



Completion Report

Project Number: 31190
Loan Number: 1797-PRC
November 2008

People's Republic of China: Tianjin Wastewater Treatment and Water Resources Protection Project

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

		At Appraisal (as of 31 October 2000)	At Project Completion (as of 30 June 2007)
CNY1.00	=	\$0.12	\$0.13
\$1.00	=	CNY8.28	CNY7.62

ABBREVIATIONS

ADB	–	Asian Development Bank
EA	–	executing agency
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
EOCC	–	economic opportunity cost of capital
FIRR	–	financial internal rate of return
IA	–	implementing agency
LIBOR	–	London interbank offered rate
LRDMB	–	Luan River Diversion Management Bureau
M&E	–	monitoring and evaluation
O&M	–	operation and maintenance
PIA	–	project implementation agency
PMO	–	project management office
PPTA	–	project preparatory technical assistance
PRC	–	People's Republic of China
PRCM	–	People's Republic of China Resident Mission
TCEPC	–	Tianjin Capital Environmental Protection Co., Ltd.
TFB	–	Tianjin Finance Bureau
TMG	–	Tianjin Municipal Government
TML	–	Tianjin Municipal Luanhe Drinking Water Resources Protection Engineering Ltd.
TSC	–	Tianjin Sewerage Company
TWRB	–	Tianjin Water Resources Bureau
WACC	–	weighted average cost of capital
WRP	–	water resources protection
WWT	–	wastewater treatment
YRRALP	–	Yuqiao Reservoir Resettlement and Alternative Livelihood Restoration Plan

NOTES

- (i) The fiscal year (FY) of the Government and its agencies ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2000 ends on 31 December 2000.
- (ii) In this report, "\$" refers to US dollars.

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BASIC DATA

A. Loan Identification

1.	Country	People's Republic of China
2.	Loan Number	1797-PRC
3.	Project Title	Tianjin Wastewater Treatment and Water Resources Protection Project
4.	Borrower	People's Republic of China
5.	Executing Agency	Tianjin Municipal Government
6.	Amount of Loan	\$130.0 million (net amount after cancellation: \$128.4 million)
7.	Project Completion Report Number	1062

B. Loan Data

1.	Appraisal	
	– Date Started	15 May 2000
	– Date Completed	26 May 2000
2.	Loan Negotiations	
	– Date Started	23 October 2000
	– Date Completed	26 October 2000
3.	Date of Board Approval	11 December 2000
4.	Date of Loan Agreement	01 August 01
5.	Date of Loan Effectiveness	
	– In Loan Agreement	30 October 01
	– Actual	30 October 01
	– Number of Extensions	0
6.	Closing Date	
	– In Loan Agreement	30 June 2006
	– Actual	5 September 2007
	– Number of Extensions	1
7.	Terms of Loan	
	– Interest Rate	LIBOR-based (floating)
	– Maturity (number of years)	25
	– Grace Period (number of years)	5
8.	Terms of Relending (if any)	
	– Interest Rate	LIBOR-based
	– Maturity (number of years)	25
	– Grace Period (number of years)	5
	– Second-Step Borrower	Tianjin Sewerage Company and Tianjin Municipal Luanhe Drinking Water Source Protection Engineering Ltd.

LIBOR = London interbank offered rate

9. Disbursements
a. Dates

Initial Disbursement	Final Disbursement	Time Interval
30 October 2001	12 July 2007	69 months
Effective Date	Original Closing Date	Time Interval
30 October 2001	5 September 2007	71 months

b. Amount (\$ million)

Category or Subloan	Original Allocation	Last Revised Allocation	Amount Canceled	Net Amount Available	Amount Disbursed	Undisbursed Balance
01A	3.90	6.03	0.00	6.03	5.89	0.14
01B	20.90	20.90	0.00	20.90	22.90	(2.00)
02A	13.40	17.55	0.00	17.55	17.16	0.39
02B	48.10	69.41	0.00	69.41	65.36	4.05
03	2.40	2.60	0.00	2.60	2.60	0.00
04	0.20	0.00	0.00	0.00	0.00	0.00
05	1.30	1.30	0.00	1.30	1.30	0.00
06	22.30	12.21	0.00	12.21	13.21	(1.00)
07	17.50	0.00	0.00	0.00	0.00	0.00
Total	130.00	130.00	0.00	130.00	128.42	1.58

10. Local Costs (Financed)	
- Amount (\$ million)	204.92
- Percent of Local Costs	100%
- Percent of Total Cost	61%

C. Project Data

1. Project Cost (\$ million)

Cost	Appraisal Estimate	Actual
Foreign Exchange Cost	169.20	132.41
Local Currency Cost	171.50	204.92
Total	340.70	337.33

2. Financing Plan (\$ million)

Cost	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
Implementation Costs						
Borrower Financed	39.20	69.20	108.40	0.00	104.39	104.39
ADB Financed	106.40	0.00	106.40	115.21	0.00	115.21
CDB Co-financed	0.00	87.80	87.80	0.00	87.80	87.80
Total	145.60	157.00	302.60	115.21	192.19	307.40
IDC Costs						
Borrower Financed	0.00	14.50	14.50	4.00	12.73	16.73
ADB Financed	23.60	0.00	23.60	13.20	0.00	13.20
Other External Financing	0.00	0.00	0.00	0.00	0.00	0.00
Total	23.60	14.50	38.10	17.20	12.73	29.93

ADB = Asian Development Bank, IDC = interest during construction.

3. Cost Breakdown by Project Component (\$ million)

Component	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
A. Wastewater Treatment Component (Part A)						
1. Civil Works	3.90	5.90	9.80	5.89	12.38	18.27
2. Equipment and Materials	13.40	0.00	13.40	17.16	0.00	17.16
3. Land	0.00	6.10	6.10	0.00	0.12	0.12
4. Resettlement	0.00	1.30	1.30	0.00	0.22	0.22
5. Project Management, Design, and Training	0.70	3.50	4.20	0.52	7.47	7.99
Subtotal (A)	18.00	16.80	34.80	23.57	20.19	43.76
B. Water Resources Protection Component (Part B)						
1. Civil Works	53.70	80.60	134.30	22.90	121.15	144.05
2. Equipment and Materials	48.10	0.00	48.10	65.36	0.00	65.36
3. Land	0.00	2.20	2.20	0.00	7.57	7.57
4. Resettlement	0.00	18.20	18.20	0.00	25.70	25.70
5. Project Management, Design, Supervision, and Training	1.90	15.00	16.90	2.08	17.58	19.66
Subtotal (B)	103.70	116.00	219.70	90.34	172.00	262.34
C. Contingencies						
1. Physical	12.20	13.30	25.50	0.00	0.00	0.00
2. Price	11.70	10.90	22.60	0.00	0.00	0.00
Subtotal (C)	23.90	24.20	48.10	0.00	0.00	0.00
D. Other Charges						
1. Front-End Fee	1.30	0.00	1.30	1.30	0.00	1.30
2. Interest and Other Charges during Construction	22.30	14.50	36.80	17.20	12.73	29.93
Subtotal (D)	23.60	14.50	38.10	18.50	12.73	31.23
Total	169.20	171.50	340.70	132.41	204.92	337.33

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants		
Part A	October 2001	October 2001
Part B	October 2001	October 2001
Completion of Engineering Designs		
Part A	December 2003	December 2004
Part B	March 2005	December 2005
Civil Works Contract		
Date of Award		
Part A	June 2002	September 2003
Part B	June 2001	May 2002
Completion of Work		
Part A	December 2003	August 2005
Part B	December 2005	June 2007
Equipment and Supplies		
Dates		
First Procurement		
Part A	June 2002	May 2003
Part B	June 2001	January 2002
Last Procurement		
Part A	December 2003	January 2005
Part B	December 2004	March 2006
Completion of Equipment Installation		
Part A	December 2004	November 2005
Part B	June 2005	June 2006
Start of Operations		
Completion of Tests and Commissioning		
Part A	March 2005	March 2006
Part B	September 2005	September 2005
Beginning of Start-Up		
Part A	April 2005	April 2006
Part B	December 2005	January 2007

5. Project Performance Report Ratings

Implementation Period	Ratings	
	Development Objectives	Implementation Progress
From 30 October 2000 to 28 February 2001	Satisfactory	Satisfactory
From 1 March 2001 to 30 June 2001	Satisfactory	Unsatisfactory
From 1 July 2001 to 31 December 2001	Satisfactory	Satisfactory
From 1 January 2002 to 31 December 2002	Satisfactory	Satisfactory
From 1 January 2003 to 31 December 2003	Satisfactory	Satisfactory
From 1 January 2004 to 31 December 2004	Satisfactory	Satisfactory
From 1 January 2005 to 31 December 2005	Satisfactory	Satisfactory
From 1 January 2006 to 31 December 2006	Satisfactory	Satisfactory
From 1 January 2007 to 3 June 2007	Satisfactory	Satisfactory

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members^a
Fact-Finding ^b	12–21 January 2000			
Appraisal ^b	15–26 May 2000			
Inception	28 January– 1 February 2002	2	20	a, h
Review 1	2–11 December 2002	3	33	h, i, j
Review 2	12–23 November 2003	2	16	d, k
Midterm Review	9–18 March 2004	4	38	h, i, j, k
Review 3	25–29 October 2004	5	25	h, j, k, l, m
Review 4	26–30 July 2005	3	12	h, i, j
Environment Safeguard Review by RSES 5	5–9 December 2005	2	8	n, o
Special Review 6	6–12 June 2006	3	18	k, j, m
Review 7	12–19 January 2007	5	25	b, k, j, m
Project Completion Review	6–16 May 2008	5	34	i, j, k, l, m, n

RSES = Environmental and Social Safeguard Division

Notes:

^a a = engineer, b = financial analyst, c = counsel, d = economist, e = procurement consultant or specialist, f = control officer, g = programs officer, h = urban development specialist, i = staff consultant, j = project analyst, k = project officer, l = finance officer, m = resettlement officer, n = environment specialist, o = senior project assistant. .

^b The project files during project processing were not transferred to the People's Republic of China Resident Mission.

I. PROJECT DESCRIPTION

1 The Tianjin Wastewater Treatment and Water Resources Protection Project (the Project) was implemented in Tianjin, People's Republic of China (PRC). Tianjin is PRC's fourth largest city, with a population of 9.6 million, including 5.0 million central urban residents as of 2007. Like many other large PRC cities, Tianjin faced serious environmental problems caused by inadequate wastewater and water resource management facilities. The shortage of potable water and wastewater management constrained the city's development potential. The existing sewage network was overloaded, and less than 50% of wastewater was treated. Most sewage was discharged untreated into the nearest watercourse, polluting the environment and threatening public health. Bohai Bay's water quality was deteriorating, with increasing pollution level that damaged the marine industry and aquaculture. Mounting pollution in the Hai River Basin threatened the city's sole raw water supply, which was transferred from the Luan River via the Yuqiao Reservoir. The Yuqiao Reservoir's water quality did not meet the minimum requirements for a raw water source, i.e., Class III of the PRC's National Environmental Quality Standards for Surface Water (GB3838-2002).

2 The Project's main objectives were to improve the urban environment by reducing environmental contamination through improved wastewater management and protection of the raw water supply quality. The Project also aimed to strengthen the capacity of the raw water supply and wastewater operations by improving operational efficiency through introduction of corporate governance principles and enhanced revenue generation through tariff reform. The Project was anticipated to support poverty reduction by (i) preventing waterborne disease incidence, thus decreasing spending on medical care and sick days and providing more income to households; (ii) safeguarding the quality of drinking water and improving wastewater services; and (iii) providing equal employment opportunities to women. The Project was targeted to benefit 5 million urban Tianjin residents through improved living conditions and public health standards via better wastewater treatment (WWT), collection, and protection of their raw water supply. Appendix 1 shows the project framework at appraisal and its achievements at completion. The chronology of major events is in Appendix 2.

3 The Project's scope had two components:

(i) **Component A.** The Beicang Wastewater Collection and Treatment component, including the construction of the Beicang WWT plant with a 100,000 cubic meters (m³) per day capacity by 2010, expandable in the future to 250,000 m³/day and using an anaerobic/oxic biological treatment process;¹ and

(ii) **Component B.** The Water Resources Protection (WRP) component, encompassing three major elements: (a) reduction of water pollution within the Yuqiao Reservoir; (b) construction of a new closed pressurized box culvert to carry raw water from the Yuqiao Reservoir to the Jiuwangzhuang Gate to avoid pollution of the water from the Zhou River and to reduce water loss; and (3) improvements to the existing open channel from the Jiuwangzhuang Gate to the Dazhangzhuang Pump Station.²

¹ Preferred in PRC, this process uses a combination of anaerobic and oxic conditions to reduce pollutants and phosphorous in wastewater.

² The existing Luan-Tianjin water diversion system was the source of potable water for Tianjin's central urban area and provided raw water to six coastal and suburban water supply systems near the city center. The system stretched 234 kilometers (km) from the Panda Group of reservoirs in Hebei Province to the Xiankai River Waterworks, which distributed raw water to treatment plants in urban Tianjin. The existing raw water system was developed in response to severe water shortages and deteriorating water quality in the Tianjin urban water supply system.

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

4 The Government's policy addressed and supported issues related to clean water supply, WWT, and pollution control through policy reform, increased investment, and improved urban infrastructure management. The Government's strategy focused on (i) developing water sources; (ii) protecting existing water sources by controlling pollution; (iii) controlling overextraction from groundwater resources; (iv) managing water resources based on river basin capacity, environmental protection, and balanced socioeconomic growth; (v) increasing WWT; (vi) introducing water-efficient technologies and management; and (vii) using proper water and wastewater tariff mechanisms. From the Ninth Five-Year Plan to Eleventh Five-Year Plan the Government identified urban wastewater and water resources as priority sectors and developed an umbrella environmental program with a target year of 2010. This national program, the Transcentury Green Plan, designated three river basins (Hai, Huai, and Liao) and three lakes (Chao, Dianchi, and Tai) for intense planning and project implementation to alleviate serious environmental problems affecting water quality and the contiguous population. In response to the required actions, the Government developed the Hai River Basin Pollution Prevention and Control Plan³ that designated Tianjin as a priority area requiring urgent intervention in pollution control.

5 The Asian Development Bank's (ADB) strategy for PRC's water supply and WWT at project appraisal and completion supported the Government's efforts to protect the urban environment by improving water quality and WWT. The strategy's aims were to (i) improve efficiency of the water supply and distribution system through investment in physical infrastructure, (ii) promote corporate governance and commercial management, (iii) improve cost recovery by strengthening tariff systems and structures for raw water and treated water, and (iv) ensure water resource conservation and environmental protection. ADB's strategy also supported water supply and wastewater tariff reform and strengthening institutional capacities to implement commercial principles in the water sector.

6 The Project was a response to Tianjin's urgent need for an improved urban environment, water supply, and WWT quality. Thus, the project design and formulation, both at appraisal and completion, were highly relevant to the policies and strategies of the Government and ADB. The detailed construction design for Yuqiao Reservoir pollution control was actually developed after intensive site survey during implementation. Various minor changes to the scope of the Yuqiao Reservoir subcomponent, due to scattered locations in large areas, were generally in line with the original objectives to reduce water pollution through minimizing soil erosion, protecting the reservoir's banks, and improving the sanitation of surrounding villages. The only substantial change made during implementation was the measure to reduce water pollution within the Yuqiao Reservoir through elimination of surrounding fishponds. The Tianjin Municipal Government (TMG) approved the elimination of all fishponds and 24,058 mu⁴ of land improvement (about 1,600 hectares [ha]), rather than elimination of 10,950 mu (730 ha) of fishponds in the reservoir (i.e., inside the dike) as envisaged at appraisal. Because the revised plan increased the number of fishponds to be removed, more people were affected (paras. 11 and 39). ADB, the Executing Agency (EA) and the Implementing Agencies (IAs) then made efforts to resettle the fishpond owners. Difficult negotiations with affected peoples delayed the implementation of this subcomponent, and the Project's completion date had to be extended by

³ Approved in 1999, the basin-wide program comprises more than 600 potential projects, of which the high-priority projects will be implemented under the Transcentury Green Plan.

⁴ "mu" is a unit of area measurement in China, 1 mu equals to 1/15 hecter.

one year. However, 14,551 mu (970 ha) of fishponds inside the dike were removed.⁵ Tianjin Municipal Luanhe Drinking Water Resources Protection Engineering Ltd. (TML) recognized that removing the remaining fishponds (outside of the dike) would be even more difficult. TML confirmed with ADB that the remaining 9,507 mu (634 ha) of fishponds would not be removed, but measures would be taken to minimize adverse impacts and to improve the reservoir's water quality.

7. During the Project implementation, ADB's close monitoring of complex and sensitive resettlement issues was essential to the smooth implementation of fishpond removal. For future projects, this suggests that the scope of land acquisition and resettlement should be carefully identified by considering implementation difficulties and mitigation of project impact to local communities at the design stage. Participation and consultation also played important roles, as timely adjustment of the resettlement policy and approaches based on feedback from affected households enabled the successful fishpond removal.

8. The project design was generally sound. It was formulated through the Project Preparatory Technical Assistance (PPTA)⁶ and included relevant support for project management and implementation through consultants' inputs and local, international, and on-the-job training. However, the PPTA could have foreseen the complexity of the resettlement issues for the Yuqiao Reservoir subcomponent, caused partly by three historical resettlements in the past 50 years: 1960–1967, 1973, and 1979–1982. The total number of affected people in these resettlements was estimated to be around 77,343 persons, or 16,680 households in 168 villages. The PPTA could have designed a detailed social and environmental monitoring system for better and timely monitoring and control of project impacts. The original project objectives and elements did not change throughout the implementation. However, some appropriate and relevant design changes under the Yuqiao Reservoir subcomponent were made in order to minimize adverse social and environmental impacts and to improve pollution control for the city's sole raw drinking water source. Overall, the PPTA's quality was satisfactory.

B. Project Outputs

9. A summary of anticipated outputs at appraisal is listed in para. 3. Apart from a few changes, the outputs were achieved for Component A. Due to some changes in mitigating activities, the Yuqiao Reservoir subcomponent under Component B was extended by 1 year. A brief summary of the outputs achieved and issues faced in each component is provided in paras. 10–11.

10. **Component A.** Implementation of this component was satisfactory. Civil works for the Beicang WWT plant were completed, and installation of equipment began in December 2004 and was completed by December 2005. Despite a delay due to problems with land acquisition, construction of one pump station with a drainage capacity of 1.0 m³/second (4 pump stations with 0.5m³/sec at appraisal) was completed by the end of October 2005 (originally planned for April 2005), and 15.9 kilometers (km) of sewer mains were installed by August 2005 (originally planned for April 2005). The 0.8 km effluent main was completed in April 2004. The entire component was completed by December 2005, as scheduled at appraisal and commissioned in March 2006. However, the Beicang WWT plant is not yet in full operation due to a delay in

⁵ The original 730 ha in the report and recommendation of the President was based on a preliminary survey at appraisal. The actual fishponds inside the dike measured 970 ha after the detailed measurement survey.

⁶ TA 3216-PRC: *Tianjin Wastewater Treatment and Water Protection Project* for \$800,000 was approved on 2 July 1999.

sewer system construction, which is being implemented under an ongoing World Bank-financed project.⁷ The plant's current treatment volume was approximately 30% of its designed capacity, but once the sewer system is installed, the plant is expected to run on full capacity.

11. **Component B.** Implementation of this component has been satisfactory. Civil works for the 34.1 km box culvert were completed in December 2004, as scheduled at appraisal. Test operation was undertaken on 29 July 2005, and full operation started in October 2005. The entire 64 km lining work for the open channel was completed in September 2004. Construction of a buffer strip and fences to protect the open channel was completed in December 2004, as originally scheduled. Additional work comprising a pump station (20 m³/second capacity) and an additional 10 km of slope protection for the open channel was completed by June 2007. The management information system was completed by June 2007. The original planned measure for the Yuqiao Reservoir subcomponent at appraisal was revised and approved by TMG in November 2004. More specific measures were designed to reduce water pollution through minimizing soil erosion and water loss, protecting the reservoir's banks, and improving the sanitation of surrounding villages. By 30 June 2007, the following works were completed for the Yuqiao Reservoir subcomponent: (i) 27,442 toilets in villages were improved; (ii) poplar and willow trees were planted on 27,700 mu of land; (iii) 351 check dams were constructed; and (iv) 89 km of village road repair work was completed. One pilot hospital WWT facility and one manual composting plant were also built, and 970 ha of fishponds inside the dike were removed. Details are provided in Appendix 3.

C. Project Costs and Financing Plan

12. The project cost at appraisal was estimated at \$340.7 million equivalent, comprising \$169.2 million in foreign exchange costs (49%) and \$171.5 million in local currency (51%). The Government requested a loan of \$130.0 million equivalent from ADB to cover 38% of total or 77% of the Project's foreign exchange cost. The original pool-based loan was transformed into a London interbank offered rate (LIBOR)-based loan at TMG's request, and the Restated Loan Agreement was signed on 15 July 2002. The actual project cost was \$337.3 million, lower than the appraisal estimate. The actual foreign exchange cost decreased to \$132.4 million, while the actual local cost increased to \$204.9 million equivalent. The reduction in foreign cost was generated from (i) lower interest payments and other charges due to the switch from ADB's pool-based loan to a LIBOR-based loan, and (ii) lower actual prices for some contracts as a result of competitive bidding. The increase in local cost was largely due to more local materials used and increased labor costs. The project cost is in Appendix 4.

13. ADB financed the \$128.4 million foreign cost, approximately 99% of loan proceeds. A loan savings in amount of \$1.6 million, due to lower interest payments and charges as a result of the switch to LIBOR-based lending, was identified and canceled upon TMG's request. TMG financed the \$204.9 million local cost and \$4.0 million for interest and other charges during construction through equity contribution and water and wastewater tariffs, and the \$87.8 million local cost was financed through a China Development Bank loan.⁸ It is confirmed that in accordance with the loan covenant, sufficient water and wastewater tariffs collected by the Tianjin Water Supply Company were remitted to TML and Tianjin Sewerage Company (TSC) for construction and operation activities. The counterpart funds were adequate and provided in a

⁷ The Tianjin Urban Construction Project (Second Phase) included two WWT plants, urban roads, sewers, and a drainage system, with the total loan in the amount of \$150 million. The project became effective on 8 October 2003 and is expected to close in 2010. Part of sewers under this World Bank-financed project will directly serve the Beicang WWT plant.

⁸ The China Development Bank loan carries an interest rate of 5.76% over 15 years with a grace period of 5 years.

timely manner. Two requests for reallocation of loan proceeds were approved on 15 June 2004 and 13 April 2007 to adjust civil works and equipment costs. The reallocations and minor changes in the financing plan did not affect the Project's scope and implementation arrangements. The financing plan is in Appendix 5.

D. Disbursements

14. Loan proceeds were withdrawn in accordance with ADB's standard disbursement procedures. Disbursements were slow at the early stage of implementation, but improved from 2003 following major contract awards in 2003 and 2004. By 30 September 2007, \$128.4 million (or 99% of loan funds) was disbursed, and a loan savings in amount of \$1.6 million was canceled at the loan's closing date. An imprest account was established after loan effectiveness to facilitate disbursements on small and eligible expenditures. Due to the large amount of procurement contracts for equipment and material, all disbursement was done through reimbursement procedures and direct payments and commitment procedures; therefore, the imprest account was not utilized. Actual contract awards and disbursement are in Appendix 6.

E. Project Schedule

15. The Loan was approved on 11 December 2000, signed on 1 August 2001, and became effective on 30 October 2001, 8 months later than expected at appraisal. The delay did not affect project implementation, because the project management office (PMO) took advantage of advance procurement for consultant recruitment actions and began preconstruction activities before the effectiveness. The original closing date, as envisaged at appraisal, was 30 June 2006, but it was extended by 1 year. The main reasons for the extension were (i) the difficulties in implementing the revised Yuqiao Reservoir subcomponent (as discussed in paras. 6 and 40), and (ii) the need to rebid the management information system contract due to the original contractor's bankruptcy. The schedule envisaged at appraisal and actual implementation schedule are compared in Appendix 7.

F. Implementation Arrangements

16. TMG was the EA, responsible for overall project supervision and coordination. TMG established a project leading group, headed by the deputy executive mayor of Tianjin City, to provide guidance to the Project. The PMO was established under the group's direction to administer all matters related to project implementation and to coordinate the activities of the two IAs. The PMO was composed of the project director, three full-time professional staff members, and other support personnel. The IAs were responsible for day-to-day activities; the IA for Component A was TSC, and TML was responsible for implementation of Component B. Each IA set up project implementation units, headed by general managers and composed of core working groups responsible for project construction management and operations finance, engineering, resettlement, environmental monitoring, and public awareness. The project organization chart at project completion is in Appendix 8. The IAs were supported by experienced international and national consultants and received training on various aspects of project administration, social and environmental monitoring, financial management, and cost recovery.

17. During project implementation, TMG proposed that Tianjin Capital Environmental Protection Co. Ltd. (TCEPC)⁹ partially invest in the Beicang WWT plant as a substitute for the local funds originally provided by TMG. In June 2002, the PMO, acting on behalf of TMG, informally advised ADB that the role of IA for the Beicang WWT plant be transferred from TSC to TCEPC. In early November 2003, ADB responded that the proposed transfer was not allowed since it was against the terms of the loan. ADB further indicated that ownership transfer, post-completion of the WWT plant, was possible. During discussions among ADB, TCEPC, PMO, and TSC, it was agreed that a project implementation unit would be formed within TSC as specified in the Loan and Project Agreements. By the end of 2007, the WWT plant was only 30% operational due to the sewer system construction delay, resulting in lower efficiency and higher operation costs. TMG subsidized the wastewater tariff for the plant by CNY1.95/m³ to ensure its operation until sewer system completion in 2010. TSC was still the IA, and there was no change in implementation arrangements. Any further arrangement will only be implemented when the WWT plant is in full operation.

18. Implementation arrangements were generally satisfactory and worked as envisioned at appraisal. The IAs' capacity was strengthened through domestic and international trainings on water resource protection and WWT and control, government policies, financial management, and project administration aspects. TML and TSC retained domestic institutes and companies for detailed engineering design and construction supervision. The output was satisfactory, and both TML and TSC carried out quality control of construction satisfactorily.

G. Conditions and Covenants

19. The loan's effectiveness was conditional on signing Onlending Agreements between TMG and the two IAs. The Relending Agreement between the Ministry of Finance and TMG was signed on 13 September 2001. The Onlending Agreements between TMG and the two IAs were signed on 12 October 2001. The Loan became effective on 30 October 2001, 8 months later than expected at appraisal. Loan disbursement for Component B was conditional on the cofinancing agreement between TML and China Development Bank, which was signed on 31 July 2001.

20. All major loan covenants concerning implementation arrangements, reporting, environmental protection, resettlement, sector institutional reforms, and water and wastewater tariff increases have been complied with or are being complied with. No loan covenant was modified, suspended, or waived. Reporting arrangements of TMG and the two IAs were adequate. All required monitoring and evaluation reports, including audited project accounts and audited financial statements, were submitted on time and in good quality. The framework contract conclusion covenant was generally complied with. The performance contract between TMG and TML was submitted to ADB in September 2004. The draft performance contract between TMG and TSC was prepared in December 2005 but has not yet been signed due to the Beicang WWT plant's lower efficiency resulting from the delayed sewer system construction. The PMO confirmed that the performance contract between TMG and TSC could be signed in 2010, when the sewer system is to be completed.

⁹ A stock-listed state-owned enterprise, TCEPC's principal activities are designing, managing, operating, and providing technological consultations to the Dongjiao sewage water treatment plant and the Jizhuangzi sewage water treatment plant in Tianjin. Other activities include infrastructure facility and auxiliary services, design, toll collection, repair and maintenance, and management. TCEPC is also involved in the technological consultation of toll roads and auxiliary services in relation to the operation of the Southeastern Half Ring Road of Tianjin's Middle Ring and development and operation of environmental protection technology and products.

21. The Project assisted in strengthening institutional capacity of the EA and IAs. At completion, enterprise restructuring progress was still limited and reform was continuing. Operations and financial management procedures to transform TML and TSC to financially and operationally independent and self-sustained entities need stronger commitment and further strengthening. The status of compliance with loan covenants is presented in Appendix 9.

H. Consultant Recruitment and Procurement

22. Following local competitive recruitment procedures, TSC and TML retained domestic design institutes and construction companies to supervise engineering and construction, which was financed by the local counterpart fund. Halcrow, International consultants were selected and engaged based on technical and financial selection criteria in accordance with *Guidelines on the Use of Consultants* (2007, as amended from time to time). The international consulting firm commenced its work in November 2001.¹⁰ Sixty-five person-months of international and 130 person-months of national consultants, as detailed at appraisal, were used to assist the PMO with project management and supervision. The consultants also provided the IAs with necessary capacity-building training and advice on institutional reform, financial management, tariff reform, environment control, and monitoring and evaluation.

23. ADB-financed equipment and materials were procured through international competitive bidding and international shopping in accordance with *Guidelines for Procurement* (2007, as amended from time to time). Civil works were procured through national competitive bidding procedures acceptable to ADB and by following local tendering and bidding laws. Procurement of \$18.3 million of civil works packages and \$17.2 million of equipment and material packages for Component A, and \$144.1 million of civil works packages and \$65.4 million of equipment and material packages for Component B were executed. TSC and TML engaged the services of CMC International Tendering Corporation for international competitive bidding procurement, and Tianjin Puze Engineering Consultants Company Limited and Tianjin Jinheng Engineering Tendering Company Limited for national competitive bidding procurement. No major problems with procurement were encountered. ADB financed 40% and 16% of the national competitive bidding civil works packages for Components A and B, respectively, and 100% of the equipment and materials packages for both components, as envisaged at appraisal. An update on the status of procurement is in Appendix 10.

24. As a result of the changes in the scope of the Yuqiao Reservoir subcomponent, drawings, bidding documents, and cost estimates had to be adjusted. Revision work was completed in September 2005. In addition, contract packages on the management information system had to be retendered due to the original contractor's bankruptcy, resulting in the delay of other contracts' execution. Due to the need for additional time to finish these contracts, as well as the delay for fishpond removal, the project completion date was extended by 1 year.

I. Performance of Consultants, Contractors, and Suppliers

25. The overall performance of consultants, contractors, and suppliers was generally satisfactory. The consultants provided necessary project management advice and training to the PMO and IAs in accordance with their terms of reference. The consultants also assisted the PMO and IAs in preparing regular monitoring reports on project progress, environment, and resettlement for submission to ADB, and advised on institutional reform and the proposed institutional arrangement changes to both IAs. However, the consultants could have established

¹⁰ The consultants' recruitment process started before loan effectiveness due to the Advance Recruitment Action (ARA) approved by ADB.

closer working relationships with TMG for better coordination and timely rectification of problems during the implementation period. The financial and institutional training could have also been conducted more effectively and efficiently. Civil works constructed by domestic contractors were completed satisfactorily and in accordance with contract specifications and quality requirements. The performance of suppliers of construction materials was satisfactory and on schedule.

J. Performance of the Borrower and the Executing Agency

26. The performance of the Borrower, the EA, and both IAs was satisfactory; they met their responsibilities and obligations during project implementation. The construction schedule, quality, and cost were well controlled. Although the complex resettlement issues under the Yuqiao Reservoir subcomponent delayed the project by 1 year, TML accomplished all works under Component B. TMG, through its PMO, provided full support throughout the project implementation period. PMO staff members made regular site visits to ensure timely implementation of project activities. Both TSC and TML had adequate experienced staff members and were capable of managing project implementation efficiently. The coordination between both IAs and PMO was close and effective. Provision of counterpart funds was adequate and timely.

K. Performance of ADB

27. The overall performance of ADB in managing and administering the Project was satisfactory. ADB's monitoring comprised eight missions,¹¹ including 229 staff days, and was considered adequate. The Project was delegated to the People's Republic of China Resident Mission (PRCM) for administration in the first quarter of 2004. Transfer to PRCM improved communication between ADB and the EA and ensured quick and efficient resolution of pending issues related to the implementation. The Midterm Review Mission conducted by PRCM in March 2004 was highly effective, providing clear guidance and action plans for resolving key issues on financial management, environmental and resettlement monitoring, benefit monitoring, and reporting. Overall, ADB worked with the Government and the EA to overcome disruptions caused by land acquisition and resettlement problems, which is attributed to close monitoring of project implementation and anticipation of potential risk. ADB was flexible and agreed to several minor changes to facilitate better implementation. At the beginning of project activities, the PRCM provided well-tailored training programs on ADB's disbursement procedures to 26 officers from concerned agencies. The training was adequate and timely.

28. However, ADB could have given more attention to the long-term historical resettlement issues in the Yuqiao Reservoir area during the PPTA and appraisal to ensure effective mitigation actions were in place at the earliest stages. Also, ADB could have provided better and more timely assistance and advice on environmental and social monitoring and reporting to ensure all procedures were in accordance with the requirements and public consultation and after proper awareness campaigns.

III. EVALUATION OF PERFORMANCE

A. Relevance

29. The Project was highly relevant in meeting the immediate and long-term objectives of the Government and ADB's country strategy. The Project was developed as an integral part of

¹¹ The missions included Inception, Mid-term Review, Environmental Safeguard Review, and five reviews.

the Government's program to alleviate serious environmental problems affecting water quality and the contiguous population. The Project was formulated in close consultation and collaboration with the local government, development partners, and communities. The Project's objectives remained unchanged throughout implementation, particularly in the context of improved wastewater management, good quality water resources development, and institutional capacity building. Key elements of the Government's policy and ADB's strategy that are still in force include improvement in the security and efficiency of water supply, promotion of corporate governance and commercial management, and improvement of cost recovery mechanisms. The changes made during the implementation enhanced the Project's relevance. The Project is rated as highly relevant.

B. Effectiveness in Achieving Outcomes

30. The Project was formulated to improve the urban environment, water supply, and water treatment quality. The Project also supported the Government's economic and enterprise reform programs by assisting in implementation of tariff and institutional reforms for Tianjin's wastewater sector. Component A improved the urban environment through better collection and increase of WWT capacity in Tianjin (full capacity of 100,000 m³/day will be reached by 2010 and could be expanded to 250,000 m³/day in the future). Component B enhanced reliability of Tianjin's water supply and improved the quality of its raw water. Improvement of toilets in the villages, forestation, and enhancement of reservoir's banks, reduced water pollution through minimizing soil erosion and protecting the Yuqiao Reservoir's banks and improved the sanitation of surrounding villages. Further activities regarding improving water pollution control and environmental monitoring and strengthening solid waste management and WWT in the Yuqiao Reservoir area enhanced the quality and reliability of water supplied to Tianjin. Consumed and recycled water tariffs set at CNY1.0/m³ and CNY0.3/m³ in 2005 met targets for 2005 as stipulated in the Loan Agreement. Up to 2007, consumed and recycled water tariffs were set at CNY1.03/m³ and CNY0.3/m³, and tariffs are sufficient to cover the operation and maintenance (O&M) costs. Also, CNY0.8/m³ for residential WWT and CNY1.2/m³ for other users, as set in 2005, met targets stipulated in the Loan Agreement. Up to 2007, wastewater tariffs for residential and other users were set at CNY0.8/m³ and CNY1.2/m³, which could have met full cost recovery had the sewer system been completed. Environmental monitoring of area surrounding the Yuqiao Reservoir was strengthened and stabilized, and the quality of water remains at the required standard of Class III. The Project generally achieved its development objectives of improving living conditions and public health standards for people in Tianjin for the long-term. Based on the analysis, the Project is rated as effective.

C. Efficiency in Achieving Outcome and Outputs

1. Efficiency of Investments

31. The Project's financial internal rates of return (FIRR) and economic internal rates of return (EIRR) were reevaluated based on finalized cost estimates and the financing plan, O&M costs, and tariffs. The FIRRs for both components were 6.0% and 7.7% respectively, lower than FIRRs of 10.7% and 14.5% estimated at appraisal. The lower FIRR for Component A was due to (i) the delay in the sewer system construction; (ii) the uncertainty in the tariff to be set in the franchise concessional arrangement, which was supposed to be finalized upon full operation of the WWT plant; and (iii) the relatively high level of operating costs for the Beicang WWT plant. However, the FIRR for Component A is still higher than the weighted average cost of capital (WACC), which is recalculated to be 2.98%. The lower FIRR for Component B is mainly due to the much lower actual consumption of water and recycled water in the past few years than

appraisal estimates and the higher additional O&M costs, which were almost 100% higher than the appraisal estimates. The WACC for Component B is recalculated to be 2.45%. The financial viability of this component is also confirmed, as the recalculated FIRR is higher than the WACC. Appendix 11 analyzes the financial evaluation in detail. The Project is rated financially efficient.

32. The EIRRs for both components were 16.2% and 18.3% respectively, which are higher than the EIRRs of 15.2% and 14.7% estimated at appraisal. Both exceeded the economic opportunity cost of capital of 12%, indicating the Project's economic viability. Detailed analysis and calculation of the EIRRs are presented in Appendix 12. Further strengthening of financial management and monitoring capacity of TSC and TML is crucial to ensuring their transition from IAs to operating entities with sustainable operational and financial capabilities. The Project is rated economically efficient.

2. Efficiency of Process

33. ADB's internal processing and support during implementation were efficient and satisfactory. The organization and management of the EA and two IAs were effective and timely. However, better coordination among the EA, IAs, and consultants, and greater scale of public consultations both at the beginning of and during implementation, could have increased the Project's efficiency. Based on the analysis, the Project is rated as efficient.

D. Preliminary Assessment of Sustainability

34. The project facilities were constructed in accordance with the required standards and specifications. They are considered to be of sufficient quality to ensure the continuous achievements of the Project's benefits over the long term. The Government committed to pursuing institutional and tariff reforms for Tianjin's water and wastewater sector to transform enterprises into independent self-financed entities. TMG approved an arrangement for TML to collect water tariffs from the water supply company, which will help to improve its operational revenue and enhance its financial creditability. The reforms are supported by international development agencies like ADB and World Bank. Sustainability will be enhanced by the presence of a professional management team and skilled work force supported by ongoing training.

35. The technology adopted for the WWT facilities is technically and commercially sound, and trained personnel are in place to handle operational and technical problems. Demand for the Project's services is increasing. It is recognized that the Beicang WWT plant is not in full operation because of the sewer system construction delay, but TMG is taking strong measures to expedite the implementation of its construction. The required system is expected to be completed by 2010, when the plant will be fully operational. Meanwhile, strong commitment for enterprise reform has been made to ensure successful application of corporate governance elements in the sector. Further strengthening of organizational, operational, and financial capacities of TSC and TML is vital for the sustainability of operations to meet the Project's long-term objectives. Based on the analysis, the Project's sustainability is rated as likely.

E. Impact

1. Environmental Impacts

36. As envisaged at appraisal, both components of the Project produced positive environmental impacts and benefit. The Project ensured reliable supply of good quality water to Tianjin and contributed to the Hai River Basin's water pollution control program. With the

construction of the Beicang WWT plant, nutrients loading especially phosphorus was decreased, positively affecting public health. However, the plant still needs sustainable sludge solutions to mitigate potential environmental pollution. Environmental impact mitigation works planned for the Yuqiao Reservoir subcomponent was completed by 30 June 2007 (see para. 11). In addition, relevant improvement measures will be implemented and continuously monitored after project completion to ensure that water quality maintains the required standards.

37. There was minimum adverse environmental impact during the construction period of both components. Monitoring and control during construction was adequate and in accordance with the environmental monitoring program prepared and approved in advance. Appendix 13 includes a summary environmental impact assessment.

2. Resettlement

38. The land acquisition and resettlement activities under Component A and the box culvert and open channel subcomponents of Component B were completed, which included: (i) under Component A, 425 mu of land permanently acquired a 3% increase over the 411 mu in the revised resettlement plan and 990 square meters (m²) of buildings demolished; (ii) under Component B's box culvert, 1,147 mu of land permanently acquired 107% of the area in the revised resettlement plan¹² and 10,889 m² of buildings demolished, which was 70% of the area in the revised resettlement plan due to the change in the culvert's alignment; and (iii) under Component B's open channel, 361 mu of land permanently acquired, which was 48% of the area in the revised resettlement plan, due to a technical design revision resulting in a narrow buffer zone.

39. Land acquisition and resettlement activities for the Yuqiao Reservoir subcomponent commenced in late 2006. By 30 June 2007, a total of 14,551 mu of fishponds (970 ha) inside the Wangguofan Dike were eliminated, accounting for 60% of the scope in the Yuqiao Reservoir Resettlement and Alternative Livelihood Plan (YRRALP)¹³, which was approved by ADB. The fishponds outside the Wangguofan Dike have not been removed. Considering the livelihood of local people and that the current water quality has met the quality requirements, TMG and the Ji County government decided to enhance management of fishponds outside of the Wangguofan Dike rather than to remove them. As a result, adverse social impacts to these affected people due to fishpond removal was largely mitigated. There were few issues concerning delay of compensation payment to affected people by village collectives, to which the Project paid the compensation; continuity of livelihood restoration for affected people; and remedial works to be undertaken by the Government. TMG committed to ensuring the successful completion of resettlement under the Project and to monitoring the livelihood restoration status of affected people.

40. The total actual resettlement cost of the Project, including Component A and Component B, is CNY144.9 million, which accounts for 94% of CNY154.1 million estimated in the revised resettlement plans and YRRALP. The resettlement monitoring reports were submitted in accordance with the loan covenants. The PMO and TML confirmed that they will continue to monitor the livelihood restoration of affected peoples in the Yuqiao Reservoir area and to submit

¹² The first resettlement plan for Component A and Component B was finished in April 2000, which was approved by ADB in May 2000. The data were sourced from the Project Feasibility Research Report and the PPTA's house demolition survey. With the technical design change in the Project's preliminary design report, the revised resettlement plans were submitted in October 2002 and March 2002.

¹³ TMG approved the technical design change in the Yuqiao Reservoir subcomponent in September 2004. After several reviews, ADB mobilized a staff consultant in 2006 to assist the PMO and TML in preparing the YRRALP, and the final version was approved in February 2007.

the report to ADB even after completion of the Project. Appendix 14 includes a summary resettlement impact assessment.

3. Social Impacts

41. The Project generated positive social impacts by improving the environment of surrounding area, protecting raw water supply and quality, and bettering WWT and collection in Tianjin. More than 5 million urban residents of Tianjin directly benefited from the Project. In the longer-term, the Project will help to improve living standards by preventing increases in the incidence of waterborne diseases, thus reducing medical care spending; (ii) safeguarding the quality of drinking water and improvements in the water service sector; and (iii) improving hygiene standards and health. To mitigate the possible adverse impact partly due to increased water and wastewater tariffs to those under the poverty line, TMG raised the urban poverty line twice in 2006 and 2007.¹⁴ The annual budget for the urban poor had been changed from CNY81.4 million in 2001 to CNY355 million in 2007, a 30% annual increase. Consequently, the amount of urban poor households was reduced from 7,000 in 2001 to 5,756 in 2007. In addition, the Project did not encounter any indigenous people issues during implementation.

42. The Project provided jobs for local people during construction and operation. The Beicang WWT plant hired 23 permanent staff members, 16 of whom were from the local area. Component B's box culvert, open channel, and Yuqiao Reservoir subcomponents temporarily employed 630,000, 160,000, and 55,000 person-days, respectively, for the construction. These unskilled labors were paid the daily wage of CNY20–50. The Project also promoted equal opportunities of employment for women. TSC and TML have 25 and 20 female employees who represent about 45% and 40% of their workforce, respectively. Appendix 15 includes a social impact and poverty reduction assessment in the project area.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

43. The Project and associated PPTA are highly relevant to the Government's developing strategy and ADB's sector policy in the PRC. It was effective in achieving its purpose and objectives and was efficient in the implementation process. The resettlement process was largely successful. Environmental impacts were positive, and all necessary mitigation measures were taken. Social impacts were positive and will increase in the future. Institutional developments were moderate and need more attention from the Government for further improvement. Changes in the institutional and operational structures were less than expected to enable the IAs to run independent and self-financing operations.

44. The project facilities were essentially built as planned at appraisal. The completed facilities were of good quality and well maintained and operated. O&M funding is sufficient. Water and wastewater tariffs have been increased to cover O&M costs and the debt repayment requirement. TSC will be more commercially operational than before when the sewer system is completed. The financial and economic viabilities for both TML and TSC have been confirmed, with tariff revenue to cover O&M costs, depreciation, and debt services. The recalculated FIRR (7.7% for TML, 6% for TSC) and EIRRs (18.3% for TML, 16.2% for TSC) confirmed the Project's financial and economic viability.

¹⁴ In 2006, Tianjin's urban poverty line was CNY265/month; it was increased to CNY300/month after 1 July 2006. In 2007, the urban poverty line was raised to CNY330/month.

45. Overall, the Project is rated successful. It is highly relevant, efficacious, efficient, and is likely to be sustainable, with positive environmental and social impacts and moderate impact on institutional arrangement. Most of anticipated outputs were achieved while the budget was well controlled. To address the remaining issues concerning sewer and livelihood restoration for the Yuqiao Reservoir subcomponent, TMG pledged that it will continue to monitor performance indicators concerning the Beicang WWT plant's sewage collection and affected peoples' income restoration in the Yuqiao Reservoir area and to submit monitoring and evaluation reports even after completion of the Project.

B. Lessons Learned

46. **Sewer Construction.** For TSC, it is recognized that building a fully functioning sewer system should have been adequately addressed during the Beicang WWT plant's planning stage and implementation period. The construction delay had a negative impact on the Project. There is a need to enhance overall coordination of project implementation among government agencies to improve the effectiveness and efficiency of project investment.

47. **Sludge Treatment and Sound Solution.** Given that proper handling of sludge has already been a broad issue for most WWT plants operating in the PRC since traditional landfill options have encountered more and more difficulties, the Government and WWT plants must work out alternative solutions for sludge treatment. The sludge solution at appraisal may need to be substituted by more sustainable methodology.

48. **Land Acquisition and Resettlement.** PRCM's close monitoring and strict following of ADB's resettlement policy ensured smooth implementation of resettlement and fishpond removal under the Project. The Project set-up is a good example of how to handle complex historical resettlement issues, which were essentially the key to the Project's success. Future projects must attempt to resolve such issues at appraisal or an early stage to minimize land acquisition and resettlement challenges during implementation, which may result to delays in project implementation.

49. **Training.** Comprehensive training on ADB's procedures and guidelines and project administration to project management staff members, provided at the beginning of and during project implementation, improved project performance. The well-controlled budget and project cost attributed to TMG and the IAs strictly followed ADB's procurement guidelines and project management procedures.

50. **Delegating the Project to PRCM.** The Project was delegated to PRCM in the first quarter of 2004, enabling more efficient communications between the EA and ADB. The EA appreciated that good communications and efficient links among the PMO, IAs, and ADB facilitated smooth project implementation.

C. Recommendations

51. Project-related and general recommendations are identified as follows:

1. Project-Related

52. **Future Monitoring.** Due to delay in connecting sewer lines under the World Bank project, the collection ratio of sewerage has been only 30%, which resulted in low operational efficiency of the completed Beicang WWT plant. ADB must be informed of the sewers' progress

and WWT plant's operational status under the Project even after completion. In addition, TMG must ensure that sludge from the plant is integrated into Tianjin's overall sludge treatment program. ADB will closely monitor and coordinate with TMG and the IAs to ensure final achievement of project objectives.

53. **Covenants.** Financial covenants on tariff reform and current ratio status should be monitored closely by TMG and reported to ADB on an annual basis for 5 years after project completion. ADB should follow up the status during its project performance audit report.

54. **Enterprise Reform.** TMG should continuously work on improvement of both TML and TSC restructuring and enterprise reform to ensure their financial independency when project facilities are in full operation. TMG should also further explore possibilities for private participation in the operating facilities to enhance market-oriented mechanisms for operation.

55. **Additional Assistance.** Technical assistance to support the Government's efforts in enterprise restructuring and introducing elements of corporate governance in the economy as a whole could be considered by ADB.

56. **Timing of the Project Performance Evaluation Report.** The project performance evaluation review could be undertaken by ADB in 2010. By that time, follow-up monitoring reports would be developed and the full benefit impact could be assessed particularly for Component A.

2. General

57. For project appraisal, recommendations include:

- (i) The design of further WWT projects should give adequate attention to accessory sewers and sound solutions for sludge treatment. Sewer and sludge facility costs and operation costs should be taken into account for technical and financial appraisal. Sludge management, treatment, and disposal solutions should be carefully reviewed, and to the maximum possible extent, secured when considering new WWT plant projects.
- (ii) A project performance monitoring and evaluation framework should be prepared before loan negotiation. More guidance should be provided to the PMO and IAs in developing meaningful and measurable performance indicators, particularly on economic and social aspects, and viable monitoring methodologies and budget supports.
- (iii) All historical preconditions of a project should be carefully assessed, particularly concerning resettlement, which might affect project performance during the implementation stage.

58. For project implementation, recommendations include:

- (i) WWT companies and water supply utilities should strengthen market-oriented mechanisms and improve plants' financial management. The Government should encourage these companies to become more autonomous, particularly in financial management and institutional reform, to cope with adverse economic situations, such as high inflation and fluctuations in foreign exchange rates.

Municipal governments should be encouraged to take on regulatory roles instead of controlling the budget and finances of wastewater and water companies. Further commercialization of operations, including cost accounting policies and assets and fund management, is required.

- (ii) The PMO should ensure that proper training on project administration is provided continuously to all parties engaged in implementation through a project. The contents of the training should also focus on financial management, institutional development, social impact assessment, and a project performance management system and its application.
- (iii) The PMO should timely and systematically review and assist in project impact and benefit monitoring, and develop well-tracked filing systems and databases, which will be necessary for project evaluation and future investment.

PROJECT FRAMEWORK

Design Summary	Performance Indicators & Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
A. Sector Goal Improve urban environmental conditions in Tianjin City	Elimination of pollution threat to raw water supply, implementation of comprehensive wastewater management strategy	1 billion per year capacity for clean raw water supply by Yuqiao Reservoir, 1.49 million ton of WWT capacity, 4 completed WWT plants	Environmental monitoring data	<ul style="list-style-type: none"> Hai River Pollution Prevention and Control Plan is implemented by upstream governments. Water quality improvements are effective. Public awareness and education programs are implemented successfully. Political support exists for reform process.
Improve public health in Tianjin City	Reduced incidence of waterborne diseases by 2010, no incidence of disease attributable to poor drinking water quality	Raw water remained good quality in accordance with national standards; cholera and hepatitis decreased by 40% and 64% from 2001 to 2007, respectively	Socioeconomic surveys, public health statistics	
Promote improved urban environment and amenities for business, tourism, and recreation	Increase in public satisfaction with urban environment	Public satisfaction with urban environment increased	Socioeconomic surveys, visual surveys	
Achieve institutional development of utilities	Self-sustaining management, operation, and financing by January 2006	TML achieved by December 2005, TSC is to be achieved by end 2010	Audited financial statements	
B. Project Objectives Provide reliable, high quality raw water supply and wastewater services to meet Beicang demand at affordable prices	Raw water quality improved to Class III by January 2006	Achieved Class III by 2005	Project completion report, water quality monitoring program	<ul style="list-style-type: none"> Input water of quality is maintained. Adequate source of water volume exists. Adequate political support for tariff reform process occurs. Demand estimate for sewage flows is correct. Sewer networks do by world bank Sufficient connections are installed.
	Reliable yield of one billion m ³ /year (75% guarantee) by January 2006	Achieved by 2005	Flow measurement	
	Average raw water cost to customers not less than CNY0.75/m ³ for water consumed and CNY0.25/m ³ for recycled water by January 2005 (constant 2000 prices)	CNY1.03/m ³ for raw water and CNY0.3/m ³ for recycled water by 2007	Project and tariff reviews	
	95% of urban wastewater in Beicang is collected by January 2005	50–60% is to be expected by end of 2008, 100% by 2010	TSC management information system and World Bank Report	
	Average wastewater charge to customers not less than CNY1.06/m ³ by January 2005 (constant 2000 prices)	CNY1.10/m ³ by 2005 and CNY 1.20/m ³ by 1 March 2007	Project and tariff reviews	
	95% of urban wastewater in Beicang is treated by January 2006	30% by 2007, 50–60% is expected by end of 2008, 100% by 2010	TSC management information system	

Design Summary	Performance Indicators & Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
Reduce pollution in Tianjin Municipality and Bohai Bay	<p>100% of water bodies meeting target by December 2005</p> <p>Incidents of illegal effluent use reduced Increase in public perception of satisfaction with the urban environment by 2006</p> <p>1 billion m³/year of raw water supply protected from pollution and water losses by December 2005 Reduction in water losses from 4% to 2% by December 2005 Increase in transfer scheme availability from 10 to 12 months per year by January 2006</p>	<p>100% of water body in Yuqiao Reservoir met target by December 2007</p> <p>No incidents occurred</p> <p>Public satisfaction with the urban environment was increased by 2006</p> <p>500 million averagely supplied from 2005–2007 attributing to reduced water consumption Reduction in water losses to 1% by December 2005</p> <p>12 months available since January 2006</p>	<p>Water quality monitoring program</p> <p>Number of prosecutions Socioeconomic survey, visual perception survey</p> <p>Flow monitoring, including Xia waterworks</p> <p>Records of operational use</p> <p>Records of operational use</p>	<ul style="list-style-type: none"> Improved water quality management by TMG is effective and sustained Upstream pollution prevention and control is adequately addressed. Public awareness and education programs are implemented successfully. Continued unauthorized usage is addressed.
C. Outputs WWT component	<p>Beicang WWT plant completed with 100,000 m³/day added by December 2005 Sewerage collection and conveyance capacity of 100,000 m³/day by December 2005</p> <p>Effective operating regime introduced: (i) compliance with sewer discharge standards by January 2006, (ii) WWT plant effluent discharge compliance by January 2006, and (iii) sludge disposed of in accordance with legal requirements by January 2006</p> <p>TSC enterprise reform completed by January 2006,</p>	<p>WWT plant construction with 100,000 m³/day capacity completed by the end of 2005 In total, 15.9 km of sewers completed under the Project. The sewer system construction under the World Bank loan was delayed, which affected the collection and conveyance of wastewater to the WWT plant. Efficiency was compromised due to delay of sewer construction: (i) only industrial water was collected and treated, (ii) the discharge is not stable due to overloaded effluent, and (iii) sustainable sludge solution is under study</p> <p>TSC enterprise reform completed by January</p>	<p>Project implementation plan and reviews</p> <p>Discharge monitoring program, sludge disposal monitoring program</p> <p>Performance contracts, audited</p>	<ul style="list-style-type: none"> Source water volume is adequate. Input water quality is maintained. Industries implement adequate pretreatment. Enforcement powers and procedures are effective. Changes in disposal regulations occur. Government supports

Design Summary	Performance Indicators & Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
WRP component	(i) full management and financial autonomy by December 2002, and (ii) self-financed WWT services by January 2006	2006, (i) full management and financial autonomy is expected by 2010, and (ii) self-financed WWT services are expected by January 2010	financial statements	institutional reform. <ul style="list-style-type: none"> Government and public accept and support tariff increases. Tariff increases are affordable in a positive economic context. Resettlement package acceptable to those affected.
	New Zhou water diversion channel completed by end of 2005, with Zhou River section water losses less than 1% Yuqiao Reservoir works completed by 2004, with sustained Class III water quality	Fully achieved The majority of civil works was completed by the end of 2006 (except for a pump station finished in early 2007). The water quality has remained Class III since 2005. Fully achieved	Project implementation plan and reviews, flow monitoring Water quality monitoring program	<ul style="list-style-type: none"> Enforcement of powers and procedures is effective. Related dam safety program is completed.
	Slope protection and renovation completed by 2005, with lower section water losses less than 1% Environmental management program implemented by January 2006 with (i) sustained Class III water quality at inlet to Tianjin WWT plant, and (ii) less than 12 pollution incidents per year	Environmental management program completed by June 2007, and (i) water quality at inlet to Tianjin WWT plant remains at Class III standards, and (ii) no pollution incidents occurred during the past few years	Project implementation plan and reviews, flow monitoring Water quality monitoring program, pollution incident report records, number of prosecutions	
	Enterprise reform of TML: (i) full operational responsibilities assumed by June 2000, (ii) full management and financial autonomy by December 2002, and (iii) operating on a self-financed basis by January 2006	TML assumed full operational responsibilities and financial and management autonomy by 2002 and was operating on a self-financed basis by 2006	Project progress reviews, legal status, review missions, audited financial statements	<ul style="list-style-type: none"> TMG authorizes reforms in the manner and time required. Government supports institutional reform. Tariff increases are affordable in a positive economic context.
D. Activities WWT component				
<ul style="list-style-type: none"> Beneficiary participation Land acquisition and resettlement Project design 	Start: October 1999 Complete: ongoing Responsibility: TSC Start: Complete: Responsibility: Start: June 2000	Started in 1999 and still ongoing Started: 2002 Completed: 2003 Responsibility: TSC Start: June 2000	Project progress reports Review missions	

Design Summary	Performance Indicators & Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
<ul style="list-style-type: none"> • Project construction • Development of operational procedures and staff training (including monitoring and control procedures) • O&M budget and staff development • TSC institutional reforms • Sewage tariff reviews and increases 	<p>Complete: December 2003 Responsibility: TSC Start: April 2002 Complete: September 2005 Responsibility: TSC</p> <p>Start: December 2000 Complete: August 2003 Responsibility: TSC, consultants</p> <p>Start: December 2000 Complete: June 2003 Responsibility: TSC, consultants</p> <p>Start: November 1999 Complete: March 2004 Responsibility: TSC</p> <p>Start: November 1999 Complete: ongoing Responsibility: TSC, TFB</p>	<p>Complete: December 2003 Responsibility: TSC The construction started in September 2003 and was completed by end of 2005. The commissioning started in April 2006. TSC provided training for personnel on the operational procedures and system, including operational management, laboratory operations, and on-time monitoring.</p> <p>Start: December 2002 Complete: June 2005 Responsibility: TSC, consultants</p> <p>Start: November 1999 Complete: ongoing Responsibility: TSC The wastewater tariff was increased in 2003, 2005, and 2007. The current tariff of domestic wastewater is CNY0.8/m³, and the tariff of all other sources of wastewater is CNY1.2/m³.</p>	Project progress reports, review missions	
<p>WRP component</p> <ul style="list-style-type: none"> • Beneficiary participation • Land acquisition and resettlement • Project design • Project construction • Establish O&M budget and staff development • TML institutional reforms • Water tariff reviews and 	<p>Start: November 1999 Complete: ongoing Responsibility: TWRB, TML</p> <p>Start: January 2001 Complete: June 2004 Responsibility: TML</p> <p>Start: October 2000 Complete: December 2003 Responsibility: TML</p> <p>Start: September 2001 Complete: June 2005 Responsibility: TML</p> <p>Start: June 2000 Complete: December 2005 Responsibility: TML, consultants</p> <p>Start: November 1999 Complete: June 2005 Responsibility: TML, consultants</p> <p>Start: November 1999 Complete: ongoing</p>	<p>Start: November 1999 Complete: ongoing Responsibility: TWRB, TML Completed: ongoing</p> <p>Start: January 2001 Complete: June 2007 Responsibility: TML</p> <p>Start: October 2000 Complete: December 2006 Responsibility: TML</p> <p>Started in 2001. Except for one pump station and the Yuqiao Reservoir subcomponent, which was completed in June 2007, the major works were completed in 2006. Start: June 2000 Complete: December 2007 Responsibility: TML</p> <p>Start: November 1999 Complete: June 2007 Responsibility: TML</p> <p>The water tariff was increased in 2003, 2005,</p>		

Design Summary	Performance Indicators & Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
increases	Responsibility: TML, TFB	and 2007. The current water tariff for domestic use is CNY3.4/m ³ , and the tariff for all industries and institutions is CNY6.2/m ³ and for special uses, CNY20.6/m ³ .		
E. Inputs				
1. Consultants	<ul style="list-style-type: none"> 65 person-months (international consultants) 130 person-months (domestic consultants) 	<ul style="list-style-type: none"> 65 person-months (international consultants) 130 person-months (national consultants) 	Project progress reports	<ul style="list-style-type: none"> Counterpart funds and domestic cofinancing are available. Competent consultants who perform well are selected. National regulations on resettlement are observed. Adequate funds are provided for resettlement.
2. Civil works	\$144.1 million	\$162.32 million		
3. Equipment and materials	\$61.5 million	\$82.52 million		
4. Project management, design, supervision, and incremental administration	\$20.9 million	\$27.65 million (with training included)		
5. Training	\$0.2 million			
6. Land and resettlement	\$27.8 million	\$33.61 million	Country and township governments and village committee, project implementation agencies, international specialist	
7. Others:				
Physical contingency	\$25.5 million			
Price contingency	\$22.6 million			
Front-end fee	\$1.3 million	\$1.30 million		
Interest during construction and commitment charges	\$36.8 million	\$29.93 million		
Total Project Cost	\$340.7 million	\$337.33 million		
TMG Equity	\$122.9 million	\$121.11 million		
Cofinancing (China Development Bank)	\$87.8 million	\$87.80 million		
ADB	\$130.0 million	\$128.42 million		

ADB = Asian Development Bank, km = kilometer, m² = square meters, O&M = operation and maintenance, TFB = Tianjin Finance Bureau, TMG = Tianjin Municipal Government, TML = Tianjin Municipal Luanhe Drinking Water Resources Protection Engineering Ltd., TSC = Tianjin Sewerage Company, TWRB = Tianjin Water Resources Bureau, WRP = water resources protection, WWT = wastewater treatment

CHRONOLOGY OF MAJOR EVENTS IN THE PROJECT'S HISTORY

Date	Project Events
2 July 1999	TA 3216-PRC: Technical Assistance to the People's Republic of China for Preparing the Tianjin Wastewater Treatment and Water Resources Protection Project approved by Asian Development Bank (ADB) for \$800,000.
12–21 January 2000	Fact-Finding Mission
15–26 May 2000	Appraisal Mission
5 June 2000	ADB approved advance action for civil works procurement.
23–26 October 2000	Loan negotiations
11 December 2000	Loan approval
31 July 2001	The cofinancing agreement between Tianjin Municipal Luanhe Drinking Water Resources Protection Engineering Ltd. and China Development Bank signed.
1 August 2001	Loan Agreement signed.
13 September 2001	Relending Agreement between Ministry of Finance and Tianjin Municipal Government (TMG) signed.
12 October 2001	Onlending Agreements signed between TMG and two Implementing Agencies.
30 October 2001	Loan became effective. First disbursement of loan proceeds made for payment of front-end fee.
November 2001	The international consulting firm, Halcrow Group Ltd., fielded consultants and commenced its services.
25 January 2002	First contract for equipment and materials awarded.
28 January–1 February 2002	Inception Mission
21 May 2002	First civil works contract awarded.
15 July 2002	The Amended and Restated Agreement transforming the Project from a pool-based loan into a London interbank offered rate (LIBOR)-based loan signed.
2–11 December 2002	Loan Review Mission 1
12–23 November 2003	Loan Review Mission 2
January 2004	Project administration transferred from ADB Headquarters to the People's Republic of China Resident Mission.
9–18 March 2004	Midterm Review Mission
15 June 2004	ADB approved the first loan reallocation among interest and other charges during construction, civil works, and equipment and material categories.
25–29 October 2004	Loan Review Mission 3
26–30 July 2005	Loan Review Mission 4
29 July 2005	Test operation for the box culvert under Component B undertaken.
December 2005	Component A completed.
5–9 December 2005	Environment Safeguard Mission
March 2006	The Beicang wastewater treatment plant under Component A completed and put into commission.

Date	Project Events
13 March 2006	First extension of loan closing date by 1 year to 30 June 2007
6–12 June 2006	Special Review Mission 6
31 July 2006	The contract for equipment and facilities of the management information system awarded.
7 September 2006	The Yuqiao Reservoir Resettlement and Alternative Livelihood Plan submitted to ADB.
12–19 January 2007	Loan Review Mission 7
15 January 2007	The Yuqiao Reservoir Resettlement and Alternative Livelihood Plan approved by ADB.
13 April 2007	ADB approved loan reallocation among interest and other charges during construction, civil works, and equipment and material categories.
June 2007	The closed pressurized box culverts and improvement to the existing open channel from Jiuwangzhuang Gate to Dazhangzhuang Pump Station completed.
4 June 2007	The project management office formally made resettlement announcement.
30 June 2007	The installation of Luanhe Water Diversion Management Information System completed.
June 2007	Completion of land acquisition and resettlement. A total of 970 hectares of fishponds inside Wangguofan Dike eliminated.
30 June 2007	Loan closing date
5 September 2007	Final disbursement of Loan proceeds
5 September 2007	Effective date of Loan closing and cancellation of remaining undisbursed balance of the Loan amounting to \$1,584,975.26.
December 2007	All procurement under Component A and Component B completed.
30 April 2008	Borrower's revised project completion report submitted
6–16 May 2008	Project Completion Review Mission

**WORKS PROPOSED AT APPRAISAL AND IMPLEMENTED
for Yuqiao Reservoir Pollution Control Subcomponent**

No.	Project Measures Planned at Appraisal	Specific Works Approved by Tianjin Municipal Government in October 2004	Status as of June 2007
1	Plant vegetation within various ranges of ground elevation	<ul style="list-style-type: none"> Plant trees on 20–60-m wide and 38,665-m long protected forest, and develop 15 access lanes along lake measuring 10,740 m Plant trees and vegetation on 1400 mu for wetland and environment protection 	<ul style="list-style-type: none"> 27,700 mu of afforestation and trees, 109,400 trees planted, 36.49 km protective forest around reservoir Wetland protection
2	Improve or restrict land use within strip of land along the edge of reservoir, extending 51 km along reservoir and lake with an area of 36 km ²	<ul style="list-style-type: none"> Fence 91,775 m, upgrading 6,566-m long embankment and 2,900-m long slope protection and renovation works 	<ul style="list-style-type: none"> Fenced 81,840 m, upgraded 4,130 m of embankment and slope protection, and renovation works
3	Construct low dams on small tributaries to retard soil erosion and to reduce flow velocities that can carry polluting substances into reservoir	<ul style="list-style-type: none"> Restore bare mountain area of 82,200 mu Slope 55,100 mu of cropping land Protect 49,100 m of forest along valley Erect soil conservation dams 	<ul style="list-style-type: none"> Restored of 87,700 mu of bare mountain area Sloped 34,800 mu of cropping land Protected 12,400 m of forest along valley Constructed 351 soil conservation dams Other
4	Create wastewater conveyance and treatment system for rural village (by open channels and stabilization pond, coupled with improvements in wastewater pretreatment in hospitals and enterprises and improvements in the handling and treatment of night soil, manure, and solid waste)	<ul style="list-style-type: none"> Clear up silt in 119 ponds, excavating 242,600 m³ 47,370 m of village concrete roads 34,697-m side ditch for sewerage collection as well as 5,348-m concrete pipe for sewer connection Create solid waste landfills for villages around lake, five manure piling plants, and one fertilizer processing plant with total capacity of 65,000 ton/year Pilot clinic wastewater treatment facilities Renovate about 30,000 household toilets 	<ul style="list-style-type: none"> Excavated 119 ponds Built 37,830 m of open channels for sewerage interception and collection works Built 89,000 m of village roads with side sewerage collection system Created six solid waste landfills Completed one pilot manure processing plant Installed one piloted sewerage treatment facility for one local clinic (Wubaihu Town). Improved 27,442 toilets in villages
5	Eliminate 730 ha of fishponds in reservoir	<ul style="list-style-type: none"> Eliminate 24,828 mu of fishponds 	<ul style="list-style-type: none"> Eliminated 14,500 mu (970

6	Improve fishponds behind a protective dike within reservoir	below a ground elevation of 22 mu (1,650 ha) in the reservoir	ha) of fishponds in the reservoir <ul style="list-style-type: none"> Improved fishponds behind a protective dike by improved raising practices and management
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ha = hectare, km = kilometer, km² = square kilometer, m = meter, m³ = cubic meter

PROJECT COSTS
(\$ million)

Component	Original Estimate at Appraisal			Actual		
	Foreign Exchange	Local Currency ^a	Total Cost	Foreign Exchange	Local Currency ^a	Total Cost
A. Wastewater Treatment Component (Part A)						
1. Civil Works	3.90	5.90	9.80	5.89	12.38	18.27
2. Equipment and Materials	13.40	0.00	13.40	17.16	0.00	17.16
3. Land	0.00	6.10	6.10	0.00	0.12	0.12
4. Resettlement	0.00	1.30	1.30	0.00	0.22	0.22
5. Project Management, Design, and Training	0.70	3.50	4.20	0.52	7.47	7.99
Subtotal (A)	18.00	16.80	34.80	23.57	20.19	43.76
B. Water Resources Protection Component (Part B)						
1. Civil Works	53.70	80.60	134.30	22.90	121.15	144.05
2. Equipment and Materials	48.10	0.00	48.10	65.36	0.00	65.36
3. Land	0.00	2.20	2.20	0.00	7.57	7.57
4. Resettlement	0.00	18.20	18.20	0.00	25.70	25.70
5. Project Management, Design, Supervision & Training	1.90	15.00	16.90	2.08	17.58	19.66
Subtotal (B)	103.70	116.00	219.70	90.34	172.00	262.34
C. Contingencies						
1. Physical	12.20	13.30	25.50	0.00	0.00	0.00
2. Price	11.70	10.90	22.60	0.00	0.00	0.00
Subtotal (C)	23.90	24.20	48.10	0.00	0.00	0.00
D. Other Charges						
1. Front End Fee	1.30	0.00	1.30	1.30	0.00	1.30
2. Interest and Other Charges During Construction ^b	22.30	14.50	36.80	17.20*	12.73	29.93
Subtotal (D)	23.60	14.50	38.10	18.50	12.73	31.23
Total	169.20	171.50	340.70	132.41	204.92	337.33

^a Inclusive of taxes at 3.41% for local costs except land and resettlement.

^b Includes commitment fee of 0.75%.

Source: TSC and TML estimates.

FINANCING PLAN
(\$ million)

Cost	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
Implementation Costs	145.60	157.00	302.60	115.21	192.19	307.40
Borrower Financed	39.20	69.20	108.40	0.00	104.39	104.39
CDB Co-financed	0.00	87.80	87.80	0.00	87.80	87.80
ADB Financed	106.40	0.00	106.40	115.21	0.00	115.21
IDC Costs	23.60	14.50	38.10	17.20	12.73	29.93
Borrower Financed	0.00	14.50	14.50	4.00*	12.73	16.73
ADB Financed	23.60	0.00	23.60	13.20	0.00	13.20
Total	169.20	171.50	340.70	132.41	204.92	337.33

Notes:

- 1) ADB = Asian Development Bank, IDC = interest during construction.
- 2) *The project closing date was extended from June 30, 2006 to June 30 2007, the IDC during the extension period (USD 4.00 million) was not capitalized. The IA financed this part of the IDC using local fund.
- 3) CDB = China Development Bank.

PROJECTED AND ACTUAL CONTRACT AWARDS AND DISBURSEMENTS

Table A 6.1 Projected and Actual Contract Awards and Disbursement

Year	Contract Awards		Disbursement	
	Projected ^a	Actual	Projected ^a	Actual
2001	2.00	2.60	0.20	1.32
2002	39.10	18.10	13.82	14.65
2003	43.10	69.90	30.15	36.50
2004	84.31	102.25	67.30	75.25
2005	110.25	105.94	95.25	93.10
2006	109.94	115.28	97.09	104.08
2007	118.28	122.07	124.08	128.42
Total	118.28	122.07	124.08	128.42

^a Annual projected plus cumulative contract awards or disbursement of previous year.

Source: Asian Development Bank.

Figure A 6.1: Projected and Actual Contract Awards

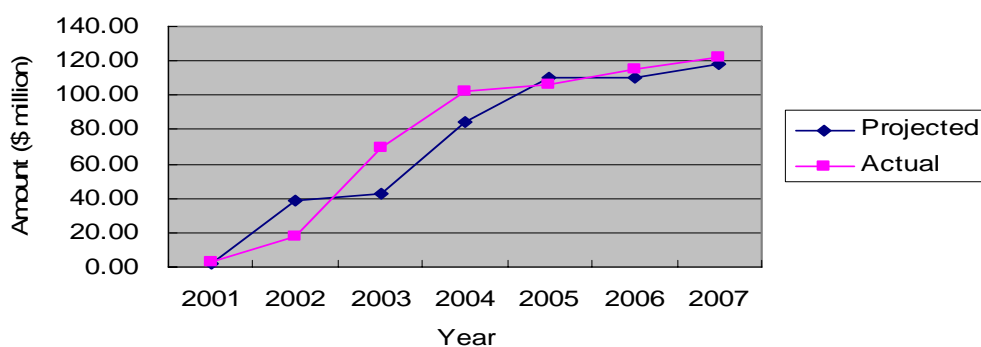
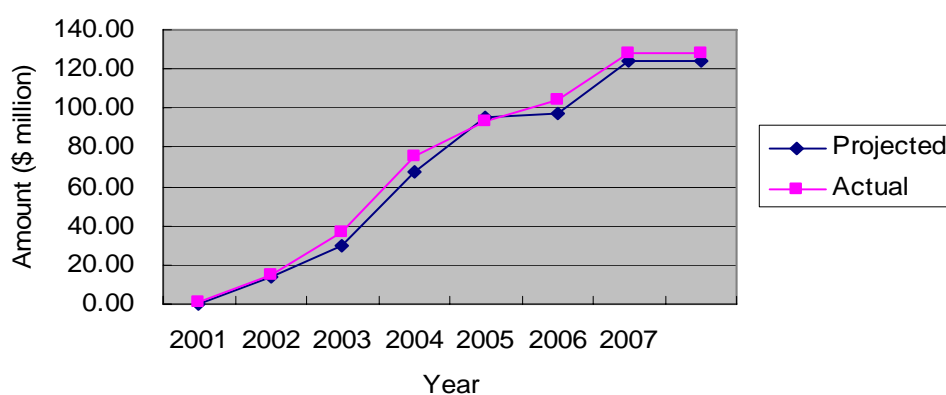


Figure A 6.1: Projected and Actual Disbursements



BREAKDOWN OF YEARLY DISBURSEMENTS OF ADB
(\$ million)




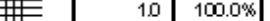





















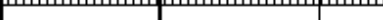









Year	Quarter	Amount	Cumulative
2001	IV	1.322	1.322
2002	I	0.447	1.769
	II	0.121	1.89
	III	4.650	6.54
	IV	8.106	14.646
2003	I	0.000	14.646
	II	3.686	18.332
	III	6.757	25.089
	IV	11.413	36.502
2004	I	5.326	41.828
	II	9.575	51.403
	III	10.934	62.337
	IV	12.915	75.252
2005	I	4.688	79.94
	II	4.337	84.277
	III	2.344	86.621
	IV	6.475	93.096
2006	I	0.761	93.857
	II	4.411	98.268
	III	0.250	98.518
	IV	5.565	104.083
2007	I	6.817	110.9
	II	16.637	127.537
	III	0.878	128.415
	IV	0.000	128.415
Total		128.415	




Source: Asian Development Bank loan financial information system.

PROJECT IMPLEMENTATION SCHEDULE AT APPRAISAL AND IMPLEMENTED

Activity	2000	2001	2002	2003	2004	2005	2006	2007	Assigned %	Actual %	Weighted Proj. (%)
	J A S C N D J F M A M J J A S O N D	J F M A M J J A S O N D J F M A M J J A S O N D	J F M A M J J A S O N D J F M A M J J A S O N D	J F M A M J J A S O N D J F M A M J J A S O N D	J F M A M J J A S O N D J F M A M J J A S O N D	J F M A M J J A S O N D J F M A M J J A S O N D	J F M A M J J A S O N D J F M A M J J A S O N D	J F M A M J J A S O N D			
ADB Loan Period			▲ Loan effective						Loan closing		
Part A: Wastewater Treatment Plant											
1. Land Acquisition									1.0	100.0%	1.00
2. Resettlement									1.0	100.0%	1.00
3. Preliminary and Final Design									1.0	100.0%	1.00
4. Tendering									2.5	100.0%	2.50
5. Wastewater Treatment Plant Construction									7.0	100.0%	7.00
6. Pumping Station Construction									1.5	100.0%	1.50
7. Sewers									2.0	100.0%	2.00
Subtotal									16.0	100.0%	16.0
Part B: Water Resource Protection											
a. Zhou Section Covered Channel											
1. Land Acquisition									1.0	100.0%	1.0
2. Resettlement									1.0	100.0%	1.0
3. Preliminary and Final Design									1.0	100.0%	1.0

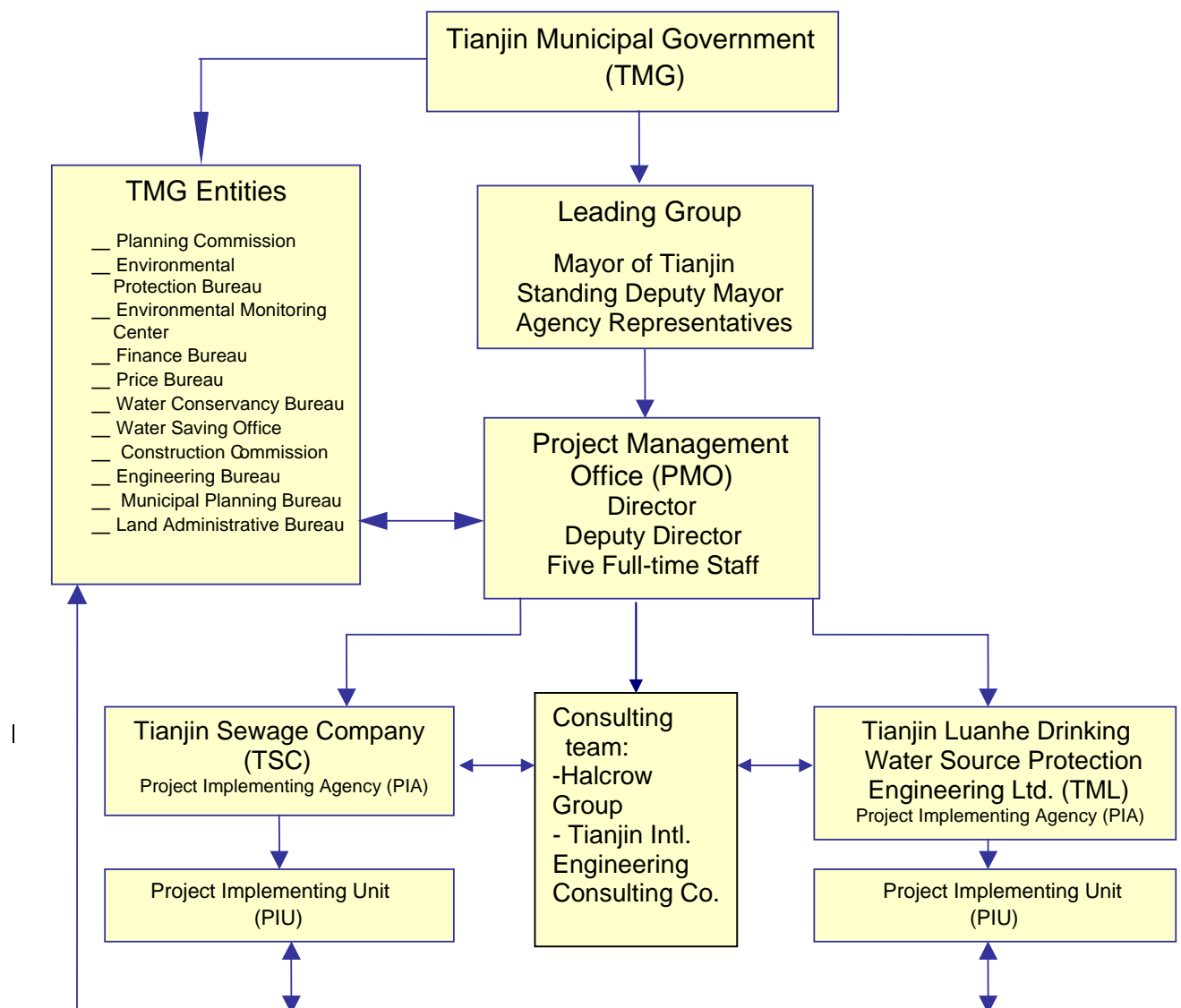
Activity	2000	2001	2002	2003	2004	2005	2006	2007	Assigned %	Actual %	Weighted Proj. (%)
	J A S C N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J			
4. Tendering									8.0	100.0%	8.0
5. Construction									32.0	100.0%	32.0
6. Commissioning									3.0	100.0%	3.0
<i>b. Open Canal Lining and Repair</i>									46.0	100.0%	46.0
1. Land Acquisition									1.0	100.0%	1.0
2. Resettlement									1.0	100.0%	1.0
3. Preliminary and Final Design									1.0	100.0%	1.0
4. Tendering									4.0	100.0%	4.0
5. Construction									10.0	100.0%	10.0
6. Commissioning									5.0	100.0%	5.0
Subtotal									22.0	100.0%	22.0
<i>c. Reservoir Protection</i>											
1. Land Acquisition									1.0	100.0%	1.00
2. Resettlement									1.0	100.0%	1.00
3. Preliminary and Final Design									1.0	100.0%	1.00

Activity	2000	2001	2002	2003	2004	2005	2006	2007	Assigned %	Actual %	Weighted Proj. (%)
	J A S C N D J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J			
4. Tendering									1.0	100.0%	1.00
5. Construction Village Waste Controls									3.0	100.0%	3.00
6. Buffer Area and Aquatic Works									2.0	100.0%	2.00
7. Fishpond Restruction									1.5	100.0%	1.50
8. Commissioning									2.5	100.0%	2.50
Subtotal									13.0	100.0%	13.0
									81.0	100.0%	81.0
Part C: Project Management and Training											
1. Project Management									2.0	100.0%	2.00
2. Training									1.0	100.0%	1.00
Subtotal									3.0	100.0%	3.00
Total									100.0	100.0%	100.00

 Original
  Revised
  Actual

Tianjin Wastewater Treatment and Water Resources Protection Project

PROJECT ORGANIZATION CHART



PROCUREMENT PLAN AT APPRAISAL AND AS IMPLEMENTED

Item	At Appraisal		At Implementation	
	Procurement Mode	Packages No.	Procurement Mode	Packages No.
Wastewater Treatment				
1. Civil Works				
Inside Wastewater Treatment Plant	NCB	1	NCB	1
Pump Stations Outside the Plant	NCB	1	NCB	1
Sewerage Networks Outside the Plant	NCB	1	NCB	1
Landscaping				
2. Equipment and Materials				
Wastewater Treatment Plant	ICB	1	ICB	4
Materials (cement, steel, cables)	ICB	1	ICB/IS	12
Water Resources Protection				
1. Civil Works				
Reservoir Village Waste Controls	NCB	2	NCB	3
Reservoir Buffer Arbor/Aquatic	NCB	2	NCB	3
Reservoir Fishponds Removal	NCB	1	FA	LF
Zhou Section Covered Channel	NCB	12	NCB	26
Existing Channel Improvements	NCB	16	NCB	34
Management Information System	NCB	1	NCB	5
2. Equipment and Materials				
Material (Cement)	ICB	4	ICB	14
Material (steel)	ICB	4	ICB/IS	32
Reservoir Buffer Arbor/Aquatic	ICB	1	ICB/IS	4
Equipment (Gates, Locks) Metal Structure	ICB	1	ICB/NCB	12
Management Information System			ICB	12

ICB = international competitive bidding; NCB: national competitive bidding; FA: force account works; LF: local financing

COMPLIANCE WITH LOAN COVENANTS

Loan 1797-PRC: Tianjin Wastewater Treatment and Water Resources Protection Project

STATUS OF COMPLIANCE WITH LOAN COVENANTS (As of June 2007)

Covenants	Status of Compliance
General	
1. TMG shall carry out the Project with due diligence and efficiency and in conformity with sound administrative, financial, engineering, environmental, water resource protection and wastewater treatment practices. (LA, Article IV, Section 4.01[a])	Complied with.
2. TMG shall make available to TSC and TML, promptly as needed, the funds, facilities, services, land and other resources which are required, in addition to the proceeds of the Loan, for the carrying out of the Project. (LA, Article IV, Section 4.02)	Complied with.
3. The Borrower shall furnish, or cause to be furnished, to the Bank all such reports and information as the Bank shall reasonably request concerning (i) the Loan, and the expenditure of the proceeds and maintenance of the service thereof; (ii) the goods and services and other items of expenditure financed out of the proceeds of the Loan; (iii) the Project; (iv) the administration, operations and financial condition of TMG, TSC and TML; (v) financial and economic conditions in the territory of the Borrower and the international balance-of-payments position of the Borrower; and (vi) any other matters relating to the purposes of the Loan. (LA, Article IV, Section 4.04)	Complied with
4. The Borrower shall exercise its rights under the Subsidiary Loan Agreement, and shall cause TMG, TSC and TML to exercise their respective rights under the Subsidiary Loan Agreement and the On-lending Agreements, as applicable, in such a manner as to protect the interest of the Borrower and the Bank and to accomplish the purposes of the Loan.	Complied with.

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- (LA, Article IV, Section 4.07)
5. The Project Executing Agencies shall carry out the Project in accordance with plans, design standards, specifications, work schedules and construction methods acceptable to the Bank. The Project Executing Agencies shall furnish to the Bank, promptly after their preparation, such plans, design standards, specifications and work schedules, and any material modifications subsequently made therein, in such detail as the Bank shall reasonably request. Complied with.
- (PA, Article II, Section 2.04)
6. TSC and TML shall each take out and maintain with responsible insurers, or make other arrangements satisfactory to the Bank, for insurance of the Project facilities for their respective parts of the Project to such extent and against such risks and in such amounts as shall be consistent with sound practice. Both companies have insured the project facilities in accordance with national laws.
- (PA, Article II, Section 2.05[a])
7. TSC and TML shall each (i) maintain separate accounts for its part of the Project and for its overall operations; (ii) have such accounts and related financial statements, audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors whose qualifications, experience and terms of reference are acceptable to the Bank; and (iii) furnish to the Bank, promptly after their preparation but in any event not later than six months after the close of the fiscal year to which they relate, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto (including the auditors' opinion on the use of the Loan proceeds and compliance with the covenants of the Loan Agreement and, as applicable, on the use of the imprest account procedures), all in English language. Complied with.

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(As of June 2007)

(PA, Article II, Section 2.09[a])

Implementation Arrangements

- | | |
|---|--|
| <p>1. TMG shall be responsible for the overall carrying out and coordination of Project activities and TSC and TML shall be respectively responsible for detailed day-to-day implementation of Parts A and B of the Project. The Project Leading Group (PLG), headed by the Deputy Executive Mayor of Tianjin City, shall provide guidance and direction during the Project implementation. TMG shall ensure that the PLG shall remain constituted, in a manner satisfactory to the Bank, throughout the period of Project implementation.
(LA, Schedule 6, para. 1)</p> | <p>Complied with.</p> |
| <p>2. The Project Management Office (PMO) shall act as the Secretariat of the PLG. TMG will ensure that the PMO is provided with, and continues to maintain during Project implementation, adequate staffing and resources to carry out Project activities including a Project Director, a full-time Deputy Director, and five full-time professional staff satisfactory to the Bank, in action to support staff, as necessary, with sufficient English language skills to ensure that all communications with the Bank are carried out in English.
(LA, Schedule 6, para. 2)</p> | <p>Complied with.</p> |
| <p>3. TSC and TML shall each (i) appoint commercial auditors, acceptable to the Bank, to undertake, at a minimum, annual independent audits; and (ii) within 3 months of the Effective Date, establish an Audit Committee comprising selected members of each of their respective Boards of directors to review internal and external audit reports and to consider other issues of corporate governance; and (iii) require each audit Committee, so established, to meet at least once every six months.
(LA, Schedule 6, para. 5)</p> | <p>Complied with.
Audit Committees have been established in both companies. Regular meetings are held.</p> |

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4. The PIAs shall implement their respective Framework Contracts in accordance with the terms of each detailed action plan and timetable specified therein and, as agreed pursuant thereto, shall enter into Performance Contracts on or before 31 December 2002, on terms and conditions satisfactory to the Bank.
(LA, Schedule 6, para. 19)

Resettlement

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| 1. | TMG will ensure that no later than 3 months of the Effective Date, the RAP shall be amplified to reflect details of preliminary technical design and shall include a livelihood restoration program, in each case satisfactory to the Bank.
(LA, Schedule 6, para. 6) | Complied with. |
| 2. | TMG will ensure that (a) all necessary measure have been taken to ensure timely implementation of the RAP; and (b) every affected person is fully compensated and assisted prior to displacement from housing, land, livelihood sources and assets.
(LA, Schedule 6, para. 7) | Complied with. |
| 3. | TMG will ensure, and cause each PIA to ensure, timely provision of counterpart funds for land acquisition and resettlement activities specified under the RAP, including funds for compensation entitlements for affected persons under Part B of the Project. TMG will ensure and cause each PA to ensure, that counterpart funds for compensation entitlements under the RAP are provided without deduction directly to affected persons and the relevant village organizations as applicable.
(LA, Schedule 6, para. 8) | Complied with. |

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| 4. | <p>TMG will ensure, and cause each PIA to ensure, that (a) the Bank is provided with an updated RAP after completion of detailed construction design; (b) adequate staff and resources are committed for internal monitoring during, and subsequent to, implementation of the RAP; (c) such internal monitoring reviews referred to under (b) will be undertaken at least every six weeks during RAP implementation and at least every three months subsequent to RAP implementation under Project completion; (d) an independent domestic monitoring agency, to be selected in accordance with procedures acceptable to the Bank no later than 3 months of the Effective Date, will carry out monitoring and evaluation of RAP implementation and will undertake at least bi-annual reviews during RAP implementation and for a period of 24 months thereafter covering no less than 15 percent of affected households; and (e) a resettlement and monitoring system and a methodology for socio-economic assessments of the impacts of resettlement under the Project, acceptable to the Bank, shall be established no later than 2 months of the Effective Date.</p> <p>(LA, Schedule 6, para. 9)</p> | Complied with. |
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Environment

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| 1. | <p>TMG will ensure that the Project facilities are constructed, operated, maintained and monitored in strict conformity with: (a) all applicable government laws and regulations; (b) all environmental mitigation and monitoring measures detailed in the Environment Impact Assessment (EIA) / Summary Environment Impact Assessment (SEIA) for the Project; and (c) all applicable Bank requirements.</p> <p>(LA, Schedule 6, para. 12)</p> | Complied with. |
| 2. | <p>Each PIA will ensure that: (a) their respective environmental monitoring</p> | Complied with. |

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offices shall include an adequate number of full-time environmental management personnel, and sufficient resources, to monitor and record the implementation of the environmental monitoring program; (b) annual environmental reports are prepared and submitted to the Bank, within 3 months of the close of each calendar year, from the start of Project implementation and until commencement of commercial operation of the Project facilities; and (c) detailed engineering designs and civil works and other contracts for Project facilities incorporate applicable environmental mitigation measures identified in the EIA/SEIA.

(LA, Schedule 6, para. 13)

3. TMG will ensure, and cause TML to ensure, that (a) the detailed design of Part B of the Project adequately addresses Yuqiao Reservoir safety concerns and a program for completion of pressurized grouting of the Yuqiao Reservoir Dam, including regular monitoring thereof; (b) sufficient funds are made available for timely completion of the pressurized grouting program of the Yuqiao Reservoir Dam no later than the expiry of 36 months from the commencement of implementation of Part B of the Project; (c) a comprehensive study and evaluation of the modification of fish ponds located within the relevant protective dike at the inlet of the Yuqiao Reservoir shall be submitted to the Bank for review prior to construction of any biological treatment basin or commencement of other environmental improvement activities in connection with continued use of remaining fish ponds around the Yuqiao Reservoir.
(LA, Schedule 6, para. 14)
- Complied with.

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| <p>4. TMG will ensure the timely implementation of the industrial pollution sources management program requiring industries to improve pretreatment of wastewater to satisfy national wastewater discharge standards no later than 31 December 2000 in accordance with TMG directives dated 9 April 1997, 31 March 1998, 28 June 1998, 24 December 1998 and 11 June 1999.
(LA, Schedule 6, para. 16)</p> | <p>Complied with.</p> |
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Counterpart Financing

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| <p>1. The Borrower, through TMG, will ensure that (a) all local and foreign currency counterpart financing necessary for purposes of the Project, including equity contributions and cash advances, is provided on a timely basis to enable completion of Project activities; and (b) additional counterpart funding will be provided, as necessary, for any shortfall of funds or cost overruns.
(LA, Schedule 6, para. 17)</p> | <p>Complied with.</p> |
| <p>2. TMG shall prepare and submit timely annual budgetary appropriation requests to the relevant authorities for the required amounts of TMG equity investment in the Project in accordance with the Financing Plan agreed with the Bank.
(LA, Schedule 6, para. 18)</p> | <p>Complied with.</p> |

Cost Recovery

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|--|---|
| <p>1. The Borrower shall cause TMG, TSC, TML and any other authorities concerned, to undertake review of applicable tariff regimes, including water and wastewater, prior to the midterm review of the Project implementation.
(LA, Schedule 6, para. 21)</p> | <p>Complied with.</p> |
| <p>2. The Borrower shall cause TMG to ensure that, by 31 December 2005, the wastewater tariffs charged by TSC to all wastewater consumers are increased from the present levels to ensure full recovery of O&M, depreciation and financial costs, including debt service requirements, and a reasonable profit</p> | <p>Complied with.
The current wastewater tariffs are CNY0.8/m³ for domestic consumers and CNY1.2/m³ for other consumers, effective in 2007.</p> |

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margin for TSC. To this end, TSC shall prepare and submit the necessary applications for tariff increased to government authorities concerned in order to ensure that the applicable wastewater tariff rates charged by TSC to wastewater consumers will be not less than Y0.56/m³ for domestic customers and Y0.75/m³ for other customers on or before 1 January 2003 and Y1.06/m³ for all customers on or before 1 January 2005.

(LA, Schedule 6, para. 22)

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|----|--|--|
| 3. | <p>The Borrower shall cause TMG to ensure that, by 31 December 2005, the raw water tariffs charged by TML to consumers are increased from the present levels to ensure full recovery of O&M, depreciation and financial costs, including debt service requirements, and a reasonable profit margin for TML. To this end, TML shall prepare and submit the necessary applications for tariff increased to government authorities concerned in order to ensure that the applicable raw water tariff rates charged by TML to consumers will be not less than Y0.61/m³ for water consumed and Y0.2/m³ for recycled water on or before 1 January 2003 and Y.75/m³ for water consumed and Y0.25/m³ for recycled water on or before 1 January 2005.</p> | <p>Complied with.
The current tariffs are Y1.03/m³ for the domestic consumers and Y0.30/m³ for the recycled water.</p> |
|----|--|--|

(LA, Schedule 6, para. 23)

Training

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| 1. | <p>Prior to carrying out of training activities, the PIA shall submit their respective training plans to the Bank for prior review and approval. Upon completion of each training program, a report shall be furnished to the Bank describing such training and the benefits accruing therefore.</p> | <p>Complied with.</p> |
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(LA, Schedule 6, para. 25)

Project Performance Management System (PPMS)

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|--|--|
| <p>1. TMG and each PIA shall ensure that, within 6 months of the Effective Date, the PMO shall have developed a PPMS framework and related procedures, satisfactory to the Bank, to generate and monitor data on Project inputs, outputs and impacts systematically including, inter alia, application of indicators on service levels, water quality and consumption, user satisfaction, resettlement, institutional strengthening, and for socioeconomic and environmental concerns. Such PPMS framework and related procedures shall be designed to permit flexibility to adopt remedial measures during Project implementation, as necessary, particularly with regard to Project design, schedules, activities and development impacts.</p> | <p>Complied with.
PPMS framework has been established and PPMS has been set up in web format and can be accessed at tj-adbproject.com.</p> |
|--|--|

(LA, Schedule 6, para. 26)

Financial

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|--|---------------------------------|
| <p>1. Neither TSC nor TML shall incur any debt in any year commencing from the start of commercial operations of the relevant Project facilities, unless a reasonable forecast of the respective revenues and expenditures of TSC and TML shows that the estimated net revenues of each of TSC and TML in such year shall be at least 1.4 times their estimated respective debt service requirement in such year on all debt, including any debt to be incurred.</p> | <p>Complied with.</p> |
| <p>(PA, Article II, Section 2.16[a])</p> | |
| <p>2. Except as the Bank shall otherwise agree, neither TSC nor TML shall incur additional debt, in any fiscal year commencing from the start of commercial operations of their respective parts of the Project, if after the incurring of such debt the ratio of debt to equity in respect of either TSC or TML shall be greater than 65 to 35.</p> | <p>Complied with.</p> |
| <p>(PA, Article II, Section 2.17[a])</p> | |
| <p>3. TSC and TML shall respectively maintain a ratio of current assets to</p> | <p>Partially complied with.</p> |

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current liabilities of not less than 2 to 1.

(PA, Article II, Section 2.18[a])

1. TSC and TML shall each respectively Complied with.
establish a retention account, at a bank acceptable to the Bank, with 6 months of the Effective Date, and ensure that the minimum balances therein shall be, at all times, not less than amounts sufficient to cover 30 days of estimated Operations and Maintenance (O&M) expenditures and, commencing no later than 1 January 2004, such minimum balances therein shall be, at all times not less than amounts sufficient to cover 120 days of their respective estimated O&M expenditures.
(PA, Article II, Section 2.19[a])
2. TSC and TML shall each respectively Complied with.
establish a debt service account, at a bank acceptable to the Bank, no later than 1 March 2005 or within 60 days of incurring any long-term debt obligations and ensure that the minimum balances therein shall be, at all times, not less than amounts sufficient to cover 120 days of their respective estimated debt service obligations.
(PA, Article II, Section 2.19[b]).

FINANCIAL REEVALUATION

A. Tariff Analysis

1. The Tianjin Municipal Government (TMG), Tianjin Sewerage Company (TSC), the Tianjin Luanhe Drinking Water Resource Protection Engineering Ltd. (TML), and other authorities undertook a review of water and wastewater tariff regimes during project implementation, following principles as agreed at project appraisal, including (i) recalculation of minimum cost recovery tariffs based on actual project costs, the proposed capital investment program, and ongoing government requirements; (ii) users' affordability and their willingness to pay; (iii) financial and economic benefits analysis; and (iv) extension of the price escalation mechanism to household and commercial users and other potential fees, charges, or market-based instruments to encourage water conservation and sound environmental behavior.

2. With the proactive tariff adjustments by TMG over the past 7 years, current water and wastewater tariffs have been adequate for satisfying the cost recovery requirement of the municipality's water and wastewater sector. Capital investment programs for water and wastewater infrastructures were funded by tariff revenues, which were increased in 2003, 2005, and 2007. In 2007, the tariff on domestic wastewater remained at CNY0.8 per cubic meter (m^3), while tariffs on other sources of wastewater were increased from CNY1.1/ m^3 to CNY1.2/ m^3 . The water tariff for domestic use remained at CNY3.4/ m^3 , while the water tariffs for industries, institutions, and special use were increased by CNY0.6/ m^3 . All water users, including industries not directly connected to the sewer system and having onsite wastewater treatment, are charged wastewater tariffs based on water consumption. The current water tariffs for industries and institutions are CNY 6.2/ m^3 , and CNY 20.6/ m^3 for special uses. The raw water tariff was increased from CNY0.4/ m^3 in 2000 to CNY0.91/ m^3 in 2001, CNY1.0/ m^3 in 2003, and CNY1.03/ m^3 in 2007. Detailed information on the tariffs is shown in Tables A11.1 and A11.2.

Table A11.1: Water & Wastewater Tariffs for End Users
(CNY/ m^3)

Year	Wastewater		Water			
	Domestic	Others	Domestic	Industries	Institutions	Special
2003	0.6	1.0	2.9	4.6	4.4	18.0
2005	0.8	1.1	3.4	5.6	5.6	20.0
2007	0.8	1.2	3.4	6.2	6.2	20.6

Table A11.2: Wastewater and Water Tariffs as Compared with Appraisal Estimates
(CNY/ m^3)

	Wastewater		Raw Water	
	Tariff for full cost recovery (as of Dec 2005)	Current Tariff	Tariff for full cost recovery (as of Dec 2005)	Current Tariff
Domestic	1.06	0.80	0.75	1.03
Industrial	1.06	1.20	0.75	1.03

3. During project implementation, TMG proposed that Tianjin Capital Environmental Protection Co. Ltd. (TCEPC)¹ invest partially in the Beicang wastewater treatment (WWT) plant as a substitute for the local fund originally provided by TMG. In June 2002, the project management office (PMO), acting on behalf of TMG, informally contacted the Asian Development Bank (ADB) about the proposal, i.e., that the Implementing Agency role for the WWT plant be transferred from TSC to TCEPC. A preliminary assessment of the proposal was made by an ADB mission in December 2002, and ADB indicated its position against the transfer in an interim reply to TMG in August 2003. Following extensive internal consultations, ADB's final response was sent in early November 2003, confirming this position as the transfer of implementation and ownership of the WWT project component would be against the terms of the loan. However, ADB did indicate that an ownership transfer, post-plant completion, was possible. During discussions among ADB, the PMO, TCEPC, and TSC, it was agreed that a project implementation unit would still be formed within TSC for project implementation as specified in the Loan and Project Agreements. TSC would still be the Implementing Agency, and there would be no change to the implementation arrangement. Any further arrangement would only be implemented when the plant was in full operation, with the required sewer system completed.

4. By the end of 2007, the WWT plant was only about 30% operational due to delay in the sewer system's construction, resulting in lower efficiency and a higher operation cost. To ensure the financial viability of the WWT project component and the financial sustainability of the Beicang WWT plant, the operating entity of the component, TMG offered a service compensation fee of CNY1.95/m³ based on the volume of wastewater treated. As this service fee is much higher than the wastewater tariff charged to end-users, it could enable recovery of operating costs, debt services, and depreciation of project facilities until planned sewer are in place by 2010.

5. The Beicang WWT plant's operating costs for the trial operation period were relatively high due to the high cost of sludge treatment and lower-than-expected influent of wastewater. The plant was designed with a treatment capacity of 100,000 tons (t) per day, comprising approximately 60% industrial and 40% domestic wastewater. However, the plant only receives 20,000–30,000 t/day of wastewater due to the sewage system's incompleteness. Moreover, the received wastewater is all industrial effluents beyond national wastewater discharge standards. The high proportion of industrial wastewater also requires more intensive treatment as compared to the design requirement, causing higher operating costs. The situation will improve as the planned sewage pipelines are completed by the end of 2010, which will increase the wastewater influent to 50% of the plant's treatment capacity by 2008 and to 100% by 2010.

6. All raw water tariff revenues are earmarked for TML and the Luan River Diversion Management Bureau (LRDMB) for raw water supply, flood control services, and capital investment for infrastructure enhancement. This tariff is sufficient to cover the full costs of TML and LRDMB at present. Of the current raw water tariff, CNY0.33/m³ is reserved for debt services.

¹ A stock-listed state-owned enterprise, TCEPC's principal activities are designing, managing, operating, and providing technological consultations to the Dongjiao sewage water treatment plant and the Jizhuangzi sewage water treatment plant in Tianjin. Other activities include infrastructure facility and auxiliary services, design, toll collection, repair and maintenance, and management. TCEPC is also involved in the technological consultation of toll roads and auxiliary services in relation to the operation of the Southeastern Half Ring Road of Tianjin's Middle Ring and development and operation of environmental protection technology and products.

B. Financial Reevaluation

1. Scope and Methodology

7. The Project's financial viability was reassessed for each component by comparing the financial internal rate of return (FIRR) with the weighted average rate of capital (WACC). Capital cost was based on actual expenditures incurred, excluding interest and other financial charges during construction. All revenue and expenses were expressed in 2007 prices for FIRR calculation. The calculation period covered the construction period and 20 years of operation after the start of trial operations in 2006. Costs of equipment replacement and infrastructure rehabilitation during the calculation period were included. Based on the economic life of the fixed assets, the Project's residual value was assumed to be 10% of the project capital cost.

2. Financial Viability of the WWT Component

8. The FIRR for the WWT component was recalculated based on the actual capital cost, the actual volume of wastewater treated, and operation cost information from the trial operation period. The Beicang WWT plant receives compensation for provision of WWT services under a temporary agreement with TMG, currently fixed at CNY1.95/m³. TMG has initiated the process of introducing a franchise concessional arrangement for WWT plants in Tianjin, including the Beicang WWT plant. It is likely that the current compensation rate will be adjusted downward when the concessional arrangement is put into place. The FIRR would be 6.0% if the tariff is reduced to CNY1.5/m³, and the operating cost could be reduced by 20% from the current level. In such a case, the component is still financially viable as the FIRR is still higher than the WACC, which is recalculated to be 2.98%.

9. There are three key factors that will affect this component's financial viability: (i) a delay in connecting the sewer system to the Beicang WWT plant; (ii) the uncertainty of the tariff to be set in the franchise concessional arrangement; and (iii) the plant's relatively high level of operating cost. As indicated in Table A11.3, a delay in connecting the sewer system will significantly lower the FIRR. In addition, measures will be taken to improve the operating efficiency and reduce the operating costs.

3. Financial Viability of Water Resources Protection Component

10. The FIRR for the water resources protection component was recalculated based on the actual capital cost, the incremental revenues, and additional operation and maintenance (O&M) costs for TML and LRDMB. It was also assumed that the annual consumption of raw and recycled water will grow at a rate of 1% per year. The recalculated FIRR is 7.7% (Table A11.4), which is much lower than the appraisal estimate of 14.5%. The variation is mainly due to a much lower actual water and recycled water consumption than appraisal estimates as well as O&M costs that were almost 100% higher than appraisal estimates. This component's WACC is recalculated to be 2.45%, so its financial viability is confirmed since the recalculated FIRR is higher than the WACC. In the light of increasing O&M costs and lower-than-expected water consumption, there is a need for better cost control and institutionalization of cost efficiency measures. A comprehensive baseline cost structure should be developed for better cost monitoring during the operation of project facilities.

C. Financial Performance Projection of Project Operating Entity

11. According to the 2006 audited project accounts and financial statements, the ratio of current assets to current liabilities were 0.97 and 1.33 for TSC and TML, respectively. The ratios were 0.980 and 0.495 for TSC and TML in 2007, respectively. TSC's ratio improved slightly in 2007 and is expected to improve further with completion of sewer system by 2010. Because the collected funds for loan repayment—CNY155,252,760—were booked under the account item of “Advance from Customers” in 2007, this account item was substantially increased, leading to an increase in “Total Current Liabilities”. The corrected ratio of current assets to current liabilities for TML was 1.33 after adjustment. The ratio of current assets to current liabilities was below the minimum of 2:1 stipulated in the Loan Agreement, resulting in noncompliance with the loan covenant. TMG began taking actions to improve the financial management capacity of TSC and TML. In July 2006, it approved TML to collect water tariffs directly from the water supply company. For TSC, in addition to transferring the revenue directly to the WWT plant, the Tianjin Finance Bureau is subsidizing the wastewater tariff until full cost recovery can be achieved under full operation of WWT plant. Meanwhile, TMG continues tariff and institutional reforms of TML and TSC to strengthen their financial management and transform them into independent entities. TMG confirmed that it will report the results to ADB for 3 years after project completion. In addition, a financial performance projection of the Beicang WWT plant was conducted, indicating that it will comply with the debt-to-equity ratio, current ratio, and debt service coverage ratio if the sewer system is completed as anticipated and the operating cost can be reduced by 20%. Details are presented in Table A11.5.

12. TML is responsible for the supply of raw water to urban Tianjin and for flood control services. TML was registered as a state-owned enterprise in January 2000, through the transfer of assets and staffing from LRDMB. It was noted that TML's financial statements do not reflect the full revenue from supply of raw water or the full operating costs, which is related to the institutional arrangement between TML and LRDMB regarding the operation of reservoirs, culverts, pump stations, and bureau administration.² The financial performance projection was conducted on the basis of consolidating the revenue and operating costs of TML and LRDMB. In general, TML could comply with all the required financial covenants, but the needed cost efficiency measures must be determined to ensure sustainability of operations since the O&M costs have increased and the amount of water sold has decreased. TML will therefore take measures to control the operating costs to maintain its financial strength. Details are presented in Table A11.6.

² The operation costs of TML suggest that it operates part of the existing facilities for the raw water delivery. It receives about CNY 0.33/m³ of the raw water tariff charged, and LRDMB receives the balance.

Table A11.3: Financial Internal Rate of Return of Wastewater Treatment Component
(CNY million)

Year	Capital Cost	O&M Cost	Total Cost	Revenues	Net Cash Flow				
					Base Case	Costs Plus 10%	Revenues -10%	Combined 10% (a) and (b)	Delay in the sewers
2001	8.6		8.6	0.0	-8.6	-9.5	-8.6	-9.5	-8.6
2002	15.3		15.3	0.0	-15.3	-16.8	-15.3	-16.8	-15.3
2003	95.2	0.0	95.2	0.0	-95.2	-104.8	-95.2	-104.8	-95.2
2004	87.1	0.0	87.1	0.0	-87.1	-95.8	-87.1	-95.8	-87.1
2005	78.6	0.0	78.6	0.0	-78.6	-86.4	-78.6	-86.4	-78.6
2006	29.2	4.4	33.7	12.3	-21.4	-24.8	-22.6	-26.0	-21.4
2007	24.6	7.6	32.2	22.1	-10.0	-13.2	-12.2	-15.5	-10.0
2008		7.6	7.6	35.6	28.0	27.2	24.4	23.7	14.5
2009		15.0	15.0	43.8	28.8	27.3	24.4	22.9	14.5
2010		15.0	15.0	54.8	39.7	38.2	34.3	32.8	28.8
2011		15.0	15.0	54.8	39.7	38.2	34.3	32.8	28.8
2012		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2013		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2014		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2015	68.8	15.0	83.8	54.8	-29.1	-37.4	-34.5	-42.9	-29.1
2016		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2017		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2018		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2019		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2020		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2021		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2022		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2023		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2024		15.0	15.0	54.8	39.7	38.2	34.3	32.8	39.7
2025	-33.9	15.0	-18.9	54.8	73.6	75.5	68.1	70.0	73.6
NPV @ WACC				618.7	118.6	68.6	56.8	6.8	80.9
FIRR					6.0%	4.7%	4.5%	3.2%	5.0%

Sources: ADB estimates.

Table A11.4: Financial Internal Rate of Return of Water Resources Protection Component
(CNY million)

Year	Capital Cost	Incremental O&M Cost	Total Cost	Incremental Revenues	Base Case	Net Cash Flow		Combined (a) and (b)
						Costs Plus 10% (a)	Revenues Less -10% (b)	
2001	65.4	0.0	65.4	0.0	-65.4	-71.9	-65.4	-71.9
2002	298.5	19.3	317.8	56.2	-261.6	-293.4	-267.2	-299.0
2003	462.6	2.6	465.2	114.5	-350.7	-397.2	-362.2	-408.7
2004	407.5	57.3	464.8	132.6	-332.2	-378.7	-345.5	-391.9
2005	280.2	53.1	333.3	166.5	-166.8	-200.1	-183.5	-216.8
2006	211.4	88.4	299.8	159.5	-140.3	-170.3	-156.3	-186.2
2007	231.4	49.0	280.4	215.7	-64.7	-92.7	-86.3	-114.3
2008	161.5	49.0	210.5	217.9	7.4	-13.7	-14.4	-35.4
2009		49.0	49.0	220.1	171.1	166.2	149.1	144.2
2010		49.0	49.0	222.3	173.3	168.4	151.1	146.2
2011		49.0	49.0	224.5	175.5	170.6	153.1	148.2
2012		49.0	49.0	226.7	177.7	172.8	155.0	150.1
2013		49.0	49.0	229.0	180.0	175.1	157.1	152.2
2014		49.0	49.0	231.3	182.3	177.4	159.2	154.3
2015	0.0	49.0	49.0	233.6	184.6	179.7	161.2	156.3
2016		49.0	49.0	235.9	186.9	182.0	163.3	158.4
2017		49.0	49.0	238.3	189.3	184.4	165.5	160.6
2018		49.0	49.0	240.7	191.7	186.8	167.6	162.7
2019		49.0	49.0	243.1	194.1	189.2	169.8	164.9
2020		49.0	49.0	245.5	196.5	191.6	172.0	167.1
2021		49.0	49.0	248.0	199.0	194.1	174.2	169.3
2022		49.0	49.0	250.5	201.5	196.6	176.5	171.6
2023		49.0	49.0	253.0	204.0	199.1	178.7	173.8
2024		49.0	49.0	255.5	206.5	201.6	181.0	176.1
2025	-635.6	49.0	-586.6	258.1	844.7	903.4	818.9	877.6
NPV @ WACC					1,224.0	984.5	862.0	622.9
FIRR					7.7%	6.3%	6.2%	4.9%

Sources: ADB estimates.

Table A11.5: Financial Statements of Beicang Wastewater Treatment Plant

(CNY million, in current prices)

Income Statements	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Wastewater Treatment Revenue						12.15	22.13	35.59	46.47	59.83	61.62	63.47	65.37	67.34	69.36
Less Taxes (5%)						0.61	1.11	1.78	2.32	2.99	3.08	3.17	3.27	3.37	3.47
Net Operating Revenue						11.55	21.03	33.81	44.14	56.84	58.54	60.30	62.11	63.97	65.89
Operating Expenses						4.45	7.61	7.84	15.92	16.39	16.89	17.39	17.91	18.45	19.00
Depreciation						2.63	7.00	7.00	13.93	13.93	13.93	13.93	13.93	13.93	13.93
Operating Income						4.46	6.41	16.82	11.46	22.76	23.04	23.32	23.62	23.92	24.22
Interest Expense							11.29	11.90	11.63	11.33	11.00	10.64	10.24	9.80	9.31
Profit before income tax						4.46	-4.87	4.92	-0.16	11.44	12.04	12.69	13.38	14.12	14.91
Income Tax Expense (33%)						1.47	0.00	1.62	0.00	3.77	3.97	4.19	4.42	4.66	4.92
Net Income						2.99	-4.87	3.30	-0.16	7.66	8.07	8.50	8.96	9.46	9.99
Cash Flow Statements	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net Income						2.99	-4.87	3.30	-0.16	7.66	8.07	8.50	8.96	9.46	9.99
Depreciation						2.63	7.00	7.00	13.93	13.93	13.93	13.93	13.93	13.93	13.93
Interest expenses						0.00	11.29	11.90	11.63	11.33	11.00	10.64	10.24	9.80	9.31
Loan Proceeds	2.13	2.65	31.60	72.76	74.60	15.01	10.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity Infusion	8.90	6.10	43.60	32.40	36.80	26.50	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Sources of Funds	11.03	8.75	75.20	105.16	111.40	47.13	26.76	22.19	25.39	32.92	32.99	33.07	33.13	33.18	33.23
Capital Investments	8.60	15.30	95.24	87.08	78.55	29.22	24.55		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan repayments	0.00	0.00	0.00	0.00	0.00	3.56	3.92	4.32	4.77	5.26	5.79	6.39	7.04	7.76	8.56
Interest payments	0.04	0.46	1.05	4.50	11.79	11.27	11.82	11.90	11.63	11.33	11.00	10.64	10.24	9.80	9.31
Total Application of Funds	8.47	5.94	-3.03	79.53	77.89	73.62	63.90	36.29	32.99	30.43	26.13	24.63	23.49	22.66	22.09
Net Cash Flow	2.56	2.81	78.23	25.63	33.52	-26.48	-37.14	-14.10	-7.60	2.49	6.86	8.44	9.64	10.52	11.14
Cash Balance Beginning	0.00	2.56	5.37	83.61	109.24	142.75	116.27	79.13	65.03	57.43	59.92	66.78	75.22	84.86	95.38
Cash balance ending	2.56	5.37	83.61	109.24	142.75	116.27	79.13	65.03	57.43	59.92	66.78	75.22	84.86	95.38	106.52
Balance Sheets	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Current Assets	0.00	5.38	106.76	135.18	162.58	119.07	84.13	72.97	68.27	73.64	81.07	90.09	100.33	111.46	123.23
Fixed Assets						138.61	366.50	366.50	366.50	366.50	366.50	366.50	366.50	366.50	366.50
Less: Accumulated Depreciation						2.72	9.72	16.72	30.64	44.57	58.50	72.42	86.35	100.28	114.20
Total Net Fixed Assets						135.89	356.78	349.78	335.86	321.93	308.00	294.08	280.15	266.22	252.30
Work in Progress	10.97	22.82	128.37	221.56	314.20	202.70				0.00	0.00	0.00	0.00	0.00	0.00
Total Assets	10.97	28.20	235.12	356.74	476.78	457.67	440.92	422.76	404.13	395.57	389.07	384.17	380.48	377.68	375.52
Current Liabilities	0.17	10.00	132.47	121.37	133.82	107.06	85.64	68.52	54.81	43.85	35.08	28.06	22.45	17.96	14.37

Long-Term Liabilities	2.13	4.94	9.91	112.90	185.35	195.19	202.11	197.79	193.02	187.77	181.97	175.58	168.54	160.78	152.22
Owner's Equity															
Equity	8.67	13.26	92.75	122.47	157.61	155.42	153.16	156.45	156.29	163.95	172.02	180.52	189.49	198.95	208.94
Total Liabilities and Equity	10.97	28.20	235.12	356.74	476.78	457.67	440.92	422.76	404.13	395.57	389.07	384.17	380.48	377.68	375.52
Ratios:															
Current Ratio	-	0.54	0.81	1.11	1.21	1.11	0.98	1.07	1.25	1.68	2.31	3.21	4.47	6.21	8.58
Debt Service Coverage Ratio	-	-	-	-	-	0.38	0.85	1.37	1.55	1.98	1.96	1.94	1.92	1.89	1.86
Debt to Equity Ratio	-	-	-	-	-	43%	46%	47%	48%	47%	47%	46%	44%	43%	41%

Sources: Tianjin Sewerage Company and ADB estimates.

Table A11.6: Financial Statements of Tianjin Municipal Luanhe Drinking Water Source Protection Engineering Ltd.*
(CNY million, in current prices)

Income Statements	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Raw Water Sales Revenue	358.89	412.88	439.52	465.89	507.88	511.97	644.7	650.65	695.23	702.72	710.21	717.7	725.18	732.67	740.16
Purchase of the Raw Water	106.92	97.21	132.15	106.17	71.68	114.62	116.05	121.33	130.19	112.16	128.18	150.21	181.25	225.31	289.39
Operating Expenses Subtotal	258.59	287.32	319.38	355.35	314	425.66	382.15	404.23	431.54	426.25	462.95	508.46	566.02	641.08	743.23
Depreciation	10.23	10.52	79.51	86.18	84.42	85.32	89.49	121.1	152.83	154.51	156.24	157.95	159.66	161.37	163.08
Cost of Sales	268.82	297.84	398.89	441.53	398.42	510.98	471.64	525.33	584.37	580.76	619.19	666.41	725.68	802.45	906.31
Operating Income	90.07	115.04	40.63	24.36	109.46	0.99	173.06	125.32	110.86	121.96	91.02	51.29	-0.5	-69.78	-166.15
Non-Operating Income	5.09	3.28	2.3	0.84	1.41	1.06	0	0	0	0	0	0	0	0	0
Non-Operating Expense	10.84	10.29	8.28	1.01	2.77	2.99	0	0	0	0	0	0	0	0	0
Net inc, before int and taxes	84.32	108.03	34.65	24.19	108.1	-0.94	173.06	125.32	110.86	121.96	91.02	51.29	-0.5	-69.78	-166.15
Interest Expense - operation	-0.6	-0.87	-0.42	-0.89	-1.35	-1.04	0	0	0	0	0	0	0	0	0
Interest Expense - ADB	0	0	0	0	0	0	16.22	24.22	23.55	22.81	22	21.11	20.12	19.04	17.84
Interest Expense - CDB	0	0	0	0	0	0	17.02	30.03	26.03	22.02	18.02	14.01	10.01	6.01	2
Income before Income Tax	84.92	108.9	35.07	25.08	109.45	0.1	139.82	71.07	61.28	77.13	51	16.17	-30.63	-94.83	-185.99
Net Income	84.92	110.49	35.19	25.08	108.98	0.6	139.82	71.07	61.28	77.13	51	16.17	-30.63	-94.83	-185.99
Cash Flow Statements	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cash Inflows:															
Net Income	84.92	110.49	35.19	25.08	108.98	0.6	139.82	71.07	61.28	77.13	51	16.17	-30.63	-94.83	-185.99
Depreciation	10.23	10.52	79.51	86.18	84.42	85.32	89.49	121.1	152.83	154.51	156.24	157.95	159.66	161.37	163.08
Interest Expenses	0	0	0	0	0	0	33.23	54.25	49.57	44.83	40.02	35.12	30.13	25.04	19.84
Loan Proceeds-ADB	8.87	109.72	181.18	219.2	72.45	83.57	184.38	0	0	0	0	0	0	0	0
Loan Proceeds-CDB	33.5	100.3	166.1	100.3	172.09	129.54	34.03	0	0	0	0	0	0	0	0
Equity Infusion	33.7	100.1													
Total Sources of Funds	171.22	431.13	461.98	430.76	437.94	299.03	480.95	246.42	263.68	276.47	247.26	209.24	159.16	91.58	-3.07
Capital Investments	65.43	298.47	462.61	407.52	280.24	211.37	231.4	145.76	0	0	0	0	0	0	0
Working Capital Incr.(decr.)	10.25	66.47	4.51	66.97	219.21	-57.64	-41.69	7.48	6.01	1.42	5.98	6.69	8.15	10.27	13.87
Loan repayments - ADB	0	0	0	0	0	13.24	14.55	16.06	17.74	19.54	21.51	23.73	26.18	28.88	31.81
Loan repayments - CDB	0	0	0	0	0	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
Interest payments - ADB	0.14	2.17	5.26	26.86	39.72	31.57	32.43	24.22	23.55	22.81	22	21.11	20.12	19.04	17.84

Interest payments - CDB	1.1	10.63	10.98	17.52	23.88	38.04	34.03	30.03	26.03	22.02	18.02	14.01	10.01	6.01	2
Total Application of Funds	76.92	377.74	483.36	518.87	563.05	309.38	343.52	296.35	146.13	138.59	140.31	138.34	137.26	137	138.32
Net Cash Flow	94.3	53.39	-21.38	-88.11	-125.11	-10.35	137.43	-49.93	117.55	137.88	106.95	70.9	21.9	-45.42	-141.39
Cash Balance Beginning	0	94.3	147.69	238.65	150.54	25.43	15.08	152.51	102.58	220.13	358.01	464.96	535.86	557.76	512.34
Cash balance ending	94.3	147.69	238.65	150.54	25.43	15.08	152.51	102.58	220.13	358.01	464.96	535.86	557.76	512.34	370.95
Balance Sheets	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Current Assets	105.18	165.3	613.72	924.757	220.99	206.18	228.23	175.22	291.52	423.87	532.56	607.2	635.18	598.89	470.87
Long-Term Assets															
Fixed Assets	276.36	1607.01	1659.98	1682.444	1721.54	1759.58	1790.21	2825.94	3860.55	3894.05	3928.66	3962.9	3997.01	4031.34	4065.56
Less: Accumulated Depreciation	71.28	81.8	161.31	247.495	331.91	417.24	506.41	627.51	780.35	934.85	1091.09	1249.04	1408.7	1570.07	1733.15
Fixed Assets (Net)	205.08	1525.21	1498.67	1434.949	1389.63	1342.34	1283.8	2198.43	3080.2	2959.2	2837.57	2713.86	2588.31	2461.27	2332.41
Work in Progress	75.26	385.15	841.79	1258.49	1567.15	1814.92	2046.32	1046.32	46.32	46.32	46.32	46.32	46.32	46.32	46.32
Disposal of Fixed Assets	0.16	0.16	0.18	0.13	0.11	0.13	0.12	0.12	0.12	0.12	0.12				
Total Long-term Investment	1	1	4.99	13.35	28.54	31.41	31.41	31.41	31.41	31.41	31.41	31.41	31.41	31.41	31.41
Intangible Assets	110.32	108.02	240.94	235.699	230.57	2040.26	2040.26	2040.26	2040.26	2040.26	225.34	225.34	225.34	225.34	225.34
Total Assets	497	2184.84	3200.29	3867.375	3436.99	5435.24	5630.14	5491.76	5489.83	5501.18	3673.2	3624.13	3526.56	3363.23	3106.35
Current Liabilities	15.29	8.94	400.81	645.2	182.86	186.71	167.82	158.94	153.49	148.51	146.49	146	146.64	148.42	78.37
Long-Term Liabilities	41.13	238.37	592.21	904.91	984.92	1108.41	1180.57	1088.33	994.11	897.73	798.92	697.42	592.96	485.28	446.85
Equity	440.58	1937.53	2207.27	2317.27	2269.21	4140.12	4281.75	4244.49	4342.23	4454.94	2727.79	2780.71	2786.96	2729.53	2581.13
Total Liabilities and Equity	497	2184.84	3200.29	3867.38	3436.99	5435.24	5630.14	5491.76	5489.83	5501.18	3673.2	3624.13	3526.56	3363.23	3106.35
Ratios:															
Current Ratio	6.88	18.49	1.53	1.43	1.21	1.10	1.36	1.10	1.90	2.85	3.64	4.16	4.33	4.04	6.01
Debt Service Coverage Ratio	76.73	9.45	7.06	2.51	3.04	0.55	1.71	1.72	1.88	2.02	1.84	1.59	1.23	0.72	-0.02
Debt to Equity Ratio	0.08	0.11	0.19	0.23	0.29	0.20	0.21	0.20	0.18	0.16	0.22	0.19	0.17	0.14	0.14

Sources: Tianjin Luanhe Drinking Water Resource Protection Engineering Limited, LRDDB, and ADB estimates.

ECONOMIC REEVALUATION

A. Scope and Methodology

1. The economic reevaluation recalculated the economic internal rates of return (EIRR) of the Wastewater Treatment (WWT) and Water Resources Protection (WRP) components, and results were compared with appraisal estimates. Project costs and benefits were reassessed based on information provided by the project management office, Tianjin Sewerage Company (TSC), and Tianjin Municipal Luanhe Drinking Water Source Protection Engineering Ltd. (TML). Project costs consisted of capital costs, operation and maintenance costs, and the costs for equipment replacement and infrastructure rehabilitation undertaken during the evaluation period. Financial capital costs were converted into economic costs by applying a standard conversion factor, consistent with appraisal estimates. The EIRRs were compared with the economic opportunity cost of capital (EOCC) for the components, which was assumed to be 12%. Sensitivity tests were undertaken to assess the robustness of the EIRR calculation.

B. WWT Component

2. Tianjin lacked a comprehensive wastewater management system, with the existing sewage network overloaded and less than 50% of wastewater treated before the Tianjin Wastewater Treatment and Water Resources Protection Project (the Project) was implemented. Eighty percent of wastewater in Tianjin was treated when the Project was completed in 2007, and the Beicang WWT plant would have treated 10% of the treated amount if the sewer system were in place. The WWT component forms part of Tianjin's wastewater management plan, enabling Tianjin to meet the quality standards set out in the Hai River Basin Pollution Prevention and Control Plan. The Project provides WWT facilities for the Beicang service area, including the provision of a trunk sewer network and a sewage pump station to serve the newly developing area of eastern Beicang, and a WWT plant to serve both the eastern area and the existing sewered area in Beicang.

1. Project Benefits

3. In the reevaluation at project completion, the major quantifiable benefits of the WWT component included (i) incremental revenue to approximate willingness to pay to control and clean up wastewater discharge, and (ii) the benefits of using recycled water for industrial usage. The irrigation potential of effluent from the WWT plant, which was assumed at appraisal, was not considered because there have been no such practices for irrigation purposes.

4. There are other unquantifiable benefits, such as economic growth benefits, that were not included in the EIRR recalculation. The Project also facilitated the development of emerging growth areas in the city where many houses and industries will be located. Such incremental economic growth effects can provide needed employment, wealth generation, and poverty reduction. Further, the poor and lower-income households will have wastewater facilities (including sewer connections), thus reducing their health risks from polluted environment.

2. EIRR

5. The results of the economic reevaluation show that the WWT Component is economically viable, with the EIRR estimated at 16.2%, exceeding the EOCC of 12% and slightly higher than the EIRR of 15.2% at appraisal. This is a result of the increase in the Project's economic benefits as compared to appraisal estimates. The EIRR remains above the

EOCC when costs increase by 10% and benefits decrease by 10%. The results are presented in Table A12.1.

C. WRP Component

6. The major beneficiaries of the WRP component are the end consumers of the Luan River diversion system, i.e., 5 million people and various institutions, industries, and commercial establishments. Water is also consumed by power plants along the Hai River for cooling and recycling purposes. Water supply companies directly benefit from an improvement in the quality of raw water,¹ resulting in cost savings in the water treatment process and reduction in water losses from flushing and backwashing. Without the Project, Tianjin's raw water supply would not meet the current required national standards, and a real risk of drinking water contamination in the future would exist.

1. Project Benefits

7. In the reevaluation at project completion, the major quantifiable benefits of the WRP component included (i) an improvement in raw water quality and reduced risk of future contamination, and (ii) cost savings in water plants from the improved raw water quality. The benefit from incremental agriculture output, which was assumed at appraisal, was not considered due to the high purchase price of raw water, which makes it economically unacceptable.

8. Other benefits not included in the EIRR reevaluation were: (i) a marginal increase in water supply capacity as less water is needed for flushing and there are less "shut down periods", but this additional water is not needed to meet demand until after 2010; (ii) a flood control benefit as additional water conveyance downstream from the reservoir increases the capacity of water that can be released from the reservoir during floods; and (iii) the protection of the city's water supply, without which economic activity would be threatened.

2. EIRR

7. The results of the economic reevaluation show that the WRP component is economically viable, with the EIRR estimated at 18.3%, exceeding the EIRR of 14.7% at appraisal. The EIRR remains above the EOCC when costs increase by 10% and benefits decrease by 10%. The results are presented in Table A12.2.

¹ This comprises of constructing and operating advanced water treatment over and above the conventional treatment of chemical feed-mixing-flocculation-sedimentation-filtration-disinfection that is done in existing WWT plants. Advanced treatment is assumed to include preozonation, intermediate ozonation, and biological filtration. Overall cost savings is estimated to be about CNY220 million per year.

Table A12.1: Economic Internal Rate of Return of Wastewater Treatment Component

(CNY million)

Year	Capital Cost	O&M Cost	Total Cost	Incremental Revenues	Recycled Water	Total Benefits	Base Case	Net Benefits			
								Costs Plus 10% (a)	Benefits Less 10% (b)	Combined (a) and (b) 10%	Delay in the sewers
2001	7.7		7.7	0.0		0.0	-7.7	-8.5	-7.7	-8.5	-7.7
2002	13.8		13.8	0.0		0.0	-13.8	-15.1	-13.8	-15.1	-13.8
2003	85.7	0.0	85.7	0.0		0.0	-85.7	-94.3	-85.7	-94.3	-85.7
2004	78.4	0.0	78.4	0.0		0.0	-78.4	-86.2	-78.4	-86.2	-78.4
2005	70.7	0.0	70.7	0.0		0.0	-70.7	-77.8	-70.7	-77.8	-70.7
2006	26.3	4.0	30.3	15.7		15.7	-14.6	-17.6	-16.1	-19.2	-14.6
2007		6.9	6.9	28.4		28.4	21.5	20.8	18.7	18.0	21.5
2008		6.9	6.9	45.6		45.6	38.8	38.1	34.2	33.5	21.5
2009		13.5	13.5	73.0		73.0	59.5	58.1	52.2	50.8	21.5
2010	0.0	13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	59.5
2011		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	59.5
2012		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2013		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2014		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2015	61.9	13.5	75.4	91.3	8.6	99.9	24.5	16.9	14.5	6.9	24.5
2016		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2017		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2018		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2019		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2020	0.0	13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2021		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2022		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2023		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2024		13.5	13.5	91.3	8.6	99.9	86.4	85.0	76.4	75.0	86.4
2025	-30.5	13.5	-17.0	91.3	8.6	99.9	116.9	118.6	106.9	108.6	116.9
EIRR							16.2%	14.8%	14.6%	13.2%	14.2%
NPV at 12%							78.4	54.6	46.7	22.9	41.3

Table A12.2 : Economic Internal Rate of Return of Water Resources Protection Component

(CNY million)

Year	Capital Cost	O&M Cost	Total Cost	Resource Cost Savings	Water Treatment Cost Savings	Total Benefits	Base Case	Net Benefits		Combined (a) and (b)
								Costs Plus 10% (a)	Revenues Less 10% (b)	
2001	58.9		58.9	0.0		0.0	-58.9	-64.8	-58.9	-64.8
2002	268.7		268.7	0.0		0.0	-268.7	-295.6	-268.7	-295.6
2003	416.3		416.3	0.0		0.0	-416.3	-457.9	-416.3	-457.9
2004	366.8	17.4	384.2	65.0	44.7	109.7	-274.5	-312.9	-285.5	-323.9
2005	252.2	2.3	254.5	155.0	48.3	203.3	-51.2	-76.7	-71.5	-97.0
2006	190.3	51.6	241.9	197.5	50.0	247.5	5.6	-18.6	-19.2	-43.3
2007	208.3	47.8	256.1	315.0	54.7	369.7	113.6	88.0	76.6	51.0
2008	145.4	79.6	225.0	327.5	55.2	382.7	157.7	135.2	119.4	96.9
2009		44.1	44.1	342.5	55.8	398.3	354.2	349.8	314.4	310.0
2010		44.1	44.1	357.5	56.4	413.9	369.8	365.4	328.4	324.0
2011		44.1	44.1	372.5	57.0	429.5	385.4	381.0	342.5	338.0
2012		44.1	44.1	387.5	57.6	445.1	401.0	396.6	356.5	352.1
2013		44.1	44.1	402.5	58.2	460.7	416.6	412.2	370.5	366.1
2014		44.1	44.1	417.5	58.8	476.3	432.2	427.8	384.6	380.2
2015		44.1	44.1	432.5	59.4	491.9	447.8	443.4	398.6	394.2
2016		44.1	44.1	447.5	60.0	507.5	463.4	459.0	412.7	408.2
2017		44.1	44.1	462.5	60.6	523.1	479.0	474.6	426.7	422.3
2018		44.1	44.1	477.5	61.2	538.7	494.6	490.2	440.7	436.3
2019		44.1	44.1	492.5	61.8	554.3	510.2	505.8	454.8	450.4
2020		44.1	44.1	507.5	62.4	569.9	525.8	521.4	468.8	464.4
2021		44.1	44.1	522.5	63.0	585.5	541.4	537.0	482.9	478.4
2022		44.1	44.1	537.5	63.6	601.1	557.0	552.6	496.9	492.5
2023		44.1	44.1	552.5	64.2	616.7	572.6	568.2	510.9	506.5
2024		44.1	44.1	567.5	64.8	632.3	588.2	583.8	525.0	520.6
2025	-572.0	44.1	-527.9	582.5	65.4	647.9	1175.8	1228.6	1111.0	1163.8
EIRR							18.3%	16.6%	16.4%	14.8%
NPV @ 12%							647.3	509.9	445.1	307.7

ENVIRONMENTAL IMPACT ANALYSIS

A. Introduction

1. The Tianjin Wastewater Treatment and Water Resources Protection Project (the Project) comprises two subprojects. The Wastewater Treatment (WWT) component, which Tianjin Sewerage Company (TSC) implemented, involved construction of a WWT plant with a capacity of 100,000 tons (t) a day in Beicang, 15.9 kilometers (km) of sewage collection pipes, 0.8 km of sewage discharge pipe, and one pump station. The Water Resources Protection (WRP) component, for which Tianjin Municipal Luanhe Drinking Water Sources Protection Engineering Ltd. (TML) implemented, included three subcomponents: (i) construction of a 34.2 km three-barrel concrete box culvert to carry raw water from the Yuqiao Reservoir to avoid pollution of the water from the Zhou River, (ii) improvement of the existing open channel by undertaking complete lining and necessary repair, and (iii) control of pollution from villages and fish ponds in areas surrounding the Yuqiao Reservoir and provision of a greenbelt around the reservoir for nonpoint pollution sources and erosion control.

2. The Project was classified by the Asian Development Bank (ADB) as environmental Category A. In February 2000, a summary environmental impact assessment (EIA) was submitted to ADB for information, which was based on the full EIA reports for the two components approved by the State Environment Protection Administration in January 2000. The summary EIA concluded that the Project would have substantial positive environmental benefits for the environment and drinking water quality in Tianjin and that adverse impacts on the physical and natural environment would be insignificant and could be mitigated through appropriate measures.

B. Environmental Protection and Management

3. The Tianjin Municipal Government (TMG) and the project management office were responsible for the Project's overall coordination of environmental management and supervision. Specific environmental matters for the two components were overseen by TSC and TML, respectively.

4. **WWT Component.** In general, adverse environmental impacts were mitigated adequately during construction through appropriate measures as proposed in the EIA. During construction, two staff members were appointed to oversee the implementation of the environmental management plan. TSC ensured an effective coordination and reporting arrangement with contractors to deal with environmental matters. Monitoring for noise and ambient air was carried out and reported effectively by a qualified monitoring institute. Total investment for environmental protection is estimated at CNY3.5 million.

5. **WRP Component.** Adverse environmental impacts were generally mitigated during construction through appropriate measures as proposed in the EIA. TML was responsible for implementing environmental management for this component. An integrated pollution control plan for the Yuqiao Reservoir was developed jointly by Tianjin Environmental Design and Research Institute and China Academy of Environmental Sciences in 2001 and was revised in 2004. Designated TML personnel coordinated and oversaw environmental matters during construction. Qualified institutes and local authorized stations were engaged in environmental monitoring for water quality, noise, air, and soil erosion. Total investment for environmental protection was estimated at CNY152.9 million.

C. Environmental Monitoring

6. Environmental monitoring during construction occurred at two levels: (i) on-site daily environmental monitoring by contractors and construction supervision companies, and (ii) periodic environmental monitoring by specialists who took samples for analysis in accordance with monitoring procedures and guidelines.

7. **WWT Component.** The monitoring was guided by a short monitoring plan prepared by Tianjin Beicang Environmental Protection Monitoring Center. Impacts of air, noise, and solid wastes were monitored and reported in annual environmental reports. A plan was created for environmental monitoring during operation, specially covering monitoring for WWT plant effluent and sludge.

8. **WRP Component.** The detailed monitoring plan for construction of the open channel lining and box culvert was developed by Tianjin Water Resources Investigation and Design Institute in March 2002 and reviewed by international consultants. Monitoring was carried out during construction by: (i) Tianjin Municipal Environmental Monitoring Center for water quality monitoring in the Yuqiao Reservoir, Sanjiadian village, and rural hospitals; (ii) TML monitoring during construction of water conveyance; (iii) Ji County Environmental Protection Bureau for water, noise, and air along box culvert alignments; and (iv) contractors for workers' health and living conditions. All monitoring results were reflected in annual environmental reports. The Yuqiao Reservoir Management Office will regularly monitor water quality in the reservoir, open channel, and box culvert during operation.

D. Implementation of Mitigation Measures

9. **WWT Component.** Appropriate measures were taken to mitigate environmental impacts associated with the construction phase. Odor from the plant has been remedied through greenbelt plantation, rational facility arrangements, and covering facilities. However, problems with sludge disposal and WWT plant effluent have yet to be addressed.

10. **WRP Component.** Appropriate measures were taken to mitigate environmental impacts that occurred during construction. As integral component parts, effective protective measures improved the water quality of the Yuqiao Reservoir and controlled soil erosion and sedimentation along the open channel. The following measures particularly improved environmental benefits.

- (i) **Rural Domestic Wastes Management.** Initiatives included treatment of rural domestic and medical waste to improve the rural community environment and to prevent contaminants from polluting reservoir water. A pilot factory was built for feces decontamination and will be put into operation with the completion of supporting facilities. One out of 9 proposed facilities for medical waste treatment has been built, and over 27,442 household toilets were renovated to reduce nonpoint pollution.
- (ii) **Elimination of Fishponds.** Approximately 970 hectares of fish ponds were removed, which were located below the elevation of a 22-meter protective dike at the inlet of the Yuqiao Reservoir. The remaining fishponds located outside of the dike will be improved and regulated according to the overall reservoir management plan.

- (iii) **Soil and Water Conservation.** Greenbelts were built around the Yuqiao Reservoir and along the open channel alignment. Engineering structures, including check dams, terraces, and protective forests, were constructed around the reservoir to control erosion in slopes and gullies.

E. Environmental Impacts and Benefits

1. Impacts Associated with the Construction Phase

11. During construction, the contractors used low-noise equipment and adopted noise mitigation measures to reduce noise at sensitive locations. Solid waste was disposed of properly in local assigned sites. Air pollution from machinery was reported to be insignificant. Dust from excavation and transport was controlled through covering and water spraying. Sedimentation relating to the open channel construction was managed through a well-designed schedule and protective technologies.

2. Impacts Associated with the Operational Phase

12. **WWT Plant Effluent.** The first phase of the Beicang WWT plant was put into trial operation in 2006. Monitoring showed that the plant's effluent hardly reaches the designated national standard for wastewater discharge.¹⁵ The unsatisfied discharge standard resulted from low wastewater receive rate. The plant was designed a treatment capacity of 100,000 tons (t) a day, comprising approximately 60% industrial and 40% domestic wastewater. However, the plant presently receives only 20,000–30,000 t/day of wastewater due to incomplete sewage collection systems. Moreover, the wastewater is industrial effluents, which is above national wastewater standards.¹⁶ Highly polluting industrial wastewater overloaded the plant's capacity and made the effluent seldom below the discharge standards. TSC will coordinate with Tianjin Environmental Protection Bureau and obtain support from TMG to ensure that industrial wastewater discharges comply with national standards.

13. **Sludge Disposal.** Presently, a total amount of 25 t/day of dewatered sludge is transported to a temporary landfill. Meanwhile, there is a discussion to use dewatered sludge as supplementary feed to a local power company. TMG will prepare a comprehensive landfill and sludge management plan to receive the city's solid wastes, including the WWT plant's sludge. However, the People's Republic of China's approach to handling wastewater sludge is still in transition, and cost is a major issue. ADB is supporting the Government in promoting cost-efficient and sustainable use of wastewater sludge, including pilot testing implementation guidelines through the recently approved Urban Wastewater Reuse and Sludge Utilization Policy Study.¹⁷

3. Environmental Benefits

14. The sanitation and living conditions of rural communities around the Yuqiao Reservoir have been improved. Regular monitoring shows that the reservoir's water quality sustains Class III of National Environmental Quality Standards for Surface Water.¹⁸ Essential water supply to Tianjin Municipality is stable and sustainable. The Beicang WWT plant receives 20,000–30,000

¹⁵ Class II, GB18918-2002: National Standards for Pollutant Discharge from Municipal Wastewater Treatment Plants.

¹⁶ Class III, GB8978-1996: National Comprehensive Standards for Wastewater Discharge.

¹⁷ TA7083-PRC.

¹⁸ GB3838-2002.

t/day of wastewater and will treat 100,000t/day when the sewer system is fully connected. According to testing, water contaminants were reduced by over 90% after treatment. In this connection, water pollution in the related drainage systems is significantly reduced.

F. Conclusions

15. The Project improved the living environment of residents in areas it serves and contributes significantly to the water pollution control program of the Hai River Basin. The Project safeguards the drinking water quality for Tianjin Municipality presently and will continue to do so in future. The Project reduced pollution in the lower reaches of the Yongdingxin River, and the WWT component is an important link in overall sewerage management for Tianjin's urban areas.

16. During construction, the Executing Agency, the Implementing Agency, and contractors fulfilled their obligation to protect the environment and to implement mitigation measures in their construction schemes. The adverse effects of project construction on the surrounding environment were therefore minimized.

EVALUATION OF LAND ACQUISITION AND RESETTLEMENT ACTIVITIES

A. Background

1. The Tianjin Wastewater Treatment and Water Resources Protection Project (the Project) comprises two components: (i) wastewater treatment (WWT), and (ii) water resources protection (WRP). The WWT component consists of wastewater collection and treatment facilities within the Beicang service area of urban Tianjin. It comprises trunk sewers and a sewage pump station to serve the newly developing portion of Beicang and a WWT plant to serve the eastern portion and the existing sewered area in its central portion. The second component encompasses three major elements: (i) a new closed box culvert to carry raw water from the Yuqiao Reservoir to the Jiuwangzhuang Gate to avoid pollution from the Zhou River and to reduce water loss, (ii) improvements to the existing open channel from Jiuwangzhuang Gate to the Dazhangzhuang Pump Station, and (iii) improvements to reduce water pollution within the Yuqiao Reservoir.

2. The earliest resettlement plans for both components were finished in April 2000 and approved by the Asian Development Bank in May 2000. The plans' data were sourced from the Project's feasibility research report and the house demolition survey completed during the project preparatory technical assistance. Following the technical design change in the Project's preliminary design report, the revised resettlement plans for both components were submitted in October 2002 and March 2002, respectively.

3. However, the technical design of the Yuqiao Reservoir subcomponent was changed again. It was finally approved by Tianjin Municipal Government (TMG) in September 2004, delaying commencement of work. The annual Loan Review Mission then found potential resettlement risks and required a detailed resettlement and alternative livelihoods development plan. Tianjin Municipal Luanhe Drinking Water Resources Protection Engineering Ltd. (TML) submitted this plan three times, as ADB rejected it due to a lack of data based on a detailed measurement survey, public participation, and extensive consultation. The plan's final version was approved in February 2007.

B. Scope of Land Acquisition and Resettlement

4. According to the revised WWT resettlement plan, the Project's construction involves land acquisition and ground attachments. Total land acquisition was estimated to be 411 mu, which included land required for construction of the Beicang WWT plant and a pump station. The impact of land loss was estimated to be equivalent to the loss of livelihood for 18 persons relocated across six villages. In addition, the land to be temporarily occupied was estimated as 48 mu. Most WWT resettlement activities were taken between July 2002 and October 2002 for the WWT plant and March 2005 for the pump station. 425 mu of land was permanently acquired, which was a 3% increase from the 411 mu noted in the revised resettlement plan, but the amount of affected people was the same. A building totaling 990 square meters (m²) was demolished, which was not anticipated in the revised resettlement plan. However, the impact was limited as it was a deserted office building belonging to a nearly bankrupt company. No special land was demanded for temporary use because the pipeline networks followed the construction of a new road.

Table A14.1: Project Impacts: Actual Amount versus Revised Resettlement Plan (WWT Component)

Item		Unit	WWT
A. Permanent land acquisition	Revised resettlement plan	mu	411
	Actual	mu	425
	Actual versus resettlement plan	%	103%
B. Building demolition	Revised resettlement plan	m ²	0
	Actual	m ²	990
	Actual versus resettlement plan	%	NA
C. Affected persons			
	1. by land acquisition		
	Revised resettlement plan	persons	18
	Actual	persons	18
	Actual versus resettlement plan	%	100%
	2. by house demolition		
	Revised resettlement plan	persons	0
	Actual	persons	0
	Actual versus resettlement plan	%	NA
D. Temporary land occupation	Revised resettlement plan	mu	48
	Actual	mu	0
	Actual versus resettlement plan	%	0%

m² = square meters, NA = not applicable, WWT = wastewater treatment

Sources: Revised resettlement plan and Tianjin Sewerage Company.

5. According to the revised WRP resettlement plan, construction of the box culvert would involve land acquisition, demolishing buildings, and resettlement of affected persons. Land acquisition was estimated to be 1,070 mu, and the impact of land loss was estimated to be equivalent to the loss of livelihood for 511 persons. About 15,612 m² of buildings would be demolished, requiring about 362 people to be relocated. The land to be temporarily occupied was estimated to be 7935 mu. Most resettlement activities for the box culvert construction were undertaken between November 2001 and September 2002, and July 2005 and October 2005. About 1,147 mu of land was permanently acquired, which is 107% of that in the revised resettlement plan, and 10,889 m² of buildings were demolished, which is 70% of that in the revised resettlement plan. This occurred because some villages refused to move, and the culvert route had to be changed. However, the actual number of affected persons by house relocation was increased by 12%—to 404—since the number was underestimated in the revised resettlement plan. In addition, 6,821 mu of land was temporarily used during the construction, which is 86% of that in the revised resettlement plan. This decrease was partly attributed to the change of construction methodology during implementation.

6. Also according to the revised WRP resettlement plan, project construction for the open channel would involve land acquisition, demolishing buildings, and resettlement of affected persons. Land acquisition was estimated to be 759 mu. The impact of land loss was estimated to be equivalent to the loss of livelihood for 465 persons. About 3,148 m² of buildings were to be demolished, but the number of people to be relocated and the amount of land to be temporarily occupied were not estimated in the revised resettlement plan. Most resettlement activities for the open channel were undertaken between December 2001 and May 2004. About 361 mu of land was permanently acquired, which is 48% of that in the revised resettlement plan due to the technical design change that narrowed the open channel's buffer zone to minimize impact. Accordingly, the actual area of house demolition was only 80 m², and only nine people were

affected. The amount of actual temporarily occupied land was unknown because the compensation for temporary land occupation was included in lump work for various construction package contractors, and TML did not collect detailed information.

**Table A14.2: Project Impacts: Actual Amount versus Revised Resettlement Plan
(WRP Component: Box Culvert and Open Channel)**

Item		Unit	Box Culvert	Open Channel
A. Permanent land acquisition	Revised resettlement plan	mu	1,070	759
	Actual	mu	1,147	361
	Actual versus resettlement plan	%	107%	48%
B. Building demolition	Revised resettlement plan	m ²	15,612	3,148
	Actual	m ²	10,889	80
	Actual versus resettlement plan	%	70%	3%
C. Affected persons				
	1. by land acquisition			
	Revised resettlement plan	persons	511	465
	Actual	persons	NA	NA
	Actual versus resettlement plan	%	NA	NA
	2. by house demolition			
	Revised resettlement plan	persons	362	NA
	Actual	persons	404	9
	Actual versus resettlement plan	%	112%	NA
D. Temporary land occupation	Revised resettlement plan	mu	7,935	NA
	Actual	mu	6,821	NA
	Actual versus resettlement plan	%	86%	NA

m² = square meters, NA = not applicable

Sources: Revised resettlement plan and TML.

7. The Yuqiao Reservoir subcomponent included fishpond elimination, the change of farmland into forests, and forestry recollection. According to the Yuqiao Reservoir Resettlement and Alternative Livelihood plan (YRRALP), since all the pertinent land had been acquired by Tianjin Water Bureau in 1959, 1973, and 1979, and all the affected villages and villagers had been compensated, the present subcomponent would not include any permanent land acquisition or temporary land occupation but would include the usage and management change of state-owned land. However, following the Asian Development Bank's resettlement policy, the affected collectives or persons owning the customary rights to land deserve compensation. Also according to the YRRALP, the fishponds estimated to be eliminated totaled 24,058 mu. Affected persons affected by fishpond elimination were estimated to be 1,659. Farmland area to be changed to forestry was estimated as 4,944 mu, with 7,810 persons affected.

8. Resettlement activities for this subcomponent commenced in late 2006. By 30 April 2008, 14,551 mu of fishponds inside the Wangguofan Dike were eliminated, accounting for 60% of those in the plan. Accordingly, affected persons numbered 764, only 46% of those estimated, but fishponds outside the Wangguofan Dike were not eliminated. Considering the livelihood of local people and that current water quality has met the requirement for water supply, TML and the Ji County Government decided to enhance fishpond management outside of Wangguofan Dike instead of eliminating them. As a result, the impact of fishpond elimination has been largely mitigated as compared with that in the plan.

9. Conversion of farmland to forestry was also changed. TML would not force all the farmland under the 22-meter contour to be converted. Instead, locals were encouraged to plant trees along the reservoir as long as the planted trees helped to improve the Yuqiao Reservoir's water quality. By 30 April 2008, 9,136 mu land was planted with trees, thanks to the subsidy and benefit-sharing policy of tree planting.

**Table A14.3: Project Impacts: Actual Amount versus Revised Resettlement Plan
(Component B: Yuqiao Reservoir Subcomponent)**

Item		Unit	Yuqiao Reservoir Subcomponent
A. Fishpond elimination	YRRALP	mu	24,058
	Actual	mu	14,551
	Actual versus resettlement plan	%	60%
B. Farmland to forestry	YRRALP	mu	4,944
	Actual	mu	9,136
	Actual versus resettlement plan	%	NA
C. Affected persons			
1. by fishpond elimination	YRRALP	persons	1,659
	Actual	persons	764
	Actual versus resettlement plan	%	46%
2. by farmland to forestry	YRRALP	persons	7,810
	Actual	persons	NA
	Actual versus resettlement plan	%	NA

NA = not applicable, YRRALP = Yuqiao Reservoir Resettlement and Alternative Livelihood Plan
Sources: YRRALP and TML.

C. Resettlement Policy and Compensation Rates

10. Land acquisition and resettlement was implemented based on the revised resettlement plans and the YRRALP; the 1998 Land Administration Law; and the following government rules, regulations, and agreements: (i) land compensation rates agreement on the box culvert and open channel among TMG, Ji County Government, and Baodi District Government (5 November 2001); (ii) temporary regulation of Tianjin Municipal Land Acquisition Management issued in 2000; (iii) the No. 22 Circular for compensation rates for house demolition issued by the Ji County Government in 1999; and (iv) the area land price reference issued by Tianjin Land and Housing Bureau in 2005. Table A14.4 compares the actual land compensation rates under various subcomponents with the rates outlined in the revised resettlement plans. Wastewater treatment plants carried out the compensation rate as planned in the revised resettlement plan. The actual compensation rates for the box culvert and open channel subcomponents were complex. The Executing Agency's (EA) explanation for the main difference between the actual and resettlement plan compensation rates was that the consultant misstated the comprehensive compensation rate as land compensation rate. The actual compensation rate for farmland occupied in the first phase of the box culvert and open channel subcomponents was CNY10,000/mu, including a young crops compensation of CNY500/mu. This means that the land compensation and resettlement subsidy is 19 multiples of the average annual output value. The actual compensation rate for farmland occupied in the second phase was increased to CNY20,000/mu or CNY35,000/mu, according to location. Further, for the extension of temporary land occupation after 2005, an additional CNY500/mu was given by TML.

Table A14.4: Compensation Rates

Table A-1-1 Compensation Rates						
Wastewater Treatment Plants			Box Culvert and Open Channel Subcomponents			
Items	RP	Actual	RP	Actual		
				Box Culvert		Open Channel
				Ji County	Baodi District	
A. Permanent Land Acquisition (CNY/mu)						
Wheat land				1st phase:		10,000
Dry land				10,000;		8,500
Nonfarm land	30,000	30,000	17,000	2nd phase:		
				20,000 or 35,000	10,000	4,000
B. Temporary Land Use (CNY/mu)						
	3,500 (2 yr.)	—	4,000 (4 yr.)	2,000 (3 yr.)	1,000 (2 yr.)	—*
C. Building Demolition (CNY)						
Houses		—	10,000– 12,000/unit		—	150 & 300/m ²
Other buildings		1,000/m ²	3,000/unit	175–686/m ²	—	
Residential land		—	20,000/mu	—	—	—
Transition allowance		—		Household: 12/m ² ; Enterprise: 25/m ²	—	—
Relocation subsidy	—	—		Household: 2,000; Enterprise: 50,000	—	—

Source: YRRALP and monitoring and evaluation reports.

11. According to the YRRALP, six levels (CNY1,500/mu–3,000/mu) of compensation rates were set for fishpond elimination as per various conditions of fishponds. The actual compensation was implemented on the basis of those in the plan. About 85.5% of all eliminated fishponds were compensated at CNY3,000/mu, and 11.2% at CNY2,700/mu. Only 3.3% were lower than CNY2,700/mu.

D. Resettlement Measures and Income Restoration

12. All relocated households received compensation for buildings and the attached properties. Seventy-nine households reconstructed their houses. In addition to cash compensation, affected households were provided new housing plots in the same village. In these, infrastructure did not change, so affected persons did not have to adapt to a new environment. Affected households also received relocation subsidies and transition allowances. According to a monitoring and evaluation (M&E) report, most relocated households thought the compensation was adequate and that the new houses were better than the old.

13. According to an M&E report, the village collectives affected by the WWT plant kept a portion of the compensation for public infrastructure, collective enterprise development, and land development. The rest was given to the affected households, and the affected households expressed their satisfaction.

14. Most villages affected by permanent land acquisition from the box culvert and open channel subcomponents reallocated the remaining land among the villagers. Also, village

collectives kept a portion of the compensation for public infrastructure, with the rest allocated among all villagers. Since all of the villagers shared a certain part of compensation, the cash per household was not adequate, but affected persons gained an equivalent amount of farmland as other villagers. In fact, the box culvert's impact was not permanent although affected persons were given compensation for permanent land acquisition. Since the box culvert was about 2–4 meters underground, local farmers still could reclaim the land after its construction. Affected villages received compensation for the loss of land ownership, but at the same time, they maintained land use rights.

15. Compensation was allocated to villages and households affected by the fishpond elimination that had reached an agreement on compensation distribution schemes. For the fishponds exploited by households, 23 village collectives kept the fishpond administration fee and gave rest to affected households. Eighteen village collectives kept a certain percentage of compensation (e.g., 7–60%) or took a fixed amount or rate (e.g., CNY15,000 or CNY10/mu). For the fishponds exploited by village collectives, village collectives often kept a majority of compensation, although five villages gave all to the affected households as the fishponds were small and the villages wealthy. Seven villages kept over 50% of compensation, and four villages refunded the affected households the fishponds' rent or gave them CNY300/mu for their investment. So far, 10 village collectives could not reach an agreement with affected households on compensation distribution schemes. The mission urged the EA and the Implementing Agencies (IAs) to coordinate with local governments to facilitate the agreements so the affected households can receive the compensation as early as possible. M&E should continue to monitor the progress of compensation delivery.

16. Village collectives often reserved part of the compensation for public infrastructure and allocated the rest to villagers. Affected households often used the compensation for living expenses and building new homes. Some also used it as start-up capital for new careers, e.g., duck breeding, goat breeding, or buying construction equipment. Most affected households were active in finding alternative incomes, the most common new jobs related to construction or local enterprise. Many affected households with large fishponds were construction contractors, employees of state-owned enterprises, or millionaires from drawing sand illegally. Unsurprisingly, the impact of fishpond elimination on these wealthy households was limited.

17. Besides cash compensation, affected persons from the Yuqiao Reservoir subcomponent will also receive CNY600 per person per year for 20 years. All affected persons have been allocated this fund twice since 2006, each for CNY300 per person. The local government also supported the improvement of public infrastructure and community facilities in the affected villages, e.g., irrigation systems, inner roads, and well digging. Cooperating with pertinent units, the Yuqiao Reservoir Training Center has provided various skill trainings 28 times since mid 2006, covering duck and cow breeding, vegetable and mushroom planting, and off-farm work skills.

18. The WWT plant did not affect any vulnerable groups. Vulnerable groups affected by the box culvert and open channel subcomponents were not identified during implementation. Fishpond elimination only affected one household with a female head. This household was not poor; thus, it did not receive any special support. The area of the eliminated fishpond was 15 mu. Before the fishpond elimination, the female head took care of the fishpond, and her son, daughter, and daughter-in-law all had steady off-farm work. After the elimination, the female head found a new job in a village enterprise.

E. Land Acquisition and Resettlement Cost

19. The actual resettlement cost of the WWT component is 110% of that estimated in the revised resettlement plan. The reason for the increase is the increase in permanent land acquisition and the compensation for demolition of an office building that was not included in the revised resettlement plan.

Table A14.5: Variation of Resettlement Cost, WWT Component
(CNY million)

Item	WWT		
	Revised RP	Actual	Variation (%)
Permanent land acquisition	12.330	12.75	103%
Building demolition	0	1.00	—
Temporary land use, affected facilities, and other	0.168	0	0%
Total	12.498	13.75	110%

RP = resettlement plan, WWT = wastewater treatment

Source: Revised resettlement plan and Tianjin Sewerage Company.

20. The actual resettlement cost of the box culvert and open channel subcomponents is 116% of that estimated in the revised resettlement plan. The actual cost of land acquisition is only 58% of that estimated due to the technical design change for open channel. However, the compensation for building demolition, temporary land use, affected facilities, and other increased by 46%. This is attributed to the underestimation in building demolition when revising the resettlement plan.

Table A14.6: Variation of Resettlement Cost, Box Culvert and Open Channel Subcomponents
(CNY million)

Item	Box Culvert & Open Channel		
	Revised RP	Actual	Variation (%)
1. Permanent Land Acquisition	28.39	16.52	58%
2. Building Demolition	12.11	77.56	146%
3. Temporary Land Use, Affected Facilities, and Others	40.93		
Total	81.43	94.08	116%

RP = resettlement plan

Source: Revised resettlement plan and TML.

21. The actual resettlement cost of Yuqiao Reservoir subcomponent is CNY37.12 million, accounting for 54% of CNY60.14 million estimated in the YRRALP. This is mainly due to a total 9,507 mu of fishponds outside Wangguofan Dike that were not eliminated.

22. Consequently, the Project's total actual resettlement cost for both components totals CNY144.94 million, which accounts for 94% of the CNY154.0677 million estimated in the revised resettlement plan and YRRALP.

F. Institutional Arrangement

23. Resettlement offices under the Tianjin Sewerage Company (TSC) and TML were responsible for coordination, fundraising, and internal M&E of land acquisition and resettlement for both components. Beicang District, Ji County, and Baodi District all established land

acquisition and resettlement coordination offices and were responsible for implementation of land acquisition, house demolition, and fishpond elimination.

G. M&E

24. The Tianjin Statistical Information Service Center was the external agency that conducted independent WWT M&E. The center submitted a baseline survey report in May 2002 and subsequently submitted resettlement M&E reports in March 2003 and February 2004. In May 2005, a resettlement completion report for WWT was also submitted to ADB.

25. The center also prepared and submitted the first M&E report for water resources protection in October 2002. Subsequently, the Tianjin Rural Survey Team was engaged as the external M&E agency, which submitted six resettlement M&E reports in June 2003, December 2003, August 2004, April 2005, October 2005, and May 2007. The latest resettlement M&E report for the Yuqiao Reservoir subcomponent was submitted during the Project Completion Review Mission.

26. Although ADB emphasized that evaluation of income restoration be included in the M&E reports, they do not monitor the income and expenditure of those affected, particularly for those households affected by the Yuqiao Reservoir subcomponent. Therefore, it is difficult to conclude the income restoration of affected households.

H. Participation and Information Disclosure

27. Participation and transparency were key principles throughout the entire process of land acquisition, house demolition, and relocation. The Yuqiao Reservoir subcomponent had the best performance in terms of participation and information disclosure. Affected persons (i) participated in measurement of affected lands and properties and endorsed the inventory; (ii) understood the scope of the Project's impact, compensation policy, and compensation rates; and (iii) discussed relocation sites, compensation, and land allocation schemes in village meetings. However, some affected persons rejected the land acquisition or house demolition in their villages and were unsatisfied with the proposed compensation distribution schemes. These affected persons and village collectives may sue.

I. Lessons Learned and Actions to Be Taken

28. The land acquisition and resettlement activities under the WWT component and the box culvert and open channel subcomponents of the WRP component have been completed. The resettlement activities of the Yuqiao Reservoir subcomponent have not fully been completed, although the fishponds were eliminated inside the Wangguofan Dike. ADB urged the EA and the IA to coordinate with local governments to (i) facilitate the compensation agreements between village collectives and affected households in those 10 villages, (ii) continue to implement the plan's resettlement and rehabilitation measures to improve the livelihood of households affected by Yuqiao Reservoir subcomponent, and (iii) enforce the policy of subsidy and benefit sharing for those households who were encouraged to plant trees along the Yuqiao Reservoir. TMG and TML committed to following ADB's advice and to ensuring that all requirements are met.

29. Many dialogues among ADB, the EA, and the IA have occurred during the resettlement implementation, particularly for the Yuqiao Reservoir subcomponent. Close monitoring by ADB during implementation was considered essential. The scope of land acquisition and resettlement for future projects should have been identified by considering the difficulties of implementation

and mitigation of project impacts to local communities.

30. Participation and consultation were important during fishpond elimination and conversion of farmland to forestry. Feedback from affected households, disclosure of the draft resettlement and compensation policy, and timely adjustments to the resettlement plans enabled the subcomponent to be continued.

31. The M&E reports were unsatisfactory because they did not provide necessary information required by ADB. Although ADB emphasized that evaluation of income restoration should be included in the M&E report, the M&E reports still did not monitor the income and expenditure of those affected, particularly of those households affected by the Yuqiao Reservoir subcomponent. TMG promised that the external resettlement M&E for the Yuqiao Reservoir subcomponent will continue to be conducted annually to monitor the subsequent compensation delivery, implementation of those measures in the YRRALP, and the income restoration of affected households as compared with those in the baseline survey. It was agreed that the next M&E report for the Yuqiao Reservoir subcomponent will be submitted to ADB before 31 March 2009.

SOCIAL IMPACT AND POVERTY REDUCTION IN THE PROJECT AREA

A. Introduction

1. In the development of Tianjin as a major industrial center, raw water supply, economic growth, and the population's health and well-being were already threatened by the increasing pollution in the Hai River Basin. To improve the urban environment and public health, promote sustainable socioeconomic development, and reduce poverty by decreasing environmental contamination and protecting water resources, the Tianjin Wastewater Treatment and Water Resources Protection Project (the Project) was launched in late of 2001 and completed at the end of June 2007.

2. The Project had two components: (i) wastewater treatment (WWT), and (ii) water resources protection (WRP). The WWT component created wastewater collection and treatment facilities within the Beicang service area of urban Tianjin. The WRP component consisted of three subcomponents: (i) a new closed box culvert that carries raw water from the Yuqiao Reservoir to the Jiuwangzhuang Gate to avoid polluting the Zhou River and to reduce water loss; (ii) improvements to the existing open channel from the Jiuwangzhuang Gate to the Dazhangzhuang Pump Station, and (iii) improvements to reduce water pollution within the Yuqiao Reservoir.

B. Environment Improvement

3. The improvement of the water environment directly benefits 10.8 million Tianjin residents through the capability improvement of urban WWT and the protection of the city's sole raw water supply.

4. After the Project, most locals witnessed the change in the water environment. About 77.4% of 93 surveyed urban residents felt that drinking water quality had improved, and half of them felt that water pollution had decreased. Of 111 surveyed rural residents around Yuqiao Reservoir, 78.4% claimed that the reservoir's water quality and surrounding environment had improved.

5. During the construction and operation period, effective measures were taken to mitigate the related environmental impacts. The noise level and air quality were both generally controlled within the standards. Of 289 persons surveyed, 80.9% expressed that they had not been affected by the dust, noise, odor, or land erosion caused by the Project's construction and operation.

C. Public Health

6. The WWT component improves the living condition of residents in areas it serves. WWT is an important link in the implementation of the overall sewerage development plan for urban Tianjin. The WRP component safeguards the drinking water quality of Tianjin's sole water supply source. It helps to raise living standards and to improve public health. For example, with the construction of the box culvert, the Zhou River reverted to its original function of carrying away storm runoff and wastewater from neighboring communities as well as its base flow. These communities were thus released from the increased incidence of waterborne diseases and threats to public health, as wastewater stopped accumulating in ponds and ditches. The incidence ratio of waterborne diseases, such as cholera and hepatitis, decreased by 40% and 64% from 2001 to 2007, respectively, according to the Tianjin Disease Control and Prevention

Center, which largely attributed this decline to improved drinking water quality and wastewater management.

7. Most people surveyed recognized the Project's benefits. Of 289 surveyed, 65.7% thought the Project improved their living conditions, 43.6% thought it decreased disease, and 11.4% thought it improved their working conditions. Of 70 persons who had responded with their household medical expenditures before and after the Project, 34.3% claimed that medical expenditures decreased, 48.6% had no change, while 17.1% saw an increase. These data support an improvement of public health.

D. Social Risks Control

8. Main social risks often come from inappropriate resettlement. In this Project, wide consultations and negotiations were carried out during the resettlement planning and implementation. This helped local people to understand the Project as well as its resettlement policies, which promoted smooth project progress and mitigated potential social risks. Compensation for land loss and house reconstruction has reached affected people; of 191 farmers, only about 12.0% felt unsatisfactory about the land loss compensation, while 82.2% felt good and 5.8% felt very good. Also, according to the resettlement monitoring and evaluation report, most affected people were satisfied with their house reconstruction. Income and livelihood restoration schemes were implemented, and the income and livelihood of affected people was effectively restored.

E. Employment

9. Directly, the Project provided jobs for local people during its construction and operation. The WWT plant hired 23 permanent staff members, 16 of whom were from the local area. The box culvert, open channel, and the Yuqiao Reservoir protection works temporarily employed 630,000, 160,000, and 55,000 persons, respectively, for their construction. These unskilled laborers were paid at the daily wage of CNY20–50.

10. Indirectly, the Project promoted local employment in the construction material and transport industries. Also, environmental improvement gave an advantage to the local government in attracting external investment to local industry and in promoting the local tourism industry, which created more job opportunities and benefited local people (Table A15.2).

F. Socioeconomic Growth

11. The improvement of the urban environment enhanced its competition ability; attracted more investment; and thus promoted economic growth, fiscal revenue, and local employment (Table A15.1). Socioeconomic development also improved the income of urban and rural households, as urban disposable income increased from CNY8,958.70 per capita in 2001 to CNY16,357.00 per capita in 2007 and the net income of farmers increased from CNY3,947.70 per capita in 2001 to CNY8,752.00 per capita in 2007.

Table A15.1 Socioeconomic Growth in Tianjin

Indicator	2001	2007	Growth Rate
Gross domestic product per capita	20,154.00	45,829.00	227.4%
Direct foreign investment (100 million \$)	21.30	115.20	540.8%
Fiscal revenue (100 million CNY)	163.60	1,204.30	736.1%
Employment (10,000 persons)	410.50	613.93	149.6%
Urban disposable income per capita (CNY)	8,958.70	16,357.00	182.6%
Per capita net income of farmers (CNY)	3,947.70	8,752.00	221.7%

Sources: 2002 Tianjin Statistical Yearbook; 2007 Tianjin Statistic Communiqué.

G. Poverty Reduction

12. First, increased local economic growth, employment, and income all helped to reduce local poverty. The annual fund used for the urban poor increased from CNY81.4 million in 2001 to CNY355.0 million in 2007. The number of urban residents entitled to basic living allowances decreased from more than 300,000 in 2001 to about 150,000 in 2007. The number of urban extremely poor households was reduced from 7,000 in 2001 to 5,756 in 2007. Also, socioeconomic development enhanced support to urban poor households. The lowest urban living safeguard standard increased from CNY241 per capita per month in 2001 to CNY330 in 2007, while the subsidy for urban extremely poor households increased to CNY88 per household per month in 2007 (See Table A15.2).

Table A15.2 Urban Poverty Comparison

Item	2001	2007	Growth Rate
Fund for urban poor (CNY million)	81.43	355.00	436.1%
Urban residents entitled to basic living allowances (,000 persons)	300	150	50.0%
Urban basic living allowances (CNY per person per month)	241	330	136.9%
Urban special poor household (households)	7,000	5,756	82.2%
Subsidy for urban special poor household (CNY per household per month)	50	88	176.0%

Sources: Tianjin Civil Affairs Bureau.

13. Second, the Project improved drinking water quality and wastewater services. The decrease in the incidence of waterborne diseases reduced spending on medical care and sick days taken, thus providing more income and mitigating disease-caused poverty. This is especially meaningful to poor households, who often lack nourishment and can be easily infected by diseases.

14. Third, the Project made sure that all persons were entitled to cleaner water and environment. Although the water price had increased from CNY2.2 per cubic meter (m³) in 2001 to CNY3.4/m³ in 2007, the water fee was less than 3% of the total income of households entitled to basic living allowances (Table A15.3). Assuming that basic water demand per household per month is 8 m³, the water fee per household per month increased from CNY17.6 in 2001 to CNY27.2 in 2007. However, the basic living allowance also increased, which made up for the water price increase. Taking the average household size as 2.95 persons and accounting for

other possible income sources, the percentage of water fee within the total income of poor households is less than 2.8% in 2007, about 0.3% more than that in 2001.

Table A15.3 Water Affordability by Urban Poverty

Item	2001	2007
Water price (CNY per cubic meter)	2.2	3.4
Water fee (CNY per household per month)	17.6	27.2
Urban basic living allowances (CNY per person per month)	241	330
Water fee/total income of poor households	2.5%	2.8%

15. Especially in the reservoir area, the local government supported the improvement of public infrastructure to reduce poverty. After 2006, about CNY7 million had been spent on digging 13 wells, setting up six transformers and 2,421 meters (m) of low-voltage power lines, and building 10,380 m of irrigation pipelines and 19.2 kilometers (km) of roads. These poverty reduction measures effectively improved the living and agricultural production conditions of local peoples and also increased their income (Table A15.4). For example, the well digging saved farmers' time in getting water and allowed them to have more time for agricultural production or off-farm work. In addition, the transport improvements made it convenient for farmers to travel to urban areas selling their agricultural products or finding off-farm work. By cooperating with pertinent units, the Yuqiao Reservoir Training Center provided various skill trainings 28 times after mid 2006. The training covered duck and cow breeding, vegetable and mushroom planting, and off-farm work skills. Further, various measures have been taken to restore the livelihoods and incomes of affected people and to avoid poverty impacts caused by the Project.

Table A15.4 Net Income Increase in Affected Reservoir Villages

Affected Township	Affected Villages Supported with Infrastructure Improvement	Net Income per Capita (CNY)		Growth Rate
		2006	2007	
Chuangfangyu	Xiaojuge	6,270	7,210	115.0%
Chutoulin	Beiwangzhuang	6,526	7,440	114.0%
	Dazhaoge	6,410	7,307	114.0%
	Peigezhuang	6,428	7,328	114.0%
Chengguan	Dongmafang	6,924	7,963	115.0%
	Sanjiadian	6,868	7,830	114.0%
	Ximafang	6,596	7,519	114.0%
	Xiazhuangzi	6,676	7,595	113.8%
Mashenqiao	Dajie	5,370	6,180	115.1%
	Fuyu	4,460	5,000	112.1%
	Mashantun	5,000	5,700	114.0%
	Mumazhuang	4,480	5,000	111.6%
	Qijiazhuang	4,460	5,100	114.3%
	Sunjiazhuang	5,050	5,650	111.9%
	Taipingzhuang	5,100	5,700	111.8%
	Wangdiaozhuang	4,480	5,100	113.8%

	Zhouguantun	4,500	5,200	115.6%
Wubaihu	Dafenggou	6,956	7,966	114.5%
	Dongshibaihu	6,530	7,500	114.9%
	Jinzhuangzi	6,495	7,400	113.9%
	Liujianiantou	6,360	7,250	114.0%
	Qingchisi	6,300	7,200	114.3%
	Zhangsihe	6,280	7,160	114.0%

Source: Various village statistical yearbooks.

H. Gender Development

16. The Project benefited local women by providing them with equal employment opportunities. During the construction period, the box culvert, open channel and Yuqiao Reservoir subcomponents temporarily employed 8,000, 37,800, and 6,600 women per day, respectively. Female labors received the same wage as males when doing the same work. Also, there were 20–25 women working permanently for TML and TSC, about half of all employees.

17. Second, local women enjoyed equal skills training opportunities. The Yuqiao Reservoir Training Center provided 10,300 person-times of skill training, of which 3,950 person-times were contributed by women. The training center encouraged the attendance of local women by selecting skills appropriate for women, e.g., livestock breeding and mushroom planting.

18. Further, the Project helped to reduce the incidence of waterborne diseases, leading to decreased spending on medical care and sick days taken. It especially benefited women, because generally women are responsible for household duties and looking after children, the elderly, and the sick. Also, it saved time for women to work and earn more.

I. Conclusion and Recommendations

19. The Project has had important impacts on local water environment improvement, socioeconomic growth, and poverty reduction, including improving living conditions and public health. Most local people felt satisfied with the improvement of the water environment. In addition, employment opportunities were created for locals during project construction and operation. Urban poverty has been effectively reduced, and support for urban poor has been enhanced. Urban poor households still can afford the water fees, given the increased water price. Various measures have been taken to avoid poverty impacts caused by the Project, and local women were entitled to equal employment and skills training opportunities.

20. There were no separate social reports before, during, and after the Project. The Project's social impact had not been detailed in the quarterly or annual reports submitted by the Implementing Agencies. Further, there was no internal or independent monitoring and evaluation, especially on social and poverty impacts. It is suggested that monitoring of social impacts be emphasized during the whole process for better project evaluation.