	EIRR (%)
II.2 City East Expand WWTP by 100,000 m ³ /day, Stage 2	50.7	16.3
V.1 Sludge Treatment Facility at Jiang Xin Zhou	28.4	16.7

EIRR = economic internal rate of return, m³ = cubic meters, NPV = net present value, WWTP = wastewater treatment plant.

Source: Asian Development Bank Project Preparatory Technical Assistance staff estimates.