

ASIAN DEVELOPMENT BANK

PPA: PRC 25013

PROJECT PERFORMANCE AUDIT REPORT

ON THE

**DALIAN WATER SUPPLY PROJECT
(Loan 1313-PRC)**

IN THE

PEOPLE'S REPUBLIC OF CHINA

November 2003

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

		At Appraisal (May 1994)	At Project Completion (April 1999)	At Operations Evaluation (July 2003)
CNY1.00	=	\$0.115	\$0.121	\$0.120
\$1.00	=	CNY8.66	CNY8.28	CNY8.30

ABBREVIATIONS

ADB	–	Asian Development Bank
AIEC	–	average incremental economic cost
AIFC	–	average incremental financial cost
DMC	–	developing member country
DMG	–	Dalian Municipal Government
DWDC	–	Dalian Water Delivery Company
DWSG	–	Dalian Water Supply Group
EA	–	executing agency
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
IESWSS	–	impact evaluation study on water supply and sanitation projects
km	–	kilometer
lpcd	–	liters per capita per day
m ³	–	cubic meter
mcm	–	million cubic meter
OEM	–	operations evaluation mission
O&M	–	operation and maintenance
PCR	–	project completion report
PPAR	–	project performance audit report
PRC	–	People's Republic of China
TA	–	technical assistance
WACC	–	weighted average cost of capital
WSC	–	Water Supply Company
WTP	–	water treatment plant

NOTES

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

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BASIC DATA

Loan 1313-PRC: DALIAN WATER SUPPLY PROJECT

PROJECT PREPARATION/INSTITUTION BUILDING

TA No.	Technical Assistance Name	Type	Person-Months	Amount (\$)	Approval Date
1506	Dalian Multipurpose Water Resources Development Project	PPTA	55	600,000 ¹	15 April 1991
1852	Dalian Water Supply	PPTA	28.5 ²	100,000	10 Mar 1993

KEY PROJECT DATA (\$ million)	As per ADB Loan Documents	Actual
Total Project Cost	379.73 ³	308.25
Foreign Exchange Cost	164.10	127.03
ADB Loan Amount/Utilization	160.00	127.03
ADB Loan Amount/Cancellation		33.0

KEY DATES	Expected	Actual
Fact-Finding		28 May–10 Jun 1993
Appraisal		16–27 May 1994
Loan Negotiations	15–9 Aug 1994	11–3 Aug 1994
Board Approval	19 Sep 1994	20 Sep 1994
Loan Agreement		15 Dec 1994
Loan Effectivity		15 Mar 1995
First Disbursement		2 May 1995
Project Completion	30 Sep 1998	May 1999 ⁴
Loan Closing	31 Mar 1999	6 Apr 1999
Months (effectiveness to completion)	48	50

ECONOMIC AND FINANCIAL RATES OF RETURN (%)	Appraisal	PCR	PPAR
Economic Internal Rate of Return			13.4
Jinshitan Water Supply		6.9	
Pulandian Water Supply		20.1	
Financial Internal Rate of Return			9.3
Northern Component	8.6	8.3	
Southern Component	9.9	14.8	
Jinshitan Water Supply		2.7	
Pulandian Water Supply		5.0	

¹ Financed by the Japan Special Fund.

² Consisting of 3.5 person-months of international consultants and 25 person-months of local consultants.

³ ADB Board approved a major change in project scope with effect from 14 May 1997 following a reappraisal of the Project. The change allowed the addition of three subprojects, increasing the estimated Project cost to \$408.4 million.

⁴ The Jinshitan subproject was transferred to the Jinshitan Water Supply Company in May 1999, after loan closing.

BORROWER People's Republic of China

EXECUTING AGENCIES Dalian Water Delivery Company
Dalian Water Supply Group

MISSION DATA	No. of Missions	Person-Days
Reconnaissance	1	13
Fact-Finding	1	56
Fact-Finding Follow-Up	1	70
Consultation	2	10
Appraisal	1	60
Project Administration		
Inception	1	7
Review	5	115
Project Completion	2	57
Operations Evaluation ⁵		
Total	14	388

⁵ The Mission, led by K.E. Seetharam and assisted by Peter Mawson (staff consultant), prepared the Project Performance Audit Report at Headquarters between June and September 2003. The Mission to the PRC, originally scheduled in June 2003, was canceled due to SARS.

EXECUTIVE SUMMARY

In the early 1990s, the water shortage in Dalian was so severe that many areas of the city had water for only few hours a day, usually in the middle of the night. Occasionally, the water pressure was insufficient to pump water to higher elevations in the city for several days. The Dalian Water Supply Project (the Project) provided new infrastructure to address the shortages as well as the future water demand through 2000. It was the first project the Asian Development Bank (ADB) funded in the water supply sector in the People's Republic of China (PRC).

In 1991, the Government of PRC requested that ADB assist the Dalian Municipal Government (DMG) in evaluating local water usage and help develop a project to improve and expand the water supply system in Dalian City. The Project was prepared between 1991 and 1994 with technical assistance (TA) from ADB. It was appraised in May 1994.

The objectives of the Project were to (i) increase Dalian's water supply for residential consumption to 100 liters per capita per day (lpcd) in 2000 from about 80 lpcd and maintain a 24-hour supply, (ii) provide additional water in the small towns located in Dalian Municipality, and (iii) ensure that the new water supply facilities were financially self-sustaining. As approved, the Project consisted of two parts: Part A included the construction of a northern conveyor system from the Biliuhe Reservoir to the Wazidian Reservoir; part B involved the construction of a southern conveyor system, including transmission pipelines, water treatment plants (WTPs), and distribution pipelines from the Wazidian Reservoir to Dalian City. During implementation, two small subprojects were added using loan savings. These comprised the expansion and rehabilitation of the Pulandian and Jinshitan water supply systems, using raw water supplied by the northern conveyor.

The estimated project cost was \$408.4 million equivalent, including a foreign exchange component of about \$179.1 million and a local currency component of about \$229.3 million equivalent. ADB approved a loan for \$160 million from its ordinary capital resources on 20 September 1994. The executing agencies (EAs) were the Dalian Water Supply Group (DWSG) and the Dalian Water Delivery Company (DWDC). The ADB loan was to finance the bulk of the foreign exchange costs. DMG was to finance the balance of the foreign exchange costs and \$151.2 million of the local currency cost. In addition, DMG was to assist DWSG and DWDC in securing grants from the central Government and loans at commercial rates from domestic banks to finance the balance of the local currency costs. The Project was scheduled for completion in September 1998.

The Operations Evaluation Mission (OEM) reviewed relevant project reports and, with the assistance of ADB's PRC Resident Mission and East and Central Asia Department, obtained additional information by fax and e-mail communications with the EAs and the Government. The evaluation also used information collected during previous missions for the Impact Evaluation Study on Water Supply and Sanitation Projects (IESWSS).¹

At appraisal, the Project was consistent with the Government's sector policies to increase urban water supply coverage, augment the water available per capita, protect the environment through water conservation measures, and promote economic growth. The Project

¹ The Project was one of the case studies included in the recent impact evaluation study on water supply and sanitation projects (ADB. 2002. *Impact Evaluation Study on Water Supply and Sanitation Projects (IESWSS) in Selected Developing Member Countries*. Manila). Surveys for the IESWSS provided useful information for this Project Performance Audit Report.

was also consistent with the ADB's priorities of improving economic efficiency, reducing poverty, and protecting the environment. The Project remains consistent with the Government and ADB's objectives in the sector. Promoting access to clean water is part of ADB's current Country Strategy and Program. The Project is rated highly relevant.

The Project achieved its objectives. At completion, all facilities constructed were being operated satisfactorily. The 673,000 residential connections in Dalian exceeded the number projected at appraisal. In Pulandian and Jinshitan, the connections totaled 42,000 and 600, respectively, also slightly higher than at reappraisal. All customers had 24-hour supply, and the color and quality of water met national standards. The Project also increased the supply to commerce and industry, removing potential constraints to economic expansion in Dalian Municipality and improving the investment environment. Use of groundwater by industrial and residential consumers has been reduced. Tariff increases generated enough revenue to cover operation and maintenance and depreciation costs for DWSG. The debt service ratio has been above 1.2 since 1998, and subsidies are not expected to be required from 2003 onwards. The Project is rated highly efficacious.

The financial internal rates of return, recalculated for the project completion report (PCR) and for this evaluation, are well above the weighted average cost of capital. The OEM estimated the economic internal rate of return at 13.4%. The Project increased the quality and quantity of water available in a cost-effective manner, which has resulted in improvements in access to water and the quality of the urban environment. Health concerns related to water quality also have decreased. The Project is rated efficient.

The sustainability of the Project and its benefits over the long term is rated most likely. DWSG and DWDC have the technical and financial skills to operate the project facilities effectively and efficiently.

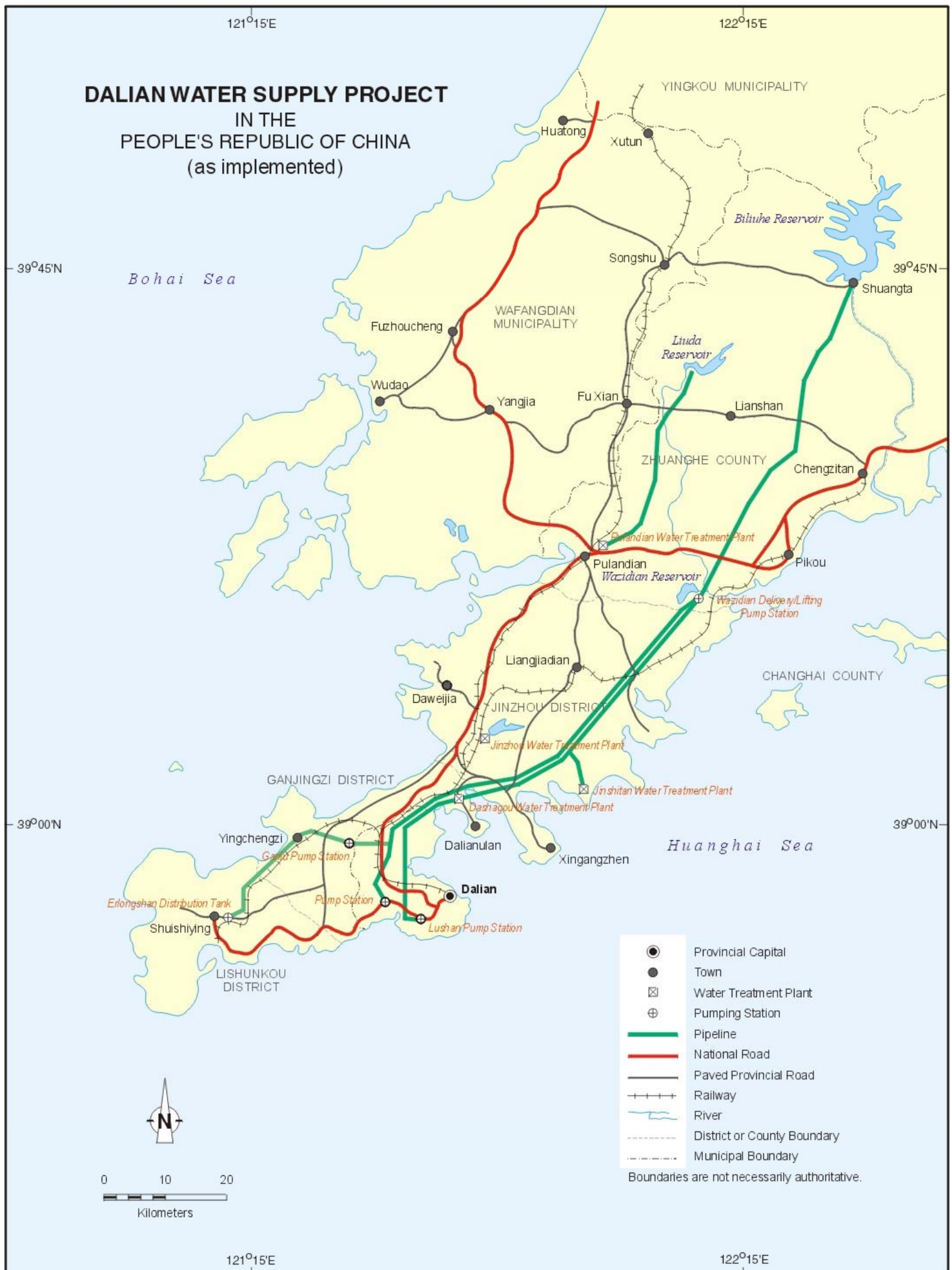
The Project's institutional development and other impacts are rated significant. The Project has had a positive impact on economic growth in Dalian by removing the bottleneck created by an inadequate water supply.

Based on these assessments, the Project is rated highly successful.

The evaluation reconfirms two important lessons. First, as DMG demonstrated in this Project, the commitment by the local government is the most important factor contributing to the success of water supply and sanitation projects. Second, consumers accept and understand the need for higher tariffs only if the water supply services are adequate and reliable, as in this Project.

The OEM recommends no follow-up actions.

DALIAN WATER SUPPLY PROJECT **IN THE** **PEOPLE'S REPUBLIC OF CHINA** **(as implemented)**



I. BACKGROUND

1. Dalian is at the southern end of the Liaodong Peninsula in Liaoning Province in northern People's Republic of China (PRC), an area where most large cities have serious water shortages. A major port, Dalian was declared an "open" coastal city in 1984 and given a large degree of autonomy for its economic planning. The Dalian Economic and Technology Development Zone, established in 1988, has been one of the most successful economic zones in the PRC. Moreover, Dalian has played an important role in the economic reforms and domestic growth in the region. By the early 1990s, however, the shortage of water was a serious constraint to economic growth and development.

2. At the time of appraisal, the population of Dalian City was projected to reach 2.2 million in 2000, while the population for the entire municipality was forecast to reach 5.2 million in that period. In addition, an estimated 1 million residents of rural towns and six rural districts suffered from inadequate water supply.

A. Rationale

3. In the early 1990s, the water shortage in Dalian was so severe that many areas had water service for only a few hours a day, usually in the middle of the night. The pressure in the system sometimes was insufficient to provide water to higher elevations in the city for several days. Frequent service interruptions had major implications for public health, allowing contamination from surrounding drains and groundwater due to the negative pressure in the system. The reduction in water deliveries from the municipal system to industries and development zones also slowed economic growth. In addition, the excessive extraction of groundwater endangered the environment. The Dalian Water Supply Project (the Project)—the first project the Asian Development Bank (ADB) funded in the PRC's water supply sector—provided new infrastructure to address the shortage as well as the growing demand through 2000. The Project aimed to ensure that limited water resources would be used in an environmentally sustainable manner. It also sought to provide institutional strengthening and training to enable the new facilities to be operated in a financially sustainable manner.

4. The Project supported the Government's medium-term objectives for urban water supply and the water supply objectives of the Eighth Five-Year Plan. The Plan envisaged raising urban water supply coverage to 95 percent; increasing the water supply for residential, public and commercial uses to 200 liters per capita per day (lpcd); and recycling 65 percent of industrial wastewater by 2000. The Project also was consistent with the PRC's guidelines, issued in 1992, for urban water supply. Those guidelines emphasized, among other things, (i) full cost recovery from industrial and commercial users, (ii) recovery of operation and maintenance (O&M) costs from residential users by 2000, (iii) prevention of excessive groundwater extraction, (iv) conservation of water resources, and (v) the use of loans and credits to finance urban water supply.

5. At project appraisal, the overall objective of the ADB's operations in the PRC was to help the country establish an economy that would generate efficient, sustainable and equitable growth. Its three strategic objectives were (i) improving economic efficiency, (ii) reducing poverty, and (iii) protecting the environment and conserving natural resources. ADB's involvement in the water supply and sanitation sector addressed these objectives by improving the health and living standards of the urban population and contributing to a better environment and economic growth.

B. Formulation

6. In 1991, the Government of PRC requested that ADB assist the Dalian Municipal Government (DMG) in evaluating local water usage and help develop a project to improve and expand the water supply system in Dalian City. DMG carried out the evaluation with the assistance of international and local consultants financed under an ADB TA.¹ In addition to offering several key recommendations for water conservation and environmental improvement, the study concluded that the raw water supply must be doubled by 2000 to address the severe water shortage in Dalian. Subsequently, the Executing Agencies (EAs)—the Dalian Water Supply Group (DWSG) and the Dalian Water Delivery Company (DWDC)²—prepared detailed feasibility studies for the Project. ADB-financed consultants reviewed and refined these studies.³ Appraisal of the Project was in May 1994.

C. Purpose and Outputs

7. The objectives of the Project were to (i) increase Dalian's water supply for residential consumption to 100 lpcd in 2000 from about 80 lpcd and maintain a 24-hour supply, (ii) provide additional water in the small towns located in Dalian Municipality, and (iii) ensure that the new water supply facilities are financially self-sustaining. The goals of the Project were to improve public health, increase employment and upgrade living standards. On the policy side, the Project aimed to promote rational pricing policies for water, strengthen the financial management of the water supply system, and improve the institutions, policies and regulations in the sector.

8. As approved, the Project consisted of two parts: (i) the construction of a northern conveyor system from the Biliuhe Reservoir to the Wazidian Reservoir; and (ii) the construction of a southern conveyor system, including transmission pipelines, water treatment plants (WTPs), and distribution pipelines, from the Wazidian Reservoir to Dalian City. During implementation, two small subprojects were added using loan savings.⁴ These comprised the expansion and rehabilitation of the Pulandian and Jinshitan water supply systems, using raw water supplied by the northern conveyor. The additional subprojects strengthened the original project objectives, led to more effective utilization of project facilities, enhanced the project impact, and were completed by the original loan closing date.

D. Cost, Financing, and Executing Arrangements

9. The estimated project cost at appraisal was \$380 million equivalent, including a foreign exchange component of about \$164 million and a local currency component of about \$216 million equivalent. The ADB approved a loan for \$160 million from its ordinary capital resources on 20 September 1994 to finance the bulk of the foreign exchange costs. The loan was to be lent to DWDC and DWSG under separate subsidiary loan agreements for \$60 million and \$100

¹ ADB. 1991 *Multipurpose Water Resources Development Project*. Manila. (for \$600,000).

² Until after project completion, the Dalian Water Supply Group was known as the Dalian Water Supply Company. The Dalian Water Supply Company was formerly known as the Dalian Yinbi Northern Water Supply Company.

³ ADB. 1993. *Dalian Water Supply*. Manila (for \$100,000).

⁴ In May 1997, the Project was reappraised and three subprojects—Dachangshan, Jinshitan, and Pulandian—were added through a major change in scope. After the feasibility study, Dachangshan was found not to be economically viable and was deleted from the Project.

million, respectively.⁵ DMG was to finance the balance of the foreign exchange costs as well as \$151.2 million of the local currency cost. In addition, DMG was to assist DWSG and DWDC in securing grants from the central Government and loans at commercial rates from various sources to finance the balance of the local currency costs. The Project was scheduled for completion in September 1998. After reappraisal in May 1997 (footnote 4), the project cost was \$408.4 million equivalent, comprised by a foreign exchange component of about \$179.1 million and a local currency component of about \$229.3 million equivalent.

E. Completion and Self-Evaluation

10. The project completion report (PCR), which rated the project as generally successful,⁶ was circulated on 30 June 2000. It recorded the implementation arrangements, noted that the construction of infrastructure had been carried out in a timely and satisfactory manner, and found the EAs generally complied with loan covenants. The PCR also carried out financial and economic analyses for the four subprojects and presented financial analyses for the four water supply companies (WSCs). The PCR found the water tariffs of the four WSCs were generally sufficient to cover O&M costs and, in some cases, depreciation. By 1999, DWSG and DWDC did not require subsidies from DMG, but subsidies were expected to continue for the two smaller companies until 2004 or 2005.

11. Except for the Jinshitan WSC, the financial internal rates of return for the WSCs were close to the appraisal estimates. Without any information on the willingness to pay for water, the PCR computed the average incremental financial cost (AIFC) and the average incremental economic cost (AIEC). The PCR's computations showed that average tariffs charged by DWDC were below the long-run marginal cost of the subproject in economic prices. The PCR also concluded that the Jinshitan and Pulandian WSCs would require financial subsidies unless tariffs were increased in real terms. The PCR recommended actions to improve sustainability and treat wastewater.

12. The PCR recorded that the Project had benefited 2.2 million people living in the Dalian service area, with 673,000 residential and 15,000 commercial and industrial connections. The project facilities are fully used and well maintained. The PCR also recorded significant economic and industrial development in Dalian due to the Project.

F. Operations Evaluation

13. The Project Performance Audit Report (PPAR) assesses the relevance, efficacy, efficiency, sustainability, and institutional development and other impacts of the Project. It also identifies the lessons and follow-up actions for future ADB operations. The PPAR relied on extensive information collected during previous missions for the Impact Evaluation Study on Water Supply and Sanitation Projects (IESWSS).⁷ The information included data on more than 100 socioeconomic indicators as well as the impact of the project on the health, living conditions, and savings over time of poor consumers. The Operations Evaluation Mission

⁵ The ADB Board approved Loan 1313-PRC on 20 September 1994, the Loan Agreement was signed on 15 December 1994 and became effective on 15 March 1995. The subsidiary Loan Agreements for relending \$60 million and \$100 million of the loan proceeds to DWSC and DWSG, respectively, were signed on 6 March 1995 and the initial disbursement was on 2 May 1995.

⁶ According to the three category rating system for overall performance then in use.

⁷ The Project was one of the case studies included in the recent impact evaluation study on water supply and sanitation projects (ADB. 2002. *Impact Evaluation Study on Water Supply and Sanitation Projects in Selected Developing Member Countries*. Manila). Surveys carried out for the IES provided useful information for this PPAR.

(OEM)⁸ reviewed relevant project reports and, with the assistance of ADB's PRC Resident Mission, obtained additional information by fax and e-mail communications with the EAs and the Government. The OEM evaluated the technical and financial management capacities of the WSCs to operate and maintain the completed facilities in a sustainable manner. Finally, the OEM reviewed the implementation of the recommendations of the PCR, particularly the water tariffs, the phasing out of subsidies, and the plan for full treatment of wastewater generated by the Project. A draft PPAR was provided to the Government, EAs, and ADB staff for their comments, which were considered in the final version.

II. PLANNING AND IMPLEMENTATION PERFORMANCE

A. Formulation and Design

14. ADB's objectives in the PRC in the early 1990s were to contribute to improving economic efficiency, reducing poverty, protecting the environment and conserving natural resources. The Project supported these objectives by increasing the supply of water to a major port and industrial center and improving the quality and accessibility of water for residential, commercial, and industrial customers in Dalian. The Project also was in line with the Government's objectives for the sector for 2000: (i) increasing urban water supply coverage to 95%; (ii) expanding the water supply for residential, public, and commercial uses to an average 200 lpcd; and (iii) recycling 65% of industrial wastewater.

15. The technical designs for the WTPs were appropriate, reflecting the least-cost option to meet the projected demand. The length of the pipelines and the WTP capacity for DWSG and the Jinshitan Water Supply Company were modified as the design details were finalized, which reduced the project costs (para. 18).

B. Achievement of Outputs

16. The northern subproject was constructed as planned. The subproject facilities have a capacity of 1.3 million cubic meters (m³) per day through a 68-kilometer (km) pipeline. The southern subproject also was constructed as planned except for two changes. First, the length of the second transmission pipeline was shortened to 61 km from 79 km because of changes in the route. Second, the capacity of the Jinzhou WTP was reduced to 70,000 m³/day from 150,000 m³/day because the demand was growing more slowly than estimated at appraisal (para. 17). The Pulandian and Jinshitan subprojects were constructed as envisaged at reappraisal, although some minor design details were revised for Jinshitan. The Project achieved the expected increases in the supply of water to the project area.

17. The Project has increased production capacity. The supply capacity of the northern conveyor was expected to reach a maximum of 340 million m³ in 2002. Through conservation initiatives, DMG has slowed the expansion of water demand in Dalian in the last few years. Consequently, the DWDC supply pipeline has taken longer than expected to attain full capacity. The Project increased residential connections in Dalian to 673,000, 109,000 higher than projected at appraisal. In Pulandian and Jinshitan, the connections (42,000 and 600, respectively) were also slightly higher than at reappraisal. However, the commercial and industrial connections in Dalian were fewer than expected at appraisal. All customers had 24-hour supply, and the color and quality of the water met national standards. In 1999,

⁸ The Mission, led by K.E. Seetharam and assisted by Peter Mawson (staff consultant), prepared the Project Performance Audit Report at Headquarters between June and September 2003. The Mission to the PRC, originally scheduled in June 2003, was canceled due to Severe Acute Respiratory Syndrome.

consumption in Dalian was 93 lpcd, only slightly below the target of 96 lpcd for 2000. A comparison of the achievements of the subprojects with the appraisal targets is presented in Appendix 1.

C. Cost and Scheduling

18. The Project facilities were generally completed ahead of schedule and under budget. The estimated project cost at reappraisal was \$408.40 million equivalent,⁹ including a foreign exchange cost of \$179.10 million. The actual cost was \$308.25 million equivalent¹⁰ with a foreign exchange cost of \$127.03 million. The resulting cost underrun of \$100.15 million equivalent represented 24.5% of the original estimate. The OEM concurred with the PCR that this was due to major savings in the procurement of materials and equipment through the international competitive bidding process, the reduced scope of the second pipeline for the southern subproject, and the smaller design capacity of the Jinzhou WTP. The reappraisal and actual costs are provided in Appendix 2.

19. The Government informed the OEM that the project financing was provided without difficulties. At appraisal and reappraisal, \$229.3 million equivalent was expected from local sources, including \$158.1 million equivalent in grants from DMG, a \$11.5 million equivalent grant from the central Government, \$52.9 million equivalent in local loans, and \$6.8 million from city governments. Because of the lower project costs, however, local funding needs were reduced to \$181.2 million equivalent, including local financing for the Pulandian and Jinshitan subprojects. DMG provided \$108.9 million equivalent, while the Government provided \$18.1 million equivalent and the State Development Bank lent \$54.2 million equivalent. Local funding was adequate and commercial loans were secured easily.

20. The completion of the original two subprojects was scheduled for September 1998. The northern subproject was commissioned in October 1997, about 11 months ahead of appraisal schedule; the southern subproject was commissioned in June 1997, some 15 months ahead of schedule. Following formal inspections by the Ministry of Water Resources and the Ministry of Construction, the northern and southern subprojects were transferred to DWDC and DWSC in July 1998 and June 1998, respectively. The Pulandian water supply subproject was commissioned in December 1998 as scheduled. The Jinshitan subproject was commissioned in May 1999 and the facilities were transferred to Jinshitan WSC.

D. Consultant Performance, Procurement, and Construction

21. Because the Project was the first funded by ADB in the PRC's water supply sector, international consultants were hired under an ADB TA (footnote 1). The OEM noted that this approach contrasted with more recent ADB projects in the PRC, in which the EA generally prepared feasibility studies using domestic consultants. As envisaged at appraisal, the international consultants engaged for the project feasibility study (para. 6) were retained for project implementation. These consultants assisted the EAs in project management and overseeing the work of domestic consultants. The EAs informed the OEM that the timely engagement of the international consultants facilitated the smooth beginning of project implementation. The EAs recruited domestic consultants for detailed engineering design and construction supervision, following local procurement procedures.

⁹ For the original two subprojects, estimates were based on May 1994 prices at an exchange rate of \$1.00 = CNY8.6. For the two additional subprojects, estimates were based on October 1996 prices at an exchange rate of \$1.00 = CNY8.3.

¹⁰ The costs are converted at average exchange rates for the years of disbursement.

22. The international consultants completed their assigned tasks on schedule, and their performance was generally satisfactory. During discussions in June 2002 for the IESWSS, senior DWSG engineers confirmed that the consultants shared their international experience designing systems similar to the one for the Project. The performance of domestic consultants involved in detailed engineering design and construction supervision also was generally satisfactory.

23. The EA informed the OEM that civil works, materials, and equipment financed by ADB were procured in accordance with ADB's *Guidelines for Procurement*. At appraisal, advanced action and retroactive financing had been envisaged for procuring steel plate for the first transmission pipelines through international competitive bidding procedures. However, DWSG decided to procure these materials through government procedures using local financing because of the acute water shortage in Dalian and the need to complete the work before the dry season in 1995. Civil works were split into contract packages according to the type of work, emphasizing concurrent implementation. These contracts were implemented smoothly. The EAs reported no major problems packaging the contracts, preparing the bidding documents, or evaluating the bids. The EAs rated the performance of the domestic contractors as satisfactory. The contractors completed the civil works ahead of the implementation schedule and achieved good quality. The suppliers of construction materials also performed satisfactorily.

E. Organization and Management

24. As envisaged at appraisal, DWSG implemented the southern subproject and DWDC implemented the northern subproject. Separate project implementation units were established within DWDC and DWSG to carry out the day-to-day implementation for each subproject. The Pulandian WSC and Jinshitan WSC implemented the Pulandian and Jinshitan subprojects, respectively, in consultation with DWSG. The Leading Group, headed by the DMG executive vice mayor and including heads of DMG departments and bureaus participating in the Project, provided overall guidance.¹¹ A project management unit, consisting of representatives of DMG departments and bureaus, acted as the liaison between the EAs and the local government. The OEM concurred with the PCR that implementation arrangements were adequate. In the OEM's view, the EAs' decision to retain the international consultants who drafted the feasibility study (para. 21) also facilitated the smooth start-up and timely completion of the Project.

25. Project implementation proceeded effectively and efficiently. The EAs avoided delays in procurement, and the two original subprojects (for the northern and southern conveyors) were completed ahead of schedule (Appendix 3). The EAs submitted progress and financial reports on time throughout project implementation and at project completion. All loan covenants were complied with or were in the process of being complied with (Appendix 4). DMG also conducted an independent post-evaluation of the resettlement program (Appendix 5, para. 46).

III. ACHIEVEMENT OF PROJECT PURPOSE

A. Operational Performance

26. The Project provides a 24-hour supply of potable water to more than 2.2 million people living in the Dalian service area and to more than 140,000 living in Pulandian and Jinshitan. In 1999, residential water connections in Dalian totaled 673,000, or 109,000 more than projected

¹¹ During project implementation, DWSG was under the leadership of Dalian Public Utilities Bureau and DWDC was under Dalian Water Conservancy Bureau. After the Dalian municipal reform at the end of 2001, both bureaus were merged into a new Dalian Water Affairs Bureau. DWDC and DWSG are under the jurisdiction of the new bureau.

at appraisal. By 2002, residential connections had increased to 715,000, while commercial and industrial connections totaled 20,000.

27. The Project improved the health and living conditions of the urban population by increasing the amount, as well as the quality, of water available for residential consumption. In Dalian, residential consumption had increased to 102 lpcd by 2002 from about 80 lpcd before the Project. Before the Project, the water supply was intermittent, pressure was weak in certain areas, and the color and quality of water did not meet the national standards. DWSG reported that the lack of a continuous supply caused water-related health problems in some areas. Water shortages occurred during drought periods, prompting residents and the media to criticize the condition of the water supply frequently. Such criticism had ceased by project completion, and surveys carried out in 2002 for the IESWSS confirmed that most customers were satisfied with the quantity and quality of water available.

28. In the Pulandian area, the Project improved water pressure, and per capita consumption increased to 80 lpcd in 2000 from 60 lpcd before the Project. Coverage increased to 98% of the population from 95%. In Jinshitan, the Project provides a 24-hour supply of water with good pressure, something not available before implementation.

29. The Project also is providing water to 20,000 commercial and industrial customers. Improved water supply has spurred economic growth in Dalian. DMG sees the water supply as an important factor in achieving growth rates exceeding 11% per year between 1999 and 2002. Improved water supply also has facilitated improvements in the urban environment, such as the expansion of parks and recreation facilities. In 2000, Dalian was ranked the top city in the PRC for the quality of its urban environment. DMG recycles wastewater to reduce the water used in parks and public areas. DMG has also encouraged industrial and commercial customers to invest in water conservation measures.

30. The quality of raw water has improved because of the Project, because now it is supplied through covered conduits rather than open channels. New WTPs have improved the quality of treated water also. Enhanced accessibility of water has encouraged many houses to put in better toilet facilities. DMG has developed a long-term plan for the development of wastewater treatment facilities and has encouraged industrial and commercial consumers to recycle up to 40% of wastewater.

31. The Project contributed to reductions in operating costs as the project facilities enable raw water to be supplied to DWSG by gravity, reducing the number of pumping stations, the demand for electricity and the cost of pump maintenance. The overall operating costs of DWDC declined to CNY0.35/m³ after the Project from CNY0.42/m³ before.

32. The rehabilitation of water supply systems has led to more cost effective and efficient use of facilities. Raising tariffs coupled with water conservation measures have helped restrain demand by the commercial and industrial consumers (para. 29). DWSG water sales dropped to 180 million cubic meters (mcm) in 2002 from 215.6 mcm in 2001 and 250.4 mcm in 2000. The financial sustainability of the project facilities is ensured by tariff increases. Although DWSG operating revenue fell in 2001, the tariff increase late in 2001 meant that revenues for 2002 were higher than in 2000, despite the decline in sales volume.

B. Performance of the Operating Entity

33. DWSG has increased tariffs to support cost recovery. The latest increase was in August 2001; the next is due before the end of 2003. Since 1995, the average tariff for the DWSG has increased on average 12.8% per year. Average revenue per m³ in 2002 was CNY2.51, compared with CNY2.40 projected for 2002 in the PCR and CNY3.19 projected at appraisal. In 1994, before the start of the Project, the average revenue per m³ was CNY0.81. In 2002, water sales, revenue and O&M costs were lower than expected at appraisal. Sales and revenue were lower than expected in the PCR, but O&M costs were higher (Appendix 6).¹²

34. At the end of 2002, DWSG had 2,836 employees, or about 3.9 per 1,000 connections. This compares favorably with the 3,000 employees, or 4.4 per 1,000 connections in 1999. In 1995, DWSG employed more than 4,000. Operating costs per m³ have increased since 1999, reaching CNY2.19 in 2002, primarily because water conservation measures implemented by DMG caused sales to fall in 2001 and 2002.

35. At the end of 2002, accounts receivable were CNY185.3 million, or 4.9 times monthly water sales. The ratio was down from 5.9 at the end of 2001, due to a decrease of about CNY4 million in accounts receivable and an increase in revenues from the tariff hike in late 2001.¹³ DWSG reports that 87% of residential customers and about 97% of commercial and industrial customers pay water bills within the normal time allowed.

36. Since 1998, DWSG's operating revenues have exceeded the cost of O&M and debt servicing, though not always O&M plus depreciation. Its debt service ratio has been above 1.2 since 1998. DWDC's debt service ratio will be above 1.2 from 2003 onwards.

37. DWSG's stated objective is to complete repayment of the loan 7-8 years ahead of schedule. DWSG has received subsidies from the municipal government every year since 1995. In 2002, the subsidy was only CNY4.2 million, and no subsidies are expected to be required from 2003 onwards.¹⁴

C. Financial and Economic Reevaluation

38. The financial internal rate of return (FIRR) was re-evaluated for DWSG using data for 2000-2002 and revised projections for 2003-2010. For DWDC, FIRR was re-evaluated using revised projections for 2003-2010. The OEM followed the methodology used in the PCR. Costs and revenues were expressed in 2003 constant prices. The FIRRs were slightly lower than those estimated at project completion, but they were well above the weighted average cost of capital (WACC), indicating the financial viability of the project. The revised FIRR for the Project is 9.3%. The assumptions and details of the estimates are in Appendix 7.

39. In computing the economic internal rate of return (EIRR) for the incremental water supplied by DWSG, the OEM followed ADB's *Guidelines for Economic Analysis Of Water Supply Projects*. The analysis separated residential and commercial and industrial consumption.

¹² The income statement for DWSG in the PCR excludes raw water charges (i.e., the cost of purchasing water delivered to it by DWSC). If these charges were reinstated, O&M costs in 2002 would have been lower than the PCR figures.

¹³ Receivables have deteriorated from 3.4 times monthly sales in 1998. The PCR noted that the level of accounts receivable is due mainly to the outstanding accounts of a few state-owned enterprises. DMG informed the OEM that DWSG is taking actions to keep the accounts receivable below 3.5 times the monthly sales.

¹⁴ The Pulandian and Jinshitan WSCs were expected to depend on DMG subsidies for at least 5 years beyond 2003, despite tariff increases.

Costs and benefits were expressed in 2003 constant prices at the domestic price numeraire. Commercial and industrial consumers, which pay higher tariffs than residential consumers, reduced their consumption after 2000 (para. 32). The benefits to commercial and industrial consumers were valued using the industrial tariff for each year converted to 2003 prices. Dalian has had a severe water shortage, and residential consumers have no alternative source of water. Historically, in the PRC, water was provided as a social good and the tariffs were generally low. DWSG raised tariffs significantly (para. 33) to achieve cost recovery. The appraisal report and the PCR did not estimate the EIRR, as information was not available on the willingness to pay for water. The OEM estimated that to achieve a 12% EIRR, the willingness to pay for the non-incremental portion of water consumed by the residential consumers would have to be CNY2.0/m³ in 2003 constant prices.¹⁵ If the non-incremental residential consumption were valued at the 2002 residential tariff of CNY2.3/m³, the EIRR would be 13.4%. The assumptions and details are in Appendix 7.

40. The PCR focused on the computation of average incremental financial cost (AIFC) and average incremental economic cost (AIEC). In the PCR, the AIFC was estimated at CNY1.8/m³ and the AIEC at CNY3.4/m³, with revenues and expenditures converted to 1999 constant prices. The OEM recalculated the AIFC and AIEC using updated data and projections converted to 2003 prices. The AIFC was CNY2.0/m³ and the AIEC was CNY3.1/m³, compared with an average tariff in 2002 of CNY2.5/m³. In financial terms, subsidies are not needed since the AIFC is below the average tariff. Details of the estimates are in Appendix 7.

D. Sustainability

41. The Project facilities operate well and have met the design requirements in terms of quality and quantity. The OEM confirmed with DWSG that revenue from water sales was sufficient to meet O&M costs and debt service requirements.

42. DMG has shown a high level of commitment to the Project since its inception, which has been significant in the efficient and effective implementation of the Project. DMG supported the tariff increases necessary for the financial sustainability of the Project, and it requires DWSG to review tariffs every 2 years to ensure that operating costs and other financial obligations are met.

43. Surveys carried out during IESWSS showed that residential, commercial, and industrial customers had a high level of satisfaction with the Project as well as with the operation of the distribution system by DWSG. The tariffs are affordable (Table A7.1), and customers have attested to the sustainability of the benefits the Project.

IV. ACHIEVEMENT OF OTHER DEVELOPMENT IMPACTS

A. Socioeconomic Impacts

44. Dalian has experienced rapid economic growth in recent years. The economy of the municipality grew more than 11% a year between 1999 and 2001, according to DMG data. At the time of project appraisal,¹⁶ water shortages in Dalian were causing reductions in water

¹⁵ The OEM obtained data on the willingness to pay for water in the PRC in ongoing ADB PPTAs. The amount ranges from CNY2.0-CNY3.0 per m³ in 2003 constant prices.

¹⁶ ADB. 1994. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the People's Republic of China for the Dalian Water Supply Project*. Manila.

deliveries to industry and the development zones, slowing economic development. The Project eliminated this constraint on economic growth and facilitated the development of the city.

45. Households surveyed in 2002 for the IESWSS¹⁷ generally agreed that the Project had improved the quality of life and the quality of the city environment. The accessibility and quantity of water have improved. Whereas before the Project many areas were supplied with water for only a few hours a day, not always at convenient times, water is now available 24 hours a day. Residential consumers no longer have to line up for water or wait for it in the middle of the night. Other results showing the impact of the Project are summarized in Table 1.

Table 1: Residential Water Supply and Sanitation^a

Item	Percentage	Item	Percentage
Residential water supply		Residential sanitation facilities	
- households connections	72%	- households with toilets	98%
- public tap	6%	- cistern flush	61%
- tubewell and hand pump ^b	31%	- pit latrine	32%
		- other	7%
Dissatisfied with water supply ^b		Hygiene practices (households)	
- wet season	23%	- hand washing after using toilet ^c	93%
- dry season	11%	- hand washing before meals ^c	92%
		- water borne disease in past month	3%

Notes:

^a Summarized from the IESWSS survey results of 180 households. Percentages represent the number of persons out of 180 who chose each answer. The answers in an item group are not mutually exclusive and the percentages would not add up to 100%.

^b Principally households in the rural counties.

^c With soap and water.

Source: Appendix 7 of IESWSS (footnote 8).

46. The number of households requiring resettlement and compensation under the Project (259) was less than estimated at appraisal (450). The total costs of resettlement, including land acquisition and compensation, was about \$13.3 million equivalent, which was about 85% of the appraisal estimate. A study of the resettlement program showed that more than 90% of affected households were satisfied with the results (Appendix 5).¹⁸

B. Environmental Impacts

47. Because the Project has more than doubled the supply of water to Dalian City, the wastewater generated has substantially increased as well. To mitigate potential environmental damage, DMG is implementing a plan for municipal wastewater collection and treatment as finances permit. This plan, which provides for the full treatment wastewater generated by the

¹⁷ The survey covered 180 households in 5 urban districts and 2 rural counties of Dalian.

¹⁸ National Research Centre for Resettlement and Hohai University. 1999. *Special Study on the Policy Impact of Involuntary Resettlement, Dalian Water Supply Project*. This study was a component of TA 5832-REG: *Evaluation Studies in the Bank's DMCs*, for \$1,000,000, approved on 12 February 1999.

Project by 2010, includes the rehabilitation of wastewater treatment plants and the construction of new ones with funding from local, bilateral and multilateral sources. The cost of the plan exceeds \$250 million equivalent. In addition, DMG environmental regulations require that all industrial enterprises provide on-site treatment of wastewater before discharge. Measures also have been taken to (i) relocate industries using large volumes of water, (ii) require on-site recycling of industrial wastewater, and (iii) require the use of seawater in industrial processes where possible.

48. The Project has contributed significantly to improving the city environment. Increasing the supply of water to the city has facilitated the development of health and educational services and recreation centers. Combined with the increased recycling of wastewater from commercial and industrial consumers, these improvements made possible the development or rehabilitation of 165 hectare of green space and parks. As the survey for the IESWSS showed, the city's population appreciates these improvements.

49. The more regular supply of water has discouraged the exploitation of groundwater, especially by industry. At the time of the PCR, conservation measures promoted by DMG had saved about 16 million m³ of groundwater. In Jinshitan, about 13,000 people who previously depended on groundwater, have access to tap water because of the Project. The reduction in the exploitation of groundwater has increased revenues for the water companies and prevented further contamination of the aquifers in the area.

50. During project implementation, measures were taken to prevent environmental damage from construction activities. These included building access roads to minimize erosion, replacing felled trees, and returning soil removed during trenching as much as possible to the same trench. There were no protected plants, animals, or cultural relics along the route of the conveyor pipelines.

C. Impacts on Institutions and Policy

51. Institutional strengthening and training activities provided with the consulting services under the loan increased the independent project management capacities of the WSCs.¹⁹ The Project provided Dalian, for the first time, with a manageable, integrated system linking reservoirs, transmission lines, and distribution networks. This development precipitated the institutional changes leading to the consolidation of the WSCs in Dalian Municipality.

52. Since the beginning of 1995, DWSG has raised tariffs three times. These increases, averaging 12.8% a year, have ensured the ability of DWSG to meet its debt servicing obligations and cover operating costs.

53. Tariffs in Dalian are set according to a procedure that involves the WSC, local and provincial governments, and consumers. To initiate a tariff revision, the DWSG sends a proposal to the municipal government, which evaluates it based on the financial position and needs of the company. If the proposal is accepted at this level, public hearings are held with representatives of consumer groups. If participants at these meetings agree with the tariff revision, the proposal is sent to the provincial government, which makes the final decision on whether to accept the revised tariff. The tariff must cover the company's O&M costs, including

¹⁹ Reported by WSC staff to the OEM during the *Impact Evaluation Study on Water Supply and Sanitation Projects in Selected DMCs*, June 2002.

debt servicing. Municipal regulations require that the tariff be reviewed every 2 years to keep it in line with costs.

54. The Project included measures for human resource development at the WSCs, including study tours to Italy, the United States, and the United Kingdom, as well as on-the-job training and workshops. Training activities, which focused on technical and engineering aspects of the Project, enabled staff to increase their experience, knowledge, and skills. These skills have been used to improve the operations of the WSCs. The OEM concurred with the view of the PCR that attention should also have been given to increasing the financial management skills of staff and management in the WSCs.

V. OVERALL ASSESSMENT

A. Relevance

55. At appraisal and after reappraisal, the Project was consistent with the Government's sector policies to increase urban water supply coverage, increase the per capita availability of water, protect the environment through water conservation, and promote economic growth. The Project also was consistent with ADB's priorities of improving economic efficiency, reducing poverty, and protecting the environment. The Project continues to be consistent with the Government's and ADB's objectives in the sector. Promoting access to clean water remains part of ADB's current Country Strategy and Program.²⁰ The Project is rated highly relevant.

B. Efficacy

56. The Project achieved its objectives. At project completion, all facilities constructed were being operated satisfactorily. The Project increased the water supply to commerce and industry, removed potential constraints to economic expansion in Dalian Municipality, and improved the investment environment. Use of groundwater by industrial and residential consumers has been reduced.

57. Tariff increases generated enough revenues to cover O&M and depreciation costs for DWSG, although a small subsidy was received from DMG until 2002. Human resource development and institutional strengthening were important elements of the Project. The planned activities were successfully implemented, although the PCR notes that more attention should have been given to financial management.

58. The Project is rated highly efficacious. The physical outputs of the project were achieved with the expected benefits for health, living conditions, the environment, and economic activity. Although the financial objectives for Pulandian and Jinshitan were not achieved fully by the end of the Project, these subprojects were a small part of the overall Project.

C. Efficiency

59. The Project is rated efficient. FIRR's recalculated for this evaluation are well above the WACC. The Project delivered cost-effective increases in the quality and quantity of water available, which resulted in improvements in access to water, health and the quality of the urban environment. The EIRR is above 12%.

²⁰ ADB. 2002. *Country Strategy and Program Update (2003-2005)*, People's Republic of China. Manila.

60. The EAs managed the Project effectively. Costs were 25% less than appraisal estimates. The main part of the Project (the northern and southern conveyors) was completed more than a year ahead of schedule. Only the subprojects for Pulandian and Jinshitan, which were added after reappraisal in 1997, were completed later than the scheduled completion dates.

D. Sustainability

61. The financial sustainability of the Project has been demonstrated by the willingness and ability of DWSG, DWDC, and the municipal and provincial governments to increase tariffs to generate the funds required to meet operating costs and debt service obligations. To ensure that costs can be covered by operating revenues, the companies are required to review tariffs every 2 years.

62. DWSG and DWDC have the technical and financial skills to operate the project facilities effectively and efficiently.

63. DMG and the WSCs have demonstrated a high level of commitment to the Project and to making available the technical and management skills to operate and maintain project facilities. Most recognize that maintaining the water supply is essential for economic development in the area. Increasing tariffs to ensure the financial viability of water supply facilities is in line with central government policy, and is generally well accepted by water consumers in Dalian. Beneficiaries are aware of the benefits generated by the Project. The sustainability of the Project and its benefits over the long term is rated most likely.

E. Institutional Development and Other Impacts

64. The Project increased the technical skills available to the WSCs and strengthened their project management capacities. It has improved living conditions for the population in Dalian. The increase in wastewater would become a problem if not addressed, but DMG has established a plan for treating all wastewater by 2010. The Project has had a positive impact on economic growth in Dalian by removing the bottleneck created by an inadequate water supply. Increased availability of water and increased recycling of wastewater have led to significant improvements in the urban environment. The Project's institutional development and other impacts are rated significant.

F. Overall Project Rating

65. Based on these assessments, the Project is rated highly successful.

G. Assessment of ADB and Borrower Performance

66. The performance of ADB in project implementation is rated satisfactory. Regular review missions monitored progress and the attainment of project targets. Although the EAs were generally positive about the responsiveness of ADB staff, they expressed reservations about the slow response of ADB during the procurement approval process. The performance of the Government and the EAs is rated highly satisfactory. The Project was completed ahead of schedule and below budget, and the commissioned facilities are operated as planned. There were no disputes or contractual difficulties with any suppliers or contractors.

VI. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS

A. Key Issues for the Future

67. Water supply and sanitation projects in many developing member countries (DMCs) suffer from delays and cost overruns, which affect the financial and economic performance of the projects. The OEM identified two key issues emerging from this Project. Its completion according to the appraisal schedule was achieved because of the commitment of the municipal and provincial governments to making the project facilities operational as quickly as possible with sound management support in the agencies concerned. Timely completion also helped solidify consumers' support for tariff adjustments, which contributed to project sustainability. Completion of the Project without cost overruns also contributed significantly to its success. Effective and efficient management plays an important part in achieving cost savings.²¹

68. In areas where populations are large and water is scarce, such as Dalian, water producers and consumers in many DMCs are under pressure to conserve water. As noted in the IESWSS, tariffs can be used to complement technical measures in managing water demand. DWSG used large tariff increases—up to 190% over a 4-year period—to promote water conservation in Dalian. However, a shared belief in the need to control consumption aided their acceptability and impact. Tariff reform established local regulations that simplified and increased the transparency of the administrative and approval procedures for tariff adjustments. Regulations now rationalize the financial basis for estimating tariff requirements and increasing water prices to levels that ensure the water supply company's financial viability and sustainability. The success with water supply tariff reform in PRC under the auspices of ADB TAs²² offers useful policy inputs for achieving similar reforms in other DMCs.

B. Lessons Identified

69. As demonstrated by DMG in this Project, a commitment by the local government is the most important factor contributing to the success of water supply and sanitation projects. The Project also was implemented against a backdrop of an escalating water supply crisis in Dalian, providing a strong incentive for all concerned to perform effectively.

70. Starting with a limited and irregular water supply, the Project produced tangible benefits for all water consumers in Dalian within a relatively short period. The Project provides a 24-hour supply of good quality water. Consumers accept and understand the need for higher tariffs, but only if the water supply services are adequate and reliable, as in this Project.

C. Follow-Up Actions

71. The OEM recommends no follow-up actions.

²¹ ADB's Operations Evaluation Department is conducting a special evaluation study on project cost estimates. This study would give further insights on the developmental impact of cost variations.

²² TA 2773-PRC: *Water Supply Tariff Study*, approved on 24 March 1997, for 169,000, and TA 3250-PRC: *Water Supply Tariff Study II*, approved on 3 September 1999, for \$950,000. The impacts of these two TAs were reviewed in the IESWSS (footnote 8).

SUBPROJECTS AT REAPPRAISAL AND ACTUAL IMPLEMENTATION

Subproject	Unit	Appraisal	Actual
A. Northern			
1. Intake Work	set	1	1
2. Closed Conduit	km	44.2	42.7
3. Tunnel	km	15.8	15.9
4. Inverted Siphon	km	19.1	9.2
5. Pipe Bridge ^a	km	1.6	0
6. Offtake	unit	6	6
7. Capacity	m ³ /day	1.2 million	1.3 million
B. Southern			
1. Delivery Pump Station			
a. Pump Station	set	7	7
b. Capacity	m ³ /day	670,000	670,000
2. Lift Pump Station			
a. Pump Station	set	7	5
b. Capacity	m ³ /day	500,000	500,000
3. Booster Pump Station	pump	8	8
4. Pipeline			
a. Transmission Pipeline 1	km	86	86
b. Transmission Pipeline 2	km	79	61
5. Water Treatment Plant	unit	2	2
a. Capacity: Dashagou	m ³ /day	180,000	180,000
b. Capacity: Jinzhou	m ³ /day	150,000	70,000
6. Distribution Network			
a. Storage Tank	piece	5	2
b. Capacity	m ³ /day	24,000	15,000
c. Pipeline	km	176.1	170.5
C. Pulandian^b			
1. Water Treatment Plant	m ³ /day	50,000	50,000
2. Pipeline			
a. Transmission	km	32.9	33.3
b. Distribution	km	20	20
D. Jinshitan^b			
1. Water Treatment Plant	m ³ /day	5,000	5,500
2. Pipeline			
a. Transmission	km	7	7
b. Distribution	km	40	43

m³ = cubic meter, km = kilometer

^a Changed to inverted siphon.

^b Additional subprojects after reappraisal.

Source: Project Completion Report (2000), Operations Evaluation Mission (2003).

PROJECT COSTS AT REAPPRAISAL AND ACTUAL COSTS
(\$ million)

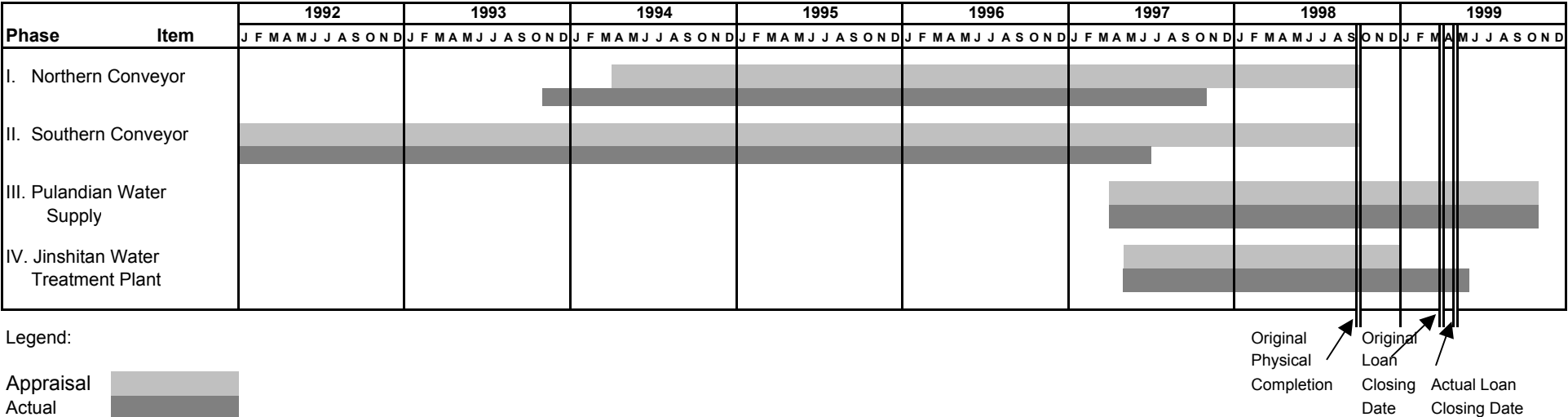
Item	Reappraisal			Actual			Variation		
	FX	LC	Total	FX	LC	Total	FX	LC	Total
A. Base Cost									
1. Land and Resettlement	0.00	15.67	15.67	0.00	13.35	13.35	0.00	(2.32)	(2.32)
2. Civil Works	17.91	132.50	150.41	13.57	132.07	145.64	(4.34)	(0.43)	(4.77)
3. Construction Materials	92.91	8.67	101.58	80.11	6.24	86.35	(12.80)	(2.43)	(15.23)
4. Equipment	29.38	1.33	30.71	15.06	5.76	20.82	(14.32)	4.43	(9.89)
5. Consulting Services and Training	3.06	8.26	11.32	1.52	8.85	10.37	(1.54)	0.59	(0.95)
6. Administration	0.44	3.26	3.70	0.15	4.41	4.56	(0.29)	1.15	0.86
Subtotal	143.69	169.70	313.39	110.41	170.68	281.09	(33.28)	6.78	(26.50)
B. Contingencies									
1. Physical	7.75	15.47	23.22	0.00	0.00	0.00	(7.75)	(15.47)	(23.22)
2. Price	10.15	26.60	36.75	0.00	0.00	0.00	(10.15)	(26.60)	(36.75)
Subtotal	17.90	42.07	59.97	0.00	0.00	0.00	(17.90)	(42.07)	(59.97)
C. IDC and Other Charges	17.51	17.53	35.04	16.62	10.54	27.16	(0.89)	(6.99)	(7.88)
Total	179.10	229.30	408.40	127.03	181.22	308.25	(52.07)	(48.08)	(100.15)
FX/LC Ratio (%)	43.90	56.10	100.00	41.20	58.80	100.00			

FX= foreign exchange cost, IDC = interest during construction, LC = local currency cost.

Note: Totals and subtotals may vary slightly due to rounding.

Source: Project Completion Report (2000), Operations Evaluation Mission (2003).

IMPLEMENTATION SCHEDULE: AS APPRAISED AND ACTUAL



Source: Project Completion Report (2000).

STATUS OF COMPLIANCE WITH LOAN COVENANTS

Covenant	Status of Compliance
A. Policy Issues	
<p>1. Dalian Municipal Government (DMG) and the Executing Agencies (EAs) will (i) investigate potential alternative sources of water and strategies for efficient allocation of water, and (ii) conduct a workshop in 1996 to address the economic pricing of water resources, allocation among competing users, calculation of prices, and progressive (incremental) tariffs, including the use of indexation to address foreign exchange fluctuations in debt servicing requirements. DMG will provide the Asian Development Bank (ADB) with a report summarizing the findings of its investigation and those of the workshop. (Loan Agreement [LA], Schedule 6, para. 6).</p>	<p>Complied with. DMG completed a feasibility study on the second stage project along Yinghahe River. DMG conducted the workshop in July 1997.</p>
<p>2. DMG will provide ADB each year after the loan effective date until fiscal year 2009 (i) a report on water quality prepared by the Dalian Environmental Protection Bureau; (ii) a progress report on the status of planned additions to wastewater treatment capacity (including industrial pre-treatment) for the areas served by the Project; and (iii) a progress report on implementation of its Water Conservancy Program, including recycling, water saving measures, salt water use, relocation of major water-consuming industrial enterprises, and other measures that have a significant impact on water conservation and wastewater reduction. (LA, Schedule 6, para. 10).</p>	<p>Being complied with. DMG, in coordination with the Dalian Environmental Protection Bureau, Public Utility Bureau, and the Urban Construction Bureau has submitted environmental reports to ADB.</p>
B. Financial	
<p>3. The Borrower will ensure that all funds required to finance the Project (other than the loan) will be made available on time. (LA, Schedule 6, para. 4).</p>	<p>Complied with. Timely availability of funds enabled early completion of the project.</p>
<p>4. Dalian Water Supply Group (DWSG), previously called Dalian Water Supply Company, and Dalian Water Supply Company (DWSC), previously called Dalian Yinbi Northern Water Supply Company, will (i) maintain separate accounts for Parts A and B of the Project, and for its overall operations; (ii) have such accounts and related financial statements (balance sheet, statement of income and expenses, and sources and uses of funds statements) audited annually by auditors acceptable to ADB, in accordance with appropriate auditing standards; and (iii) furnish to ADB each</p>	<p>Complied with. DWSC and DWSG have submitted the annual audited financial statements from FY1995 to FY1998.</p>

Covenant	Status of Compliance
<p>year for the first 10 years of operation of the project facilities, promptly after their preparation but not later than 6 months after the close of the fiscal year (FY) to which they relate, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto, all in English. (Project Agreement [PA], Section 2.09 (a).)</p>	
<p>5. Except as ADB may otherwise agree, DWSG and DWSC will use the proceeds of the loan to finance expenditures on the Project in accordance with the provisions of the LA and PA, and will ensure that all goods and services financed out of such proceeds are used exclusively for carrying out the Project. (PA, Section 2.13).</p>	Complied with.
<p>6. DWSG and DWSC will not incur any new debt from the beginning of fiscal year 1999 unless their internal cash generation for the fiscal year immediately preceding the date of such debt or for the 12-month period ended prior to the date of such debt, whichever is greater, will be at least 1.2 times the projected debt service requirements for any succeeding fiscal year on all long-term debt (including the debt to be incurred). (PA, Section 2.16).</p>	Being complied with.
<p>7. The water tariffs of Dalian will be maintained at a level sufficient to generate revenue for DWSG and DWSC (i) to cover (a) all operating and maintenance (O&M) costs, and (b) all debt service requirements or depreciation expenses, whichever is greater; and (ii) to maintain a debt service ratio not less than 1.2 times from the beginning of FY1999. DMG will ensure that water tariffs will enable DWSG and DWSC to comply with the financial requirements stated in the preceding sentence. For this purpose, DMG will, during the first half of every fiscal year starting from FY1997, annually review water tariffs charged by DWSG and DWSC and communicate its findings promptly to ADB for review and comments for 10 years until FY2007. (PA, Section 2.18).</p>	<p>Complied with by DWSC and being complied with by DWSC. Two tariff increases were carried out during project implementation. The latest tariff increase, implemented in August 1998, generated sufficient revenue to maintain O&M costs and with no losses incurred. An action plan for 2001/02 proposed in the Project Completion Report.</p>
<p>8. DMG will phase out its subsidy covering a portion of the O&M costs of DWSG within 1 year after the completion and commissioning of the project facilities. DMG will ensure that such costs will be recovered directly from consumers of water. (PA, Section 2.20).</p>	<p>Being complied with by DWSC. DMG has been reducing subsidies each year and plans to eliminate them by 2005 (Appendix 6, para. 8).</p>

Covenant	Status of Compliance
C. Institutional	
9. The Leading Group (LG) for the Project, headed by the executive vice mayor of Dalian and the heads of appropriate Dalian bureaus and departments, will provide overall guidance to the Project. (LA, Schedule 6, para. 1).	Complied with.
10. A project management unit and a project finance unit will (i) provide regular and systematic liaison between the LG and the EAs, (ii) ensure that policy decisions of the LG are implemented effectively, and (iii) provide senior-level project management, coordination, and quality control, and coordination of the services of the international consultants. (LA, Schedule 6, para. 2).	Complied with.
11. Project implementation units (PIU)—one formed by DWSG and one by DWSC—will be responsible for day-to-day implementation of Parts A and B of the Project, respectively. Each PIU will establish project offices at appropriate sites within Parts A and B. DWSG and DWSC will ensure that each PIU is staffed with an adequate number of qualified and experienced personnel throughout the implementation of the Project. (LA, Schedule 6, para. 3).	Complied with.
D. Implementation	
12. The Borrower will ensure that all lands and properties necessary for the resettlement of people who will be affected by the Project will be acquired or made available in time to avoid any delay in the implementation and operation of the Project. (LA, Schedule 6, para. 11).	Complied with. Lands for building houses, vegetable lands, and for productive materials were provided to ensure the normal production and living conditions of residents.
13. In carrying out Parts A and B of the Project, DWSG and DWSC will employ competent and qualified consultants and contractors acceptable to ADB to the extent and upon terms and conditions satisfactory to ADB. (PA, Section 2.03).	Complied with.
14. DWSG and DWSC will carry out Parts A and B of the Project in accordance with plans, design standards, specifications, work schedules, and construction methods acceptable to ADB. (PA, Section 2.04).	Complied with.
15. DWSG and DWSC will furnish to ADB quarterly and annual reports on the execution of Parts A and B of the Project, and on the operation and management of the project facilities. The reports will be submitted within 1 month after the end of each quarter and year, and will indicate, among	Complied with. Reports for Parts A and B were submitted regularly.

Covenant	Status of Compliance
<p>other things, progress made and problems encountered during the quarter under review, steps taken or proposed to be taken to remedy these problems, and proposed program of activities and expected progress during the following quarter. (PA, Section 2.07).</p>	
<p>16. Promptly after completion of the Project, but not later than 1 year thereafter or such later date as ADB may agree for this purpose, DWSG and DWSC will prepare and furnish to ADB reports on the execution and initial operation of Parts A and B of the Project, including cost, the performance by DWSG and DWSC of their obligations under the PA, and the accomplishment of the purposes of the loan. (PA, Section 2.08).</p>	<p>Complied with. Project Completion Reports for the northern and southern subprojects and Pulandian and Jinshitan subprojects have been submitted.</p>
<p>E. Operational</p>	
<p>17. Training will be provided for selected staff of the EAs and related Dalian staff involved in project implementation, quality control, and various aspects of management, administration, and O&M of the project facilities. DMG and the EAs will prepare a training program and, in consultation with the international consultants, develop the format of the report that will be submitted by participants upon completion of their training. The training program, list of candidates, and report format will be provided to ADB for its review and comments prior to the commencement of the training program. (LA, Schedule 6, para. 5).</p>	<p>Complied with. Training of selected staff of the EAs was undertaken, including overseas study tours.</p>
<p>18. The EAs will continuously monitor the Project and report to ADB on the physical and financial aspects of the project implementation. The PIUs will develop a detailed benefit monitoring and evaluation (BME) system with the assistance of the international consultants, following ADB's guidelines for BME. (LA, Schedule 6, para. 7).</p>	<p>Complied with. The implementation consultants have developed BME system.</p>
<p>19. After ADB has approved the BME system, the EAs will use it to evaluate the benefits of the Project in accordance with a schedule and terms of reference to be agreed upon with ADB. Data will be collected and prepared after the first year of implementation and updated annually thereafter, with the first report prepared in FY1996. DMG will furnish the annual reports to ADB for 10 years thereafter, or as ADB may otherwise agree. (LA, Schedule 6, para. 8).</p>	<p>Complied with. BME reports have been submitted by DWSG and DWSC.</p>

Covenant	Status of Compliance
20. The EAs will ensure that the project facilities are designed, constructed, and operated in strict conformity with the Borrower's codes and regulations and in compliance with the national environmental emission and effluent standards. (LA, Schedule 6, para. 9).	Complied with. Design, construction, and operation of facilities are in accordance with the national standards.
21. DMG will conduct an independent post-evaluation of the resettlement program, including a socioeconomic survey of those resettled, in the year following commencement of operation of the project facilities. These findings will be reported to ADB. (LA, Schedule 6, para. 12).	Complied with. A post-evaluation of the resettlement program has been conducted and the report submitted to ADB.
22. DWSG and DWSC will reduce their O&M expenditures. (PA, Section 2.11 [c]).	Being complied with. Measures are being adopted to reduce operating costs.

RESETTLEMENT ISSUES

1. At appraisal, the Executing Agencies (EAs) and the Dalian Municipal Government (DMG) prepared a resettlement plan that was reviewed and accepted by the Asian Development Bank (ADB). The plan required the resettlement of 450 households (1,800 persons) in accordance with the Government's Resettlement Law of 1991. Under the plan, 250 households in rural areas were to be resettled in newly constructed houses and provided with an equivalent land area of equal quality and production capacity. About 50 of the households were expected to return to their own land after the completion of project construction, with the added benefit of a new house. The other 200 households were in urban areas and chose to be resettled in apartments in existing developments. The new housing was expected to be of superior quality, with modern conveniences. The resettled families were to be compensated for loss of income or productivity of their land due to the Project. All households were to be resettled within their existing communities. The allocation for resettlement activities was about \$13.5 million (mostly for land and house replacement), which was included under the land acquisition cost for the Project.

2. At project completion, 259 of the 450 households estimated at appraisal had been resettled. Adopting alternative routes for pipelines significantly reduced the number of affected households. Resettlement costs including land acquisition totaled about \$13.3 million equivalent. Resettlement was carried out in accordance with the relevant law. Of those resettled, 149 households were under the northern component. Average compensation paid (CNY257,000) was more than 12 times the mean rural annual income. Other affected households received compensation for loss of agricultural production and additional transportation costs. All households rebuilt their houses along the conveyor alignment with new materials and improved standards. The other 110 households that were resettled were under the southern component. All were resettled near their original sites, but with improved housing quality and new economic opportunities.

3. Resettlement was given priority early in the project preparation. Special committees and investigating teams were formed to assess losses, establish market values of assets, select resettlement sites, and prepare relocation schedules. Affected families were consulted extensively. A study¹ completed in 1999 showed that 97% of the respondents agreed that the resettlement program had been a success. Most households (94%) indicated that they were better off than they had been before resettlement, and all were satisfied with the compensation process in which local authorities and the affected households were consulted extensively. The study concluded that the resettlement component of the project had been satisfactorily implemented.

¹ National Research Centre for Resettlement and Hohai University. 1999. *Special Study on the Policy Impact of Involuntary Resettlement, Dalian Water Supply Project*. This study was a component of TA 5832-REG (ADB. 1999. *Evaluation Studies in the Bank's DMCs*. Manila [for \$1,000,000]).

FINANCIAL PERFORMANCE OF DALIAN WATER SUPPLY COMPANIES

A. Project Financial Aims

1. The Project aimed to improve the financial performance of the Dalian Water Supply Group (DWSG), previously called Dalian Water Supply Company, and the Dalian Water Supply Company (DWDC), previously called the Dalian Yinbi Northern Water Supply Company. It covered (i) controlling operation and maintenance (O&M) expenditures; (ii) maintaining internal cash generation at a level at least 1.2 times the debt service requirements; (iii) maintaining water tariffs sufficient to generate revenues to cover O&M costs and debt service requirements or depreciation, whichever is higher; (iv) reviewing water tariffs annually; and (v) phasing out operating subsidies from the Dalian Municipal Government (DMG) within a year of the completion and commissioning of project facilities. Similar financial objectives applied to the subprojects added in 1997 for Pulandian and Jinshitan.

B. Tariffs

2. For water consumers, tariffs have risen rapidly since the beginning of the Project. DWSG tariffs since 1992 are shown in Table A6.1. The most recent tariff adjustment was in August 2001. Since the beginning of project implementation in the first quarter of 1995, the domestic tariff has increased by 475% and the tariffs for commercial and industrial consumers by 178% and 167%, respectively. During the same period, inflation has been around 12% and per capita gross domestic product has increased by around 50%.

Table A6.1: Water Tariffs, 1992–2002
(CNY/m³)

Category	Time of Adjustment				
	Jul 1992	Oct 1993	Aug 1995	Aug 1998	Aug 2001
Domestic	0.40	0.40	1.20	1.60	2.30
Institutions	0.40	1.00	1.50	2.20	3.20
Commercial	0.80	1.80	2.00	3.00	5.00
Industrial	0.60	1.20	1.50	2.20	3.20
Public Bath Houses	0.40	1.00	1.20	2.20	5.00
Saunas, Pools, etc.	0	0	0	12.00	20.00
DETDZ (raw water)	0.54	0.80	1.20	1.80	2.30

DETDZ = Dalian Economic and Technology Development Zone.
Source: Dalian Water Supply Group (2003).

3. At the same time, the rates for different types of users have converged, reducing cross-subsidies and reflecting a more equitable allocation of costs. Between 1995 and 2001, the ratio of tariffs for the two major consuming groups—industrial and domestic (residential) consumers—declined to 1.4:1 from 3:1.

4. Tariff increases for domestic consumers have been relatively well accepted¹ because of the generally rising incomes and the significant improvement in the water supply for households. Commercial and industrial consumers have responded to the price increases by reducing consumption where possible (i.e., by adjusting processes, introducing water saving devices, recycling, etc.).

C. Dalian Water Supply Group

5. Under the loan covenants, the EAs were required to increase and maintain tariffs high enough to cover O&M costs plus debt service or depreciation, whichever was greater. In addition, they had to maintain a debt service ratio of at least 1.2 from the beginning of fiscal year (FY) 1999. Tariffs were to be reviewed annually and subsidies phased out within a year of the completion and commissioning of project facilities. DWSG has maintained operating revenues above the cost of O&M and debt servicing since 1998, though not above the cost of O&M and depreciation.² From 2004, internal cash generation is projected to be greater than O&M costs and depreciation. The debt service ratio will be greater than 1.2 from 2003 onwards.

6. At the time of the project completion report (PCR), neither the assets nor the liabilities of the Project had been included in the DWSG balance sheet. The DWSG portion of these assets appear to have been included in the balance sheet in 2001, when there was an increase of CNY965 million in fixed assets, equivalent to almost 40% of project-related assets. For the projections in the income statement, a straight line depreciation of this amount over 25 years has been used, although it is higher than the total depreciation charged to the accounts in 2002.

7. Accounts receivable for DWSG were CNY185.3 million at the end of 2002, which was equivalent to 4.9 times monthly water sales. This was an improvement from the end of 2001 when accounts receivable amounted to 5.9 times monthly sales. The change is due to the increased value of water sales in 2002 following of the tariff increase in August 2001 and a decrease of about CNY4 million in the total value of accounts receivable. However, 2001 and 2002 show a deterioration from earlier years. Accounts receivable were 1.9 times monthly sales at the end of 1995 and 3.4 times monthly sales at the end of 1999. The major receivables are from relatively few state-owned enterprises, which are subject to reform and restructuring. DWSG pointed out that about 87% of domestic customers and 97% of non-domestic customers pay water bills regularly within the time permitted.

8. DWSG has been receiving subsidies from DMG. In 2002, subsidies amounted to CNY4.2 million. The loan covenants included a requirement that subsidies be phased out within a year of the completion and commissioning of the project facilities, but DWSG has not complied yet. Based on the revised projections for the income statement, subsidies will be eliminated from 2005.

9. O&M expenditures are greater than those included in the PCR income statement for DWSG, which excludes the cost of bulk water delivered by Dalian Water Delivery Company (DWDC) If these are included, then O&M costs are lower than those expected at project completion. Even taking into account lower-than-expected sales volumes, O&M expenditures appear to be well controlled.

¹ ADB. 2003. *Impact Evaluation Study on Water Supply and Sanitation Projects in Selected Developing Member Countries*. Manila.

² Debt service for 2001 and 2002 are not clear and data from the PCR indicate relatively large debt service costs in these 2 years. It may be that operating revenues were not above O&M and debt servicing in these two years.

D. Dalian Water Delivery Company

10. DWDC buys water from the Dalian Water Affairs Bureau and sells bulk water to DWSG for treatment and distribution to its customers. There is a single tariff for water sales. The PCR provides the most recent data for DWDC. The income statement has been revised using up-to-date projections, principally slower sales growth to reflect the slower growth in DWSG sales. Costs, with the exception of purchases of raw water, have not been adjusted.

11. At project completion, DWDC was in compliance with the covenants on cash generation and the debt service ratio. Based on the debt service data in the PCR and the revised projections, the company will have a positive net income from 2003 onwards with a debt service ratio above 1.2 for 2003-2010.

Table A6.2: Dalian Water Supply Group: Income Statement
(CNY million)

Item	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Actual									Projected							
Revenues																	
Water Sold (mcm)	201.8	219.3	229.6	245.9	259.9	231.5	241.7	215.6	179.7	185.1	190.6	196.3	202.2	208.3	214.5	221.0	227.6
Revenue per Unit (CNY/m ³)	0.8	0.9	1.2	1.2	1.4	1.8	1.8	1.8	2.5	2.7	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Water Sales Increase (%)	—	8.7%	4.7%	7.1%	5.7%	-10.9%	4.4%	-10.8%	-16.67%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Average Tariff Increase (%)	—	16.3%	29.3%	0.7%	13.8%	26.2%	-0.6%	2.3%	39.6%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Operating Revenues	163.8	207.1	280.4	302.4	363.7	409.0	425.6	388.2	451.3	492.8	538.0	587.4	641.3	700.2	764.5	834.6	911.3
Other Revenues	56.1	90.0	71.2	56.0	68.5	114.8	44.9	24.7									
Total Revenues	219.9	297.1	351.6	358.4	432.2	523.8	470.5	412.9	451.3	492.8	538.0	587.4	641.3	700.2	764.5	834.6	911.3
Expenses																	
Operating Expenses																	
Salaries and Benefits	23.5	32.3	39.7	44.7	37.0	37.0	37.6	41.4	38.2	39.0	39.7	40.5	41.3	42.2	43.0	43.9	44.8
Power	97.4	103.0	122.4	116.6	111.3	112.8	111.7	97.6	91.9	94.7	97.5	100.5	103.5	106.6	109.8	113.1	116.5
Bulk Water	64.8	73.5	75.8	79.7	82.2	100.6	106.2	101.7	168.0	173.0	178.2	183.6	189.1	194.7	200.6	206.6	212.8
Chemicals/Maintenance & Repairs	24.1	29.1	37.6	36.5	40.7	34.4	34.3	37.8	49.1	50.6	52.1	53.7	55.3	57.0	58.7	60.4	62.2
Administration/Overhead	31.2	38.6	39.2	39.2	43.6	42.2	51.8	56.5	46.9	48.3	49.7	51.2	52.8	54.4	56.0	57.7	59.4
Subtotal Operating Expenses	241.0	276.5	314.7	316.7	314.8	327.0	341.6	335.0	394.1	405.6	417.3	429.5	442.0	454.8	468.0	481.6	495.6
Other Expenses (Subcompanies)	47.9	86.2	59.0	45.7	62.3	89.5	31.7	17.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Operating Expenses	288.9	362.7	373.7	362.4	377.1	416.5	373.3	352.1	394.1	405.6	417.3	429.5	442.0	454.8	468.0	481.6	495.6
Net Income Before Depreciation	(69.0)	(65.6)	(22.1)	(4.0)	55.1	107.3	97.2	60.8	57.2	87.2	120.6	157.9	199.4	245.4	296.4	353.0	415.6
Depreciation	19.9	19.4	21.4	21.4	21.7	104.0	93.6	58.0	25.8	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6
Net Income Before Interest & Tax	(88.9)	(85.0)	(43.5)	(25.4)	33.4	3.3	3.6	2.8	31.4	48.6	82.0	119.3	160.8	206.8	257.8	314.4	377.0
Interest - ADB (1)	0.0	0.0	0.0	0.0	32.9	34.8	34.5	33.9	32.3	32.5	31.6	30.7	29.7	28.6	27.4	26.0	24.5
Interest - SDB (1)	0.0	0.0	0.0	0.0	13.0	13.0	13.0	13.0									
Tax	0.4	1.1	1.7	1.4	2.2	3.3	3.6	2.8	3.4	—	—	—	—	—	—	—	—
Net Income Before Subsidy	(89.3)	(86.1)	(45.2)	(26.8)	(14.7)	(47.8)	(47.5)	(46.9)	(4.2)	16.1	50.4	88.6	131.1	178.2	230.4	288.4	352.5
Government Subsidy (DMG)	88.9	85.0	46.0	28.9	14.9	47.8	47.5	46.9	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Income	(0.4)	(1.1)	0.8	2.1	0.2	0.0	0.0	0.0	(0.0)	16.1	50.4	88.6	131.1	178.2	230.4	288.4	352.5
Financial Indicators																	
Operating Ratio	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5
Debt Service Ratio					1.5	3.2	2.5	2.2	1.8	2.0	2.7	3.5	4.4	5.3	6.3	7.5	8.7
Net Internal Cash Generation	19.5	18.3	22.2	23.5	67.8	151.8	141.1	104.9	58.0	87.2	120.6	157.9	199.4	245.4	296.4	353.0	415.6
Principal Amortization	0.0	0.0	0.0	0.0	0.0	0.0	8.9			11.8	13.1	14.5	15.9	17.5	19.3	21.3	23.5
Total Debt Service	0.0	0.0	0.0	0.0	45.9	47.8	56.4	46.9	32.3	44.3	44.7	45.2	45.6	46.1	46.7	47.3	48.0

— = data not available.

ADB = Asian Development Bank, DMG = Dalian Municipal Government, m³ = cubic meter, SDB = State Development Bank.

Source: Project Completion Report (2000), Operations Evaluation Mission (2003).

Table A6.3: Dalian Water Supply Group: Balance Sheet
(CNY million)

Item	1994	1995	1996	1997	1998	1999	2000	2001	2002
	Actual								
Assets									
Current Assets									
Cash	16.15	26.59	18.39	36.85	76.17	84.57	48.06	59.01	64.63
Inventories	18.98	17.35	15.56	21.44	13.94	27.14	16.33	14.18	16.22
Accounts Receivable	20.01	32.80	47.51	51.53	86.83	114.86	154.30	189.47	185.31
Other Receivables	113.36	64.65	70.87	44.87	44.59	27.84	73.88	157.34	161.34
Subtotal	168.50	141.39	152.33	154.69	221.53	254.41	292.57	420.00	427.49
Fixed Assets									
Gross Value	1,009.70	1,053.00	1,516.34	1,527.01	1,557.88	1,650.86	1,647.71	2,565.23	2,608.92
Accumulated Depreciation	425.05	445.62	467.00	487.58	552.59	530.60	549.29	649.08	674.81
Net Fixed Assets	584.65	607.38	1,049.34	1,039.43	1,005.29	1,120.26	1,098.42	1,916.15	1,934.11
Work in Progress	2.06	3.03	3.64	5.12	6.04	11.42	28.78	44.77	71.92
Subtotal	586.71	610.41	1,052.98	1,044.55	1,011.33	1,131.68	1,127.20	1,960.93	2,006.03
Long-Term Investments	7.56	1.66	6.27	6.79	10.48	10.47	27.74	31.55	32.31
Other Assets	0.41	3.80	5.02	8.29	9.08	10.24	9.39	8.96	8.66
Total Assets	763.18	757.26	1,216.60	1,214.32	1,252.42	1,406.80	1,456.90	2,421.44	2,474.49
Liabilities									
Current Liabilities									
Accounts Advanced	33.10	39.25	27.98	39.91	68.35	24.44	2.84	2.28	1.34
Accounts Payable	3.72	3.23	10.96	0.15	—	—	—	125.49	179.55
Other Payables	110.62	66.95	61.20	67.16	48.13	139.08	193.32	88.26	35.19
Current Portion of Loans	—	—	—	—	20.00	45.00	80.00	129.70	160.00
Subtotal	147.44	109.43	100.14	107.22	136.48	208.52	276.16	345.74	376.08
Long-Term Liabilities	4.04	2.45	8.45	0.34	9.17	20.69	8.02	1.56	8.38
Total Liabilities	151.48	111.88	108.59	107.56	145.65	229.21	284.18	347.30	384.456
Subscribed Capital	406.90	406.90	406.90	404.90	404.91	404.91	404.91	404.91	404.91
Reserved Capital (donation)	203.99	237.05	699.01	698.78	698.78	769.60	767.81	1,669.23	1,685.12
Retained Earnings	0.81	1.43	2.10	3.08	3.08	3.08			
Total Equity	611.70	645.38	1,108.01	1,106.76	1,106.77	1,177.59	1,172.72	2,074.14	2,090.03
Total Liabilities and Equity	763.18	757.26	1,216.60	1,214.32	1,252.42	1,406.80	1,456.90	2,421.44	2,474.49

— data not available.

Source: Project Completion Report (2000), Operations Evaluation Mission (2003).

Table A6.4: Dalian Water Delivery Company: Income Statement
(CNY million)

Item	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Actual						Projected										
Revenues																	
Water Sold (mcm)	247.4	261.2	288.7	229.5	241.0	259.1	265.7	252.4	239.8	247.0	254.4	262.0	269.9	278.0	286.3	294.9	303.8
Revenue per Unit (CNY/m ³)	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8
Water Sales Increase (%)	—	5.6%	10.5%	-20.5%	5.0%	7.5%	2.5%	-5.0%	-5.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Average Tariff Increase (%)	—	0.0%	0.0%	0.0%	58.8%	0.0%	0.0%	15.0%	4.7%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Operating Revenues	84.1	88.8	98.2	78.0	130.1	139.9	143.5	156.7	155.9	165.4	175.5	186.1	197.5	209.5	222.3	235.8	250.2
Other Revenues																	
Total Revenues	84.1	88.8	98.2	78.0	130.1	139.9	143.5	156.7	155.9	165.4	175.5	186.1	197.5	209.5	222.3	235.8	250.2
Expenses																	
Operating Expenses																	
Salaries	1.7	1.9	2.0	2.1	2.2	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.8	4.0	4.3	4.6	4.9
Power	8.7	9.5	14.9	17.8	15.8	6.2	7.0	7.2	7.4	7.6	7.9	8.1	8.4	8.6	8.9	9.1	9.4
Raw Water	44.7	47.2	52.1	41.5	43.5	43.1	48.0	45.6	43.3	44.6	46.0	47.3	48.8	50.2	51.7	53.3	54.9
Maintenance	19.5	6.3	9.7	20.5	9.9	10.2	11.9	13.1	14.4	15.8	17.4	19.2	21.1	23.2	25.5	28.1	30.9
Administration/Overhead	5.9	5.9	6.6	6.7	6.4	7.3	7.0	7.4	7.7	8.1	8.5	8.9	9.4	9.8	10.3	10.9	11.4
Subtotal Operating Expenses	80.5	70.8	85.3	88.6	77.8	69.1	76.4	75.9	75.7	79.3	83.0	87.1	91.3	95.9	100.7	105.9	111.5
Other Expenses																	
Total Operating Expenses	80.5	70.8	85.3	88.6	77.8	69.1	76.4	75.9	75.7	79.3	83.0	87.1	91.3	95.9	100.7	105.9	111.5
Net Income before Depreciation	3.6	18.0	12.9	(10.6)	52.3	70.8	67.1	80.8	80.2	86.1	92.4	99.1	106.2	113.6	121.5	129.9	138.7
Depreciation	9.4	9.4	9.4	9.4	56.5	28.5	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3	56.3
Net Income before Interest and Tax	(5.8)	8.6	3.5	(20.0)	(4.2)	42.3	10.8	24.5	23.9	29.8	36.1	42.8	49.9	57.3	65.2	73.6	82.4
Interest - ADB						18.1	27.2	26.7	25.5	24.9	24.1	23.3	22.4	21.4	20.2	19.0	17.7
Interest - SDB						15.2	8.7	8.7	3.7	0.0							
Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Income Before Subsidy	(5.8)	8.6	3.5	(20.0)	(4.2)	9.0	(25.1)	(10.9)	(5.3)	4.9	12.0	19.5	27.5	35.9	45.0	54.6	64.7
Government Subsidy (DMG)	11.6	4.9	3.2	23.6			25.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Income	5.8	13.5	6.7	3.6	(4.2)	9.0	0.1	(10.9)	(5.3)	4.9	12.0	19.5	27.5	35.9	45.0	54.6	64.7
Financial Indicators																	
Operating Ratio	1.0	0.8	0.9	1.1	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
Debt Service Ratio						2.1	2.1	0.7	0.8	2.5	2.6	2.8	3.0	3.2	3.4	3.6	3.7
Net Internal Cash Generation	15.2	22.9	16.1	13.0	52.3	70.8	92.3	80.8	80.2	86.1	92.4	99.1	106.2	113.6	121.5	129.9	138.7
Principal Amortization	0.0	0.0	0.0	0.0	0.0	0.0	7.3	88.0	68.9	9.7	10.8	11.8	13.0	14.4	15.9	17.5	19.3
Total Debt Service	0.0	0.0	0.0	0.0		33.3	43.2	123.4	98.1	34.6	34.9	35.1	35.4	35.8	36.1	36.5	37.0

Note: Based on data from PCR with updated projections.

ADB = Asian Development Bank, DMG = Dalian Municipal Government, m³ = cubic meter, mcm = million cubic meter, SDB = State Development Bank.

Source: Project Completion Report (2000) and Operations Evaluation Mission (2003).

FINANCIAL AND ECONOMIC ANALYSIS

A. Financial Analysis

1. Affordability

1. An affordability analysis for the Dalian Water Supply Group (DWSG) service area was conducted at appraisal, and a re-evaluation was made at project completion. These data, together with data for 2002 from the Impact Evaluation Study on Water Supply and Sanitation Projects (IESWSS)¹ survey and data supplied by the DWSG for the end of 2002 are used in this analysis. The data, in Table A7.1, gives typical household monthly consumption and incomes for different periods. The affordability ratio, representing the monthly water bill as a proportion of the household income, is below 2% in all cases. The data for 1998 and 2002 shows the ratio was below the rate estimated at appraisal for this period. Average daily consumption was slightly higher in 2002 than was estimated at appraisal for 2000.

Table A7.1: Affordability: Dalian Water Supply Group Water Tariff

Item	At Appraisal		Actual		
	1995	2000	1998 ^a	2002 ^b	2002 ^c
Household Income (CNY/month)	896	1,295	1,028	1,628	1,614
Average Household Size (persons)	3.1	3.1	3.1	2.7	2.97
Daily per Capita Consumption (lpcd)	84	96	88	101	102
Household Water Consumption (m ³ /month)	7.812	8.928	8.184	8.200	9.100
Average Water Tariff (CNY/m ³)	1.20	2.78	1.97	2.49	3.22
Average Household Water Cost (CNY/month) ^b	9.37	24.82	16.12	20.40	29.30
Affordability Ratio ^d	1.05%	1.92%	1.57%	1.3%	1.8%

lpcd = liters per capita per day, m³ = cubic meter.

^a Data for 1998 provided by Dalian Water Supply Group (DWSG) in December 1999.

^b Data from IESWSS survey of 180 households (footnote 1).

^c Data from DWSG for the end of 2002.

^d Affordability ratio = $\frac{\text{Average Household Water Cost}}{\text{Household Income}}$

Source: Impact Evaluation Study on Water Supply and Sanitation Project in Selected Developing Member Countries (December 2002).

2. A survey of Dalian households in August 2002, conducted as part of the IESWSS, found that an average household size of 2.7 persons paid CNY20.40 per month for water, or around 1% of household income. The survey found a high level of satisfaction with the water supply service among respondents, particularly in comparison with the pre-project situation. Respondents also appreciated the better quality of life in the city due to the improved availability of water, and they generally accepted that higher water tariffs were the cost for improved supply and easier access. Rising household incomes have made increased water costs more affordable and acceptable.

3. A small number of commercial and industrial users were included in a separate survey for the impact evaluation study. Average monthly consumption of this group ranged from just

¹ ADB. 2002. *Impact Evaluation Study on Water Supply and Sanitation Projects in Selected Developing Member Countries*. Manila.

more than 900 m³ to 85,000 m³. Most of these respondents were satisfied with the post-project supply system and the service provided by DWSG. In response to tariff increases, the industrial and institutional users have reduced average monthly consumption by more than 25% over the past four years. Commercial enterprises such as hotels and shopping centers can take steps to control water consumption (e.g., installing water saving devices), but they have less scope for large-scale savings than many industrial users.

4. Estimates of the affordability ratio were also made for the Pulandian Water Supply Company at reappraisal and at project completion. The survey's data was consistent with the data in the Project Completion Report (PCR). The PCR data showed an affordability ratio of 3-4%, an acceptable level. However, the ratio was higher than the 1.2% that had been anticipated due to higher tariffs and lower income than expected at appraisal. Similarly, for the Jinshitan Water Supply Company area, an affordability ratio of about 1% was estimated in the PCR.

2. Financial Internal Rates of Return

5. Financial internal rates of return (FIRR) were calculated at project appraisal and again at project completion. Using the estimates in the PCR income statements² and the same gross domestic product deflator index for all cost and revenue streams, FIRRs have been recalculated to provide a more consistent basis for comparison with the updating and recalculation of data for this Project Performance Audit Report (PPAR).

6. The FIRRs estimated at project completion were lower than at appraisal for DWSG and the combined companies, but higher for DWDC (Table A 7.2). All FIRRs were above the respective weighted average cost of capital (WACC). The FIRRs have been recalculated in the PPAR based on updated data for DWSG and updated projections to 2010. All costs and revenues were expressed in to 2003 constant prices. The FIRRs are slightly lower than those estimated in the PCR, but are still well above the WACCs. The principal assumptions are in Table A7.3.

7. The results of the sensitivity analysis on the FIRRs are in Table A7.4. The FIRRs remain above the WACCs if operation and maintenance (O&M) costs increase 10% and revenues decrease 10%. In all cases, FIRRs were more sensitive to a reduction in revenues than to increases in O&M costs. Switching values shows that changes in costs or revenues would have to be significant for FIRRs to fall to the respective WACCs.

² ADB. 2000. Project Completion Report for the *Dalian Water Supply Project* (for the respective income statements and the assumptions used for their estimation).

Table A7.2: Financial Internal Rates of Return
(%)

Item	Appraisal		PCR		PPAR
	WACC	FIRR	WACC	FIRR	FIRR
DWDC	4.30	8.60	4.49	7.80	8.80
DWSG	4.30	9.90	4.52	10.20	9.40
DWDC + DWSG	4.30	9.60	4.51	9.50	9.30

DWDC = Dalian Water Delivery Company, DWSG = Dalian Water Supply Group,
FIRR = financial internal rate of return, PPAR = project performance audit report,
WACC = weighted average cost of capital.

Table A7.3: PPAR Assumptions

Item	Details
Costs and Revenues	Costs and revenues were adjusted to 2003 prices, using a) an index based on PCR inflation projections for 2000–2010, and b) an index based on actual data for 2000-2002 and current projections for 2003-2010.
O&M Costs	O&M costs were based on income statement projections. From 2003, salaries are increased in line with projected inflation (2%) and all other costs are increased in line with projected increases in water sales (3%).
Incremental Revenues	Incremental revenues were based on actual data until 2002. From 2003, water sales increases were set at 3%, lower than in PCR since actual sales since 1999 have been below PCR projections.
Tariffs	Tariffs increase at 6% per year, based on historical record of tariff increases.
Replacement Costs	Replacement costs for equipment was assumed after 20 years of operation.
Depreciation	Depreciation was estimated on straight line basis over 25 years based on the assumed value of project assets in DWSG books of CNY965 million.

DWSG = Dalian Water Supply Group, O&M = operation and maintenance, PCR = project completion report,
PPAR = project performance audit report.

Source: Operations Evaluation Mission (2003).

Table A7.4: Sensitivity Analysis for FIRR
(%)

Item	% Change	Project Completion			PPAR		
		DWDC+ DWSG	DWDC	DWSG	DWDC+ DWSG	DWDC	DWSG
Base Case		9.4	8.9	9.6	9.3	8.8	9.4
A: O&M Costs	+10%	8.0	8.2	7.8	8.1	8.0	8.1
B: Revenues	-10%	7.1	7.3	7.0	7.3	7.2	7.4
A& B		5.5	6.6	5.0	6.0	6.4	5.9
Switching Values							
A: O&M Costs		+31.8%	+58.4%	+26.9%	+38%	+53%	+35%
B: Revenues		-19.6%	-25.4%	-18.1%	-22%	-25%	-22%

DWDC = Dalian Water Delivery Company, DWSG = Dalian Water Supply Group, FIRR = financial internal rate of return, O&M = operation and maintenance, PPAR = project performance audit report.
Source: Project Completion Report (2000), Operations Evaluation Mission (2003).

B. Economic Analysis

1. Economic Internal Rates of Return

8. In computing the economic internal rate of return (EIRR) for the additional quantities of water supplied by DWSG, the OEM followed ADB's *Guidelines for Economic Analysis of Water Supply Projects*. The analysis was on an incremental basis between the without-project and with-project demand, and the benefits were valued separately for residential, commercial and industrial consumption. The costs and benefits were expressed in 2003 constant prices at the domestic price numeraire. Commercial and industrial consumers, which pay higher tariffs than residential consumers, reduced their consumption after 2000 (para. 32). The benefits to commercial and industrial consumers were valued using the industrial tariff for each year converted to 2003 prices. Dalian has had severe water shortage, and residential consumers have no alternative source of water. Historically, in the PRC, water was provided more as a social good and tariffs were generally low. Residential consumption was assumed to consist of nonincremental consumption of 80 lpcd (as stated in the appraisal report), while incremental consumption would be the difference between that amount and current consumption (102 lpcd for 2002, increasing at 1% per year until 2010, and then constant). DWSG has raised tariffs significantly (para. 33) to achieve cost recovery. Tariffs are projected to increase from 2003 to 2010 at a real annual rate of 4% and then remain constant. The incremental consumption was valued using the residential tariff of each year in 1999 prices. The appraisal report and the PCR did not estimate the EIRR, as information was not available on the willingness to pay for water. The analysis is for 25 years from the start of project implementation. The OEM estimated that to achieve an EIRR of 12%, the willingness to pay for the nonincremental portion of water consumed by the residential consumers would have to be CNY2.0/m³ in 2003 constant prices.³ This price is about 20% above the residential tariff in 1997, the year the Project started to deliver water. If the nonincremental residential consumption were valued at the 2002 domestic tariff of CNY2.3/m³, the EIRR would be 13.4%.

³ The OEM obtained data on willingness to pay for water in PRC estimated in ongoing ADB PPTAs. The amount ranges from Y2.0-Y3.0 per cubic meter in 2003 constant prices.

2. Average Incremental Costs

9. The appraisal report estimated the average incremental financial and economic costs for the Project. The average incremental economic cost (AIEC) calculation included an estimate of incremental wastewater treatment costs, reflecting the cost of disposing of wastewater generated by the Project. The average incremental costs were re-estimated in the PCR, but as seen with the re-calculation of FIRR⁴, there were some inconsistencies in the conversion of the data to constant prices. In the PPAR, the average incremental financial costs (AIFC) were calculated using the WACC as the discount rate, while the AIEC was calculated using the economic opportunity cost of capital. This gives an AIFC of CNY2.0 per cubic meter and an AIEC of CNY3.1 per cubic meter. In financial terms, subsidies are not needed since the AIFC is below the average tariff. The results are compared in Table A7.5.

Table A7.5: Average Incremental Costs (CNY/m³)

Item	Appraisal ^a		Project Completion				PPAR	
	AIFC	AIEC	AIFC	AIEC	AIFC ^b	AIEC ^b	AIFC	AIEC
DWSG	1.8	3.8	1.8	3.4	1.6	2.3	2.0	3.1
Jinshitan	—	—	3.6	9.8	4.0	7.0	—	—
Pulandian	—	—	2.8	3.6	2.6	3.0	—	—

AIEC = average incremental economic cost, AIFC = average incremental financial cost,
DWSG = Dalian Water Supply Group, m₃ = cubic meter, PPAR = project performance audit report
— = not calculated.

^a AIFC at a discount rate of 6% and AIEC at a discount rate of 14%.

^b Recalculated from PCR in 2003 constant prices.

Source: Project Completion Report (2000), Operations Evaluation Mission (2003).

⁴ See Appendix 7: Financial Analysis.

Table A7.6: Financial Internal Rates of Return
(CNY million)

Year	Northern and Southern Components					Northern Component: DWDC					Southern Component: DWSG				
	Capital Costs	O&M Costs	Total Costs	Total Revenue	Net Revenue	Capital Costs	O&M Costs	Total Costs	Total Revenue	Net Revenue	Capital Costs	O&M Costs	Total Costs	Total Revenue	Net Revenue
1995	1,005.4		1,005.4		(1,005.4)	220.7		220.7		(220.7)	784.7		784.7		(784.7)
1996	1,098.1		1,098.1		(1,098.1)	361.5		361.5		(361.5)	736.6		736.6		(736.6)
1997	591.4		591.4		(591.4)	353.4		353.4		(353.4)	238.0		238.0		(238.0)
1998	76.2	430.2	506.4	541.1	34.7	40.3	85.3	125.6	142.6	17.0	35.9	344.9	380.8	398.5	17.7
1999	10.3	405.2	415.5	561.5	146.0	10.3	70.7	81.0	143.1	62.1		334.5	334.5	418.4	83.9
2000		425.9	425.9	579.8	153.9		77.8	77.8	146.2	68.3		348.1	348.1	433.7	85.6
2001		415.8	415.8	551.4	135.6		76.8	76.8	158.6	81.8		339.0	339.0	392.8	53.8
2002		479.3	479.3	619.4	140.1		77.2	77.2	159.0	81.8		402.0	402.0	460.4	58.3
2003		484.8	484.8	658.2	173.3		79.3	79.3	165.4	86.1		405.6	405.6	492.8	87.2
2004		490.6	490.6	699.5	208.9		81.4	81.4	172.0	90.6		409.2	409.2	527.4	118.3
2005		496.5	496.5	743.5	247.0		83.7	83.7	178.9	95.2		412.8	412.8	564.6	151.8
2006		502.5	502.5	790.4	287.9		86.1	86.1	186.1	100.0		416.5	416.5	604.3	187.9
2007		508.7	508.7	840.4	331.7		88.6	88.6	193.6	105.0		420.2	420.2	646.9	226.7
2008		515.1	515.1	893.7	378.6		91.2	91.2	201.3	110.1		423.9	423.9	692.4	268.5
2009		521.7	521.7	950.5	428.8		94.1	94.1	209.4	115.3		427.7	427.7	741.1	313.5
2010		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2011		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2012		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2013		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2014		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2015		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2016	137.9	528.5	666.4	1,011.1	344.7	56.4	97.0	153.4	217.8	64.3	81.5	431.5	513.0	793.3	280.3
2017		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2018		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2019		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2020		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2021		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2022		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2023		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2024		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2025		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2026		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2027		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2028		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2029		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2030		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2031		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2032		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2033		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2034		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2035		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2036		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2037		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
2038		528.5	528.5	1,011.1	482.6		97.0	97.0	217.8	120.7		431.5	431.5	793.3	361.8
NPV					3,094.1					774.3					2,314.9
FIRR					9.25%					8.78%					9.44%
Real Weighted Average Cost of Capital					4.51%					4.49%					4.52%

DWDC = Dalian Water Delivery Company, DWSG = Dalian Water Supply Group, FIRR = financial internal rate of return, NPV = net present value, O&M = operation and maintenance.

Source: Operations Evaluation Mission (2003).

Table A7.7: Dalian Water Supply Group: Average Incremental Costs of Water
(CNY million)

Year	Water (mcm)	Average Incremental Financial Cost					Average Incremental Economic Cost							
		Water Supply Costs			O&M Costs	Total Financial Costs	Water Supply Costs					Total Economic Costs		
		Capital Costs					Capital Costs			O&M Costs	Total Costs		Sewerage Costs	
		Foreign	Local	Total			Foreign	Local	Total				Capital	O&M
SCF							1.1	1.0		1.0				
1995		33.7	751.0	784.7	0.0	784.7	37.4	751.0	788.4	0.0	788.4	139.9	14.0	942.3
1996		382.9	353.7	736.6	0.0	736.6	425.0	353.7	778.7	0.0	778.7	232.6	37.2	1,048.5
1997		196.1	41.9	238.0	0.0	238.0	217.7	41.9	259.6	0.0	259.6	124.3	49.7	433.6
1998	259.9	35.9		35.9	344.9	380.8	39.8		39.8	344.9	384.8	114.2	61.1	560.1
1999	231.5				334.5	334.5				334.5	334.5	106.0	71.7	512.2
2000	241.7				348.1	348.1				348.1	348.1	95.8	81.3	525.2
2001	215.6				339.0	339.0				339.0	339.0	93.9	90.7	523.6
2002	179.7				402.0	402.0				402.0	402.0	92.1	99.9	594.0
2003	185.1				405.6	405.6				405.6	405.6	89.4	108.8	603.8
2004	190.6				409.2	409.2				409.2	409.2	95.7	118.4	623.3
2005	196.3				412.8	412.8				412.8	412.8	92.9	127.7	633.4
2006	202.2				416.5	416.5				416.5	416.5	201.3	147.8	765.6
2007	208.3				420.2	420.2				420.2	420.2	195.5	167.3	783.0
2008	214.5				423.9	423.9				423.9	423.9	144.3	181.8	750.0
2009	221.0				427.7	427.7				427.7	427.7	38.4	185.6	651.7
2010	227.6				431.5	431.5				431.5	431.5	37.3	189.3	658.1
2011	227.6				431.5	431.5				431.5	431.5	36.2	193.0	660.7
2012	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2013	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2014	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2015	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2016	227.6				431.5	513.0				431.5	431.5		193.0	624.5
2017	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2018	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2019	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2020	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2021	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2022	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2023	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2024	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2025	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2026	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2027	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2028	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2029	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2030	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2031	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2032	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2033	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2034	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2035	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2036	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2037	227.6				431.5	431.5				431.5	431.5		193.0	624.5
2038	227.6				431.5	431.5				431.5	431.5		193.0	624.5
NPVs	4,087.8					8,321.0	1,813.9			2,298.2	3,833.0		823.3	5,550.1
AIC/m³						2.04								3.06
Discount Rate:		4.5%					12.0%							

m³ = cubic meter, mcm = million cubic meter NPV = net present value, O&M = operation and maintenance, SCF = standard conversion factor.

Source: Operations Evaluation Mission (2003).

Table A7.8: Dalian Water Supply Group - Economic Internal Rate of Return
(2003 constant prices, domestic prices numeraire, CNY million)

Year	Population Served	Incremental Costs (Capital + O&M)	Benefits		Total	Net Benefits
			Domestic Consumption	Nondomestic Consumption		
1995	1,945,000	788.41	62.47	150.03	212.50	(575.91)
1996	1,993,500	778.72	64.03	200.09	264.12	(514.60)
1997	2,043,300	259.57	65.63	236.63	302.26	42.69
1998	2,094,200	384.79	67.27	313.79	381.05	(3.74)
1999	2,146,500	334.52	74.69	353.79	428.48	93.96
2000	2,200,000	348.06	82.46	364.09	446.55	98.48
2001	2,227,400	338.97	91.45	342.92	434.37	95.40
2002	2,255,200	402.01	102.81	300.26	403.08	1.07
2003	2,255,200	405.57	105.52	333.66	439.19	33.61
2004	2,255,200	409.17	108.44	370.56	479.00	69.83
2005	2,255,200	412.80	111.59	411.29	522.89	110.09
2006	2,255,200	416.46	114.99	456.26	571.26	154.80
2007	2,255,200	420.16	118.67	505.89	624.55	204.39
2008	2,255,200	423.90	122.63	560.63	683.26	259.37
2009	2,255,200	427.67	126.91	621.02	747.93	320.26
2010	2,255,200	431.48	131.54	687.59	819.13	387.65
2011	2,255,200	431.48	132.45	736.38	868.83	437.34
2012	2,255,200	431.48	133.37	787.92	921.29	489.80
2013	2,255,200	431.48	134.31	842.35	976.66	545.18
2014	2,255,200	431.48	135.27	899.82	1,035.10	603.61
2015	2,255,200	431.48	136.26	960.50	1,096.76	665.27
2016	2,255,200	431.48	137.26	1,024.56	1,161.81	730.33
2017	2,255,200	431.48	138.28	1,092.16	1,230.44	798.95
2018	2,255,200	431.48	139.32	1,163.50	1,302.82	871.33
2019	2,255,200	431.48	140.38	1,238.77	1,379.15	947.67
2020	2,255,200	431.48	141.46	1,318.18	1,459.64	1,028.16
EIRR						13.4%

EIRR = economic internal rate of return, O&M = operation and maintenance.

Source: Operations Evaluation Mission (2003).