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Report No: 20663-KO

**IMPLEMENTATION COMPLETION REPORT
(CPL-35900)**

ON A

LOAN

IN THE AMOUNT OF US\$ 110 MILLION EQUIVALENT

TO THE

REPUBLIC OF KOREA

FOR A

KWANGJU AND SEOUL SEWERAGE PROJECT

June 29, 2000

**Urban Development Sector Unit
East Asia and Pacific Region**

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CURRENCY EQUIVALENTS

(Exchange Rate Effective June 30, 2000)

Currency Unit = Won
1,000 Won = US\$ 0.90
US\$ 1.00 = 1,109 Won

FISCAL YEAR

Government: January 1 -- December 31

ABBREVIATIONS AND ACRONYMS

BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
ERR	-	Economic Rate of Return
FRR	-	Financial Rate of Return
ICB	-	International Competitive Bidding
ICR	-	Implementation Completion Report
LPC	-	Local Public Corporation
MOC	-	Ministry of Construction
MOE	-	Ministry of the Environment
NBF	-	Not Bank-financed
NCB	-	National Competitive Bidding
NGO	-	Non Governmental Organization
NPV	-	Net Present Value
NRW	-	Non Revenue Water
QAG	-	Quality Assurance Group
SAR	-	Staff Appraisal Report
SS	-	Suspended Solids
UNDP	-	United Nations Development Programme
WTP	-	Wastewater Treatment Plant

Vice President:	Jemal-ud-din Kassum
Country Manager/Director:	N. G. Sri-Ram Aiyer
Sector Manager/Director:	Keshav Varma
Task Team Leader/Task Manager:	Ming Zhang

**IMPLEMENTATION COMPLETION REPORT
REPUBLIC OF KOREA
KWANGJU AND SEOUL SEWERAGE PROJECT
(LN. 3590-KOR)**

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<i>Project ID:</i> P004169	<i>Project Name:</i> Kwangju and Seoul Sewerage Project
<i>Team Leader:</i> Ming Zhang	<i>TL Unit:</i> EASUR
<i>ICR Type:</i> Core ICR	<i>Report Date:</i> June 29, 2000

1. Project Data

Name: Kwangju and Seoul Sewerage Project
Country/Department: KOREA, REPUBLIC OF
Sector/subsector: WS - Sewerage

L/C/TF Number: CPL-35900
Region: East Asia and Pacific Region

KEY DATES

	<i>Original</i>	<i>Revised/Actual</i>
<i>PCD:</i> 11/15/91	<i>Effective:</i> 09/28/93	09/28/93
<i>Appraisal:</i> 09/28/92	<i>MTR:</i>	11/01/97
<i>Approval:</i> 04/13/93	<i>Closing:</i> 12/31/97	12/31/99

Borrower/Implementing Agency: Republic of Korea/Kwangju and Seoul Metropolitan Governments
Other Partners:

STAFF	Current	At Appraisal
<i>Vice President:</i>	Jemal-ud-din Kassum	Gautam S. Kaji
<i>Country Manager:</i>	M. G. Sri-Ram Aiyer	Khalid Ikram
<i>Sector Manager:</i>	Keshav Varma	Jeffrey Gutman
<i>Team Leader at ICR:</i>	Ming Zhang	Jaroslav Kozel
<i>ICR Primary Author:</i>	Ming Zhang; Jaehyang So	

2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

Outcome: S
Sustainability: HL
Institutional Development Impact: SU
Bank Performance: S
Borrower Performance: S

Quality at Entry: QAG (if available) ICR
S

Project at Risk at Any Time: No

3. Assessment of Development Objective and Design, and of Quality at Entry

3.1 Original Objective:

Korea is one of the most densely populated countries in the world, coupled with one of the highest urbanization levels as well. Its rapid industrialization and urbanization have caused serious environment problems in its major urban areas. In this context, the project aimed to assist the environmental clean-up in two large cities, Kwangju and Seoul, with the following objectives:

(a) Assist in cleaning the Yongsan and Han Rivers in order to reduce health hazards and attain the water quality needed for the comfort and prosperity of much of the cities' population as well as those using water downstream;

(b) Focus the attention of water agencies on conservation of water to reduce water demand and the wastewater generated;

(c) Encourage the cities to develop self-financing efficiency for wastewater activities; and

(d) Support technological and institutional improvements in the sector.

These objectives were clearly stated, realistic, and important for the country at the time. The physical elements, which involve constructing some of the largest wastewater treatment facilities in Asia, were quite demanding for the borrower. The financial and institutional objectives, such as water conservation and self-financing, were equally or even more challenging for the implementing agencies. These objectives were developed in response to the requirements of national and city governments at the time, and correctly highlighted the key development priorities in the sector. The objective was relatively straightforward and not overly complicated. There were no major risks anticipated for the project.

3.2 Revised Objective:

Not applicable

3.3 Original Components:

To achieve the project objectives, the following components were included in the project:

(a) In Kwangju, expansion of the Yu Deog Dong wastewater treatment plant (WTP), to increase its capacity from 300,000 m³/d to 600,000 m³/d; a wastewater pumping station at Song Am and about 36 km of interceptors of various diameters;

(b) In Seoul, expansion of Kayang WTP, to increase its capacity from 1.0 million m³/d to 2.0 million m³/d; and

(c) Engineering services to supervise construction and water conservation studies in both cities.

These components were directly related to the stated objectives of the project. Their selection was based on extensive studies and master plans conducted by the government. In Kwangju, the expansion was to enable the city to treat almost all its wastewater, while in Seoul, the expansion of the Kayang WTP was to allow the treatment of all wastewater generated from the southwest catchment of the city. The project design was based on proven administrative capacities of the implementing agencies, and provided assistance to further improve their financial capacities. With its emphasis on adequate preparation, well defined objectives with regard to project targets, and commitment of the responsible agencies, the project also took into account the relevant lessons in prior Bank-financed projects in the country, including five water supply projects, one sewerage project and a sewerage sector study.

3.4 Revised Components:

Not Applicable

3.5 Quality at Entry:

The project's quality at entry is rated satisfactory. The project's overall design was based on very strong borrower ownership. The objectives were clearly defined and realistic. The physical design was based on well tested technologies and least-cost solutions. The Bank's primary role was to help Korea

adopt appropriate technology and practices for planning, design, construction and operation of water and wastewater facilities. At the same time, the project design directed attention to finance, accounting, cost recovery and institutional reform issues. An important element was included by linking pollution prevention efforts with the need to conserve water thereby reduce wastewater. The results, therefore, would have important implications for the whole country.

4. Achievement of Objective and Outputs

4.1 Outcome/achievement of objective:

The overall outcome of the project is satisfactory. The objective of assisting in cleaning the Yongsan and Han Rivers was achieved. The wastewater treatment plants were completed and are operating at full capacity. The impact on the quality of water in both rivers has been observed and is positive.

The objective of focusing on conservation of water was achieved with better results in Kwangju than in Seoul. The studies were completed and a number of the recommendations from the studies were adopted. Products introduced through the studies, such as water-saving toilets and shower heads, are now available on the market and were promoted by the government. Measures to reduce non-revenue water (NRW) were also adopted.

The objective of encouraging self-financing efficiency was partially achieved. Neither Kwangju nor Seoul realized the rate of return which was covenanted in the Loan Agreement, and which reflected Ministry of Construction (MOC) guidelines on sewerage tariffs at the time. So far, however, no wastewater organization in the country has been able to achieve this rate of return.

The objective of supporting technological and institutional improvements was partially achieved. Technological improvements have been made in both cities. Institutional improvements were achieved in Kwangju. In fact, Kwangju pushed institutional efficiency much further than originally contemplated during project appraisal by privatizing the operations and management of its WTP in 1998. Seoul, on the other hand, made no progress towards achieving the outlined institutional objectives and remains a department of the city rather than a local public corporation (LPC) with separate accounts.

4.2 Outputs by components:

Sector Policies

The project's primary goal was helping the cities adopt appropriate approaches to wastewater collection and treatment technology. In addition, the project directed attention to finance, accounting, and cost recovery, and linked pollution prevention control with initiatives for water conservation. The results show that the wastewater system and treatment technologies adopted by the cities are advanced and appropriate. They reflect the cities' environment and fit within their long-term development plans.

Through the water conservation studies, the project also directed attention to the generation of wastewater. The Kwangju water conservation study has achieved its objectives. The water agency strengthened its NRW control effort and initiated water conservation activities. The NRW was reduced from 30.7% in 1996 to 27.3% in 1998. It is expected that a NRW rate of 20% will be achieved by 2001. Water conservation actions, prompted in 1999 through pilot installation of 7,300 water-saving toilet faucets, are estimated to be saving some 300,000 m³/y; the plan expects installation of about 265,000 faucets in the next two years.

The Seoul water conservation study achieved its objectives only partially. Since the study was carried out by the research institute associated with water agency, its focus was shifted from the whole

spectrum of water conservation topics to leakage control, the agency's key interest. The NRW growth was arrested from the start of the study for several years at 38% of production and was gradually reduced to 36% in 1999. The leakage control programs aim at achieving 30% by 2001. A summary of supporting data is available in Annex 7.

While their actual impact on specific water use per capita is negligible, the studies are proving timely, since civic groups as well as the government are showing increased interest in water conservation. Various water-saving fixtures are now available at reasonable prices. This year, the Ministry of Environment (MOE) started encouraging local administrations to support various civic groups promoting water conservation by households and commercial users. However, since the implementing units for the water conservation studies -- the water agencies in the two cities -- were not directly involved in the main physical investments of the project, they did not demonstrate the same level of commitment as the sewage agencies. Bank supervision and intervention by the governments played important roles in ensuring that the studies were completed and major recommendations adopted.

Physical and Environmental Objectives

Achievement of the project's physical objectives is highly satisfactory. In Kwangju, the completed second phase of Yu Deog Dong WTP, Song Am pumping station, and associated interceptor sewers (32.7 km) was taken over by Kwangju City for operation in May 1997 after five months of testing. Implementation took five months longer than expected because of severe winter weather. Also, changes in Kwangju City planning and requests from civic groups during implementation eliminated 3.3 km of interceptor sewers from the component's initial 36 km, but this change did not compromise the delivery capacity in any way. In Seoul, the completed second phase of Kayang WTP was taken over by Seoul City for operation in January 1999. The construction, carried out from December 1992 through July 1998, concluded with six months of testing. Implementation took two years longer than planned due to factors discussed below. Nevertheless, the completed works are of high quality, and were constructed with due concern to environmental requirements such as landscaping and control of noise and odor. The required monitoring is also in place. In accordance with projections, both plants are operating almost at capacity. The treatment performance expressed in biochemical oxygen demand (BOD), chemical oxygen demand (COD) and suspended solids (SS) is substantially better than required by Korean standards for effluent from WTPs.

The expansion of the WTPs has measurably improved the water quality in the respective rivers. In Kwangju, in 1998, the expansion enabled the removal of around 64 t/d of BOD and 82 t/d of SS from the wastewater discharged into the Yongsan River. Also, monitoring data provided by MOE laboratories shows that some sections of the Yongsan River did experience significant reductions in BOD during the period from 1996 to 1998.

In Seoul, the expanded WTP treated 1.8 million m³/d of wastewater in the first half of 1999 and removed about 152 t/d of BOD and 157 t/d of SS from the wastewater discharged into the Han River. Monitoring data shows that comparing the first half of 1999 with that of 1997, there was apparent improvement in the quality of the Han River downstream from the Kayang WTP outlet. Monitoring data are available in Annex 7.

Both WTPs have taken exceptional care to mitigate the negative impacts on the surrounding environment with landscaping. The majority of the tanks have been enclosed with fibre reinforced plastic covers.

Financial Objectives and Institutional Development

The achievement of financial objectives and institutional development is considered substantial. In defining the financial objectives of implementing agencies the project followed MOC guidelines instructing local governments to start implementing sewerage tariffs from 1992. While the guidelines required achieving a substantial rate of return (up to about 7%), the Bank agreed on values of 3% and 2% for Kwangju and Seoul respectively, considering the extent of planned investments and impact on tariffs. During preparation and implementation, Bank staff provided training support and institutional advice in order to achieve the agreed rate of return, although with moderate effect. From the hindsight, the FRR objective is too ambitious. As compared to water supply, where gradual expansion of distribution and production facilities normally takes several decades, the Kwangju and Seoul interceptor sewers and treatment plants, which fully serve the entire city, were constructed over the last 10 years. Tariffs reflecting such huge capital outlays over a short time and generating a substantial rate of return are very high and are not acceptable to local governments. It would appear, therefore, that under such conditions, even small rates of return are not currently achievable in the wastewater sector since none of the wastewater agencies in the country has been successful in meeting them. Other financial parameters, such as working capital ratios, debt/equity ratio, and accounts receivable are satisfactory for both wastewater agencies.

Project monitoring indicators were designed to track the status of financial and institutional development of the implementing agencies. While Kwangju provided audited financial statements as a basis for the financial monitoring indicators, Seoul's monitoring indicators were estimated because the wastewater accounts were not separated from the accounts of the city, and the assets were not formally revalued during the project time period.

Many institutional aspects of the project, such as cost recovery, accounting and financing from user charges, were new in the sector, since sewerage tariffs were implemented for the first time in 1992. At the end of project implementation, institutionally, Kwangju had adopted LPC status with commercially based accounting and annual auditing which had gradually improved during project implementation. It also revalued its wastewater assets in operation. Seoul, however, failed to comply with the understanding at appraisal and has not changed its accounting system to LPC status, nor revalued its wastewater assets.

4.3 Net Present Value/Economic rate of return:

The net present value and economic rates of return were not calculated during appraisal. The project was justified on the basis of least-cost solution, and also on the grounds that both city governments and the national government had demonstrated strong commitment. The national government formally required that wastewater be treated before being discharged into the river. The cities constructed the interceptor sewers and the first phase of WTPs and were ready to carry out construction of the second phase.

Implementation has shown that these two justifications were largely valid. Willingness to carry out the project was demonstrated by the cities' successful efforts in mobilizing domestic funding, and by their gradually increasing sewerage tariffs. (The Bank contributed only 4% of the total investment in Kwangju and 12% in Seoul.) Kwangju increased tariffs to make the wastewater activities almost financially self-sustaining, even though the planned 3% rate of return was not achieved. In Seoul, tariffs were increased several times, but not to the break-even point. The conclusion that the original solution is least-cost remained valid. While some minor improvements were made to the original design of the WTPs, no major changes were necessary.

The main project benefits were expected to result from a cleaner environment, especially the water

quality improvements in Yongsan and Han Rivers. In Kwangju, the Yu Deong Dong WTP removed pollution equivalent to 64 t/d of BOD and 84 t/d of SS, while in Seoul the Kayang WTP removed 152 t/d of BOD and 157 t/d of SS from the wastewater discharged into Yongsan and Han Rivers. Apparent improvement was observed near the Kayang WTP outlet and downstream. Therefore, the expansion of both the Kwangju and Seoul WTPs has already had a positive impact on the surface water quality in the recipient rivers.

Other benefits of the project, as summarized during project appraisal, were improvements in the health of the population and increased property values along the river. Examination of the available health statistics shows apparent inconsistencies in the statistical method employed during the observed period, which disallows comparison of data from different years. The sample land value data provided shows that there were increases in land values both near and some distance from the Han River. It is difficult to judge whether this land value increase can be attributed to improvements in the river environment. Experience from various countries shows that the capitalization effect from environmental improvements usually takes quite some time to be realized.

The major non-physical component of the project is water conservation studies for the two cities. They have achieved their objectives. Benefits were realized in terms of the amount of water saved, but they have not been calculated.

Since it is difficult to value most of the benefits outlined above, a simplified cost-benefit analysis is presented in Annex 3. The major assumption used is that the economic value of each ton of wastewater treated is equal to the current wastewater tariff. This is of course a very insufficient way of valuing the benefits, but in absence of a comprehensive WTP survey and with the difficulties of valuing the benefits, it is possibly the only method available. The results, however, are thus only indicative and should be used cautiously. Generally, the current tariff level is most likely lower than actual WTP, so the actual benefits are likely to be higher.

With these simplified assumptions, the results show that the Economic Rate of Return (ERR) is 7.4% for the Seoul component and 6.6% for the Kwangju component. At a discount rate of 10%, the net present values (NPV) for Seoul and Kwangju are -58 billion won and -29 billion won respectively (1999 prices). These are probably the lower boundaries of the project's net benefits.

4.4 Financial rate of return:

The financial rate of return (FRR) on revalued assets in operation was calculated during project appraisal using assumptions regarding the tariff implications for the two cities. Recalculated using current assumptions on tariffs and operating costs, the Kwangju FRR compares from 4.2% during appraisal to 2.3% using the latest estimated data. The Seoul rate of return compares from 3% calculated during appraisal to 1.17%, using the latest estimated data. Detailed assumptions are available in Annex 7.

The lower rate of return for both Kwangju and Seoul can be attributed to the level of tariffs, which were not set high enough during the project period. It can be assumed that Kwangju made significant attempts to achieve the higher rate of return since its tariffs are the second highest in the country after Pusan. Seoul was less successful in setting tariffs adequate to meet the targeted rate of return. However, the Seoul Sewerage Bureau has maintained a small cash surplus each year due to generous subsidies from the City general account. Since the city governments make decisions on tariff levels, the Seoul government chose to replenish the wastewater accounts on a cash basis rather than to allow the wastewater agency to be run autonomously through a tariff-based revenue system.

Finally, even the appraisal rates of return of 3 – 4% were actually too low to provide a purely financial justification for the project. It is useful to note that the justification for the project was based on

other non-quantifiable benefits of increasing wastewater investment, such as improved health, increased property value and a cleaner environment in terms of cleaner riverside parks and aquatic areas for citizens and tourists.

4.5 Institutional development impact:

The Kwangju Sewerage Department, an autonomous LPC, made significant institutional reforms during the course of the project. The Kwangju government supported the self-financing goal of wastewater operations, and granted increases in sewerage tariffs in order to achieve self-sufficiency. In 1998, Kwangju officials privatized the operations and management of the WTP in order to reduce operating costs and the pressure to raise tariffs. This is expected to successfully reduce the operating costs of the WTP by 30%.

Seoul City maintained the existing structure of the Sewerage Bureau as a department of the local government, rather than separating it out as a LPC. The accounts of the Sewerage Bureau were maintained using the government's cash-based accounting standards, and the wastewater operations continued to receive subsidies from the city's general account. Seoul Sewerage Bureau was not able to reevaluate its assets, the first step in becoming a LPC.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

One major factor outside government control affected implementation. Shortly after awarding a civil works contract for the construction of deep aeration tanks in Seoul, engineers discovered that the foundation of the tanks as originally designed would be inadequate, and would require dense and long piling. This design change and the associated additional construction work prolonged the implementation schedule. Severe winter weather also made construction impossible at times, thereby causing delays. The effects of the Asian crisis (1997-1998) were minimal as the project was largely complete by then.

5.2 Factors generally subject to government control:

Three major factors were subject to the control of the city governments. First, low allocation of local counterpart funds in the early stages of implementation caused major delays in Seoul. Second, also in Seoul, a dispute arose over land and crop compensation. Farmers, who were not considered the legal owners of the land on which the WTP was to be built, were farming vegetables on seasonally inundated lands. Compensation was offered for the crops. In July 1993, three months after Board presentation, only 53% of the land for the Seoul WTP had been acquired, with numerous cases of compensation pending in the court system. Eventually collective civil petitions were filed on behalf of the farmers so that they would be compensated for the loss of the lands they were farming. As a gesture of goodwill, Seoul city government finally compensated the farmers, but the matter delayed implementation by approximately eight months.

Third, for both cities, the ability to raise tariffs was under their control. In the course of implementation, the Kwangju government kept approving gradual tariff increases. Kwangju city government eventually privatized its wastewater system to reduce costs. The Seoul government, on the other hand, made minimal tariff increases, and did not take steps to convert its sewerage division into a local public corporation. It chose instead to provide subsidies from the city's general account.

5.3 Factors generally subject to implementing agency control:

Various reorganizations of the responsible agencies had some negative impact on the project, but these were largely offset by keeping the core staff of the agencies intact. Generally speaking, in both Kwangju and Seoul, strong project management was responsible for successful implementation.

5.4 Costs and financing:

Kwangju's actual implementation costs are estimated at Won 101.83 billion (US\$ 125.92 million equivalent) as compared with the appraisal estimate of Won 102.42 billion (US\$ 133.01 million equivalent). The actual cost estimate in Won is 1% lower than appraisal estimates because the costs of equipment and construction supervision were lower. The actual costs estimates and appraisal cost estimates expressed in US\$ equivalent show a greater difference (5%) due to exchange rate fluctuations.

Seoul's actual implementation costs are estimated at Won 250.9 billion (US\$287.3 million equivalent) as compared with the appraisal estimate of Won 288. 8 billion (US\$ 375.1 million equivalent). The actual cost estimate in Won is 13% lower than appraisal estimate, because some stand-by equipment (pumps, generators) and associated buildings were deemed unnecessary. Also, to a minor extent, bid prices for the equipment came in lower than estimated. The actual implementation cost estimate and the appraisal cost estimate expressed in US\$ equivalent show a greater difference (23%) due to exchange rate variations.

The project's actual total implementation costs are estimated at Won 352.7 billion (US\$413.2 million equivalent) as compared with appraisal estimate of Won 391.2 billion (US\$508.1 million equivalent). The Loan disbursed US\$39.3 million, about US\$70.7 million below the actual Loan amount. Kwangju and Seoul cities' equity, revenue generation, and local loans provided the balance of financing. Actual implementation costs estimated in Won and US\$ are about 15% and 19% lower than the appraisal estimate respectively. A substantial part of the Loan was cancelled shortly after it was approved and replaced by local loans. A greater difference in US\$ equivalent was caused by the currency exchange, which had only slight variations between 1992 and 1996 (US\$=770 Won). But from 1997 to 1998 the Won value changed from 800 to 1,400 to the dollar. The original Loan closing date of December 31, 1997 was extended by two years to complete the Seoul component. Project costs by components, procurement arrangements and financing are in annexes 2a, 2b, and 2c, and supporting data are available in Annex 7.

6. Sustainability

6.1 Rationale for sustainability rating:

Project sustainability is rated highly likely due to the high level of technical and professional knowledge of the wastewater agencies in the two cities and the well developed management techniques of the private operator in Kwangju. Steady pressure from independent citizen groups will also provide incentive to maintain high quality environmental standards.

In Kwangju, the first phase of the WTP (300,000 m³/d) was successfully operated by the wastewater agency which succeeded in building up an operational and managerial team with several years of experience and high proficiency. Currently, management of the WTP, including the associated interceptor sewers and pumping station, is contracted out to an experienced local operator. The terms of the contract (3 years duration with an option for extension, monthly payments to contractor, supervision of performance by independent laboratory) in combination with regulatory management by an experienced team will ensure the sustainability of high quality of operations and maintenance.

In Seoul, the sewerage agency has been successfully operating the four largest treatment plants in the country for more than 10 years, achieving a very high treatment performance. Expansion of the Kayang facility by 1.0 million m³/day represents only about a 17% increase of the city's treatment capacity, which is easily absorbed within the existing wastewater management organization with an adequate number of trained staff. Independent environmental laboratories and civic groups control the quality of operations. In addition, the recipient of the treated effluent, the Han River, crosses the city, and as such its water quality has always been a very sensitive issue and is under tight scrutiny by the population, fishermen's

organizations and various environmental groups. Therefore, strong government commitment to environmental protection, pressures from the public, combined with technical and financial viability of the project, will ensure the project's sustainability.

6.2 Transition arrangement to regular operations:

For six months following completion of the expanded WTPs, the contractors, suppliers and both wastewater agencies jointly tested the equipment and trained operational staff. After successful completion of both testing and training, the wastewater agencies merged the new interceptor sewers and WTP extensions with the existing facilities. Later, Kwangju turned over operations and maintenance of the WTP, including the interceptors and pumping stations, to a private local company. Seoul plans to privatize the operations and maintenance of one of its four WTPs in late 2000. Selection of the plant will be determined through a study, and bidding documents will be prepared.

7. Bank and Borrower Performance

Bank

7.1 Lending:

The Bank's activities during the identification, preparation, and appraisal stages were satisfactory, with considerable support provided to the borrower and the implementing agencies. The project is a logical follow-up of the Bank's previous involvement in the water and wastewater sector in Korea and was consistent with the government's development priorities at the time. The project team working on the preparation and appraisal of the project had the right skill mix, and assisted the borrower on technical, financial, economic, institutional, environmental and social aspects of the project and helped improve project design. The technical alternatives selected for the project were appropriate, and represented the least-cost solution to improving wastewater systems and treatment facilities in the project cities. Project appraisal was conducted when the borrower was in an advanced stage of preparation, and confirmed the government's commitment to the project. The main risk recognized at appraisal was implementation of the findings of water conservation studies since the range of possible actions including pricing and technological intervention in households could be unpopular. With regard to safeguard policies, project preparation and appraisal were thorough on environment assessment. It also reviewed land acquisition and compensation policies and found them adequate; however the treatment of land acquisition and resettlement issues in the staff appraisal report is less detailed than that of the environment impact.

7.2 Supervision:

Supervision by Bank staff during implementation was satisfactory, with some appraisal team members taking part in supervision missions. This continuity was especially important as the Bank's Task Team Leader and also the key staff of the borrower and implementing agencies changed several times during implementation. Supervision mission members generally possessed an appropriate mix of skills, identified and resolved key issues in a timely fashion, and assessed development impact regularly. Implementation progress was reported adequately and performance ratings in supervision reports were realistic. Reviews of procurement documents, audit and progress reports were carried out satisfactorily and in a timely fashion. Particular attention was given to reviewing the water conservation studies, which represented major implementation risks. This contributed to an improved focus of Kwangju study but had a minor impact in Seoul. Project implementation did not deviate from applicable Bank policies and procedures. The Bank did not intervene in settling the land compensation dispute discussed earlier because the Korean policy framework and institutional capacity were deemed satisfactory. The Bank supervision missions were also consistent in bringing the governments' attention to financial covenants, also with better success in Kwangju than in Seoul.

There were several changes in Bank management and Task Team Leader. The negative impact, however, was mitigated by the retaining of one member in the core project team throughout project identification, appraisal, supervision and completion.

7.3 Overall Bank performance:

The Bank's performance on this project is rated satisfactory. While the project itself included modestly stated institutional goals, during supervision missions the Bank team discussed at length with relevant officials advanced management and institutional options, including privatization and informed officials regarding worldwide experiences which were relevant in the Korean context.

Borrower

7.4 Preparation:

The performances of the implementing agencies and government ministries during project preparation were satisfactory. Preparation was carried out and financed by the implementing agencies under the general guidance of government ministries. The staff of the respective wastewater agencies was technically capable and the engineering consultant demonstrated a high level of professional competence. Preparation was completed within the agreed schedules without unnecessary delays or difficulties. The design and analysis of various project aspects were found to be adequate.

Water conservation studies were formulated during preparation with assistance provided by UNDP. While the water agencies concurred with carrying out the studies, they were reluctant to commit resources for the entire experiment fearing an unpredictable impact of water conservation experiments on users. Later on during implementation they financed and completed the water conservation studies.

7.5 Government implementation performance:

Government implementation performance was satisfactory. The government ministries provided general guidance and assistance in the areas of financing, environment, and procurement and, toward the end of implementation, took a lead in supporting water conservation. The ministries also helped coordinate Bank supervision missions and the implementing agencies.

7.6 Implementing Agency:

The managerial and technical performances of implementing agencies were satisfactory in spite of various reorganizations resulting in multiple changes of names, managers, and lines of reporting. The core team responsible for managing and monitoring implementation remained almost intact. The agencies successfully implemented the project within the agreed performance parameters. Compliance with legal covenants as stipulated in the Loan and Project Agreements was generally satisfactory, with the exception of the financial performance covenants.

Kwangju's sewerage agency made considerable efforts to achieve the institutional goals of the project and proceeded beyond the project goals to increase efficiency through privatization of operations and maintenance. However, Seoul's sewerage agency made no progress towards becoming an LPC during the project period. The accounts are still maintained using cash-based accounting methods with no clear distinction between operational and non-operational activities. Semiannual progress reports and annual audit reports were submitted to the Bank; the latter were often delayed by one-year in the case of Seoul where the sewerage department's statements had to be approved by the National Assembly before being released to the Bank. Audits were always found satisfactory, both for Kwangju and Seoul. The implementing agencies maintained excellent records and were able to comply with data requests by the Bank promptly and with detailed explanations. The Borrower's contribution to the Implementation

Completion Report was made available to the Bank as required. (Kwangju's contribution, originally in Hangul, was translated through the Bank office).

7.7 Overall Borrower performance:

Overall, the Borrower's performance is rated satisfactory. The government ministries provided adequate and timely guidance to the project cities and implementing agencies. The cities' allocation of funds was adequate, though in Seoul counterpart funds were lower than required early on. The two wastewater agencies managed, monitored and reported on implementation competently with only minor delays.

8. Lessons Learned

The implementation of this project highlights the following lessons:

1. Strong ownership by the national and particularly the city governments helps ensure the successful implementation and sustainability of the project.
2. A comprehensive wastewater strategy should include both water conservation and wastewater treatment measures; however, water supply and wastewater functions are often the responsibility of separate agencies, making an integrated approach difficult. Implementation experience demonstrates the need to elevate the water agencies' commitment to water conservation. Therefore, more extensive involvement of the water agencies and strong support from the city government can be instrumental in making gains in this area.
3. The financial covenants which require a FRR of 2-3% for wastewater agencies have proven unrealistic in a situation of huge capital outlays over a short time. The experience in Kwangju and Seoul shows that the facilities were constructed and are being operated in a satisfactory and likely sustainable fashion even without achieving the required rates of return. In the future, the financial objectives of operations in the wastewater sector, instead of focusing on FRR, should be more oriented towards promoting financial viability (such as internal cash generation) and prudent financial management.
4. Though not included in the project design, Kwangju successfully implemented privatization of its wastewater facilities with observable cost savings. Seoul is also considering pilot schemes for one of its WTPs. Therefore, for sophisticated borrowers with considerable prior experience in the sector, opportunities for further efficiency enhancement through private sector participation exist and should be considered thoroughly early in project design.

9. Partner Comments

(a) Borrower/implementing agency:

Comments from Kwangju Metropolitan Government

1. Introduction

Kwangju sewage treatment plant of 300,000 m³/day was constructed from 1985 to 1991. As the population increase and urban development are steadily going on and sewage treatment capacity becomes short for full treatment of the sewage (total sewage amount of the city by 1992 is 384,440 m³/day), an expansion project of sewage treatment plant was planned by Loan project with the capacity of 300,000 m³/day based on the sewage treatment master plan for total treatment capacity of 600,000 m³/day by 1996.

2. Evaluation of Project

2-1. Project Objective

The project includes the construction of a sewage treatment plant of 300,000 m³/day, a sewage interceptor of 32.7 km and a sewage boost pumping station of 32,000m³/day. Water conservation program for reduction of water leakage is also included in the project. The project is focusing on improvement of water quality of Yongsan river.

2-2. Achievement of Objective

Regional Policy

Excess sewage is to be treated by the project completion and helps the water quality of Yongsan river.

Financial Objective

Total project cost is 101,827 million Won including borrowings of 50,197 million Won (IBRD Loan of 19,244 MW and public fund of 23,925 MW), developers contribution of 47,744 MW and city general account of 3,886 MW. The project was satisfactory completed with the above mentioned project costs.

Original IBRD Loan was planned as USD 30 million, but it was amended to USD 6,250 thousand by June 1994 because of increasing local fund (national environmental fund and public budget management fund). Total withdrawal was USD 6,610,823.19 by February, 1998 with a canceled amount of USD 639,176.81.

Kwangju sewerage work is operated by public enterprise system from 1985 with the operating cost by sewage tariffs.

For the sound financial management, sewage tariffs have been increased by 9.9% in September, 1994, 9.9% in December, 1995 and 25% in January, 1977 resulting in second high sewage tariff level next to Pusan in the country.

Institutional Improvement

Sewage department of Kwangju city was the Sewage Division (Sewage Administration Section, Sewage Facility Section) under Construction and Housing Bureau at the time of Loan Processing.

The Sewage Division was transferred to Environment and Forest Bureau in July, 1995, moved back to Construction and Housing Bureau by September, 1998, and re-transferred to Environment and Forest Bureau with the new name as Water Quality Preservation Division (Water Quality Administration Team, Water Quality Preservation Team, Sewers Team, Sewage Facility Team).

Physical Objective

The physical component of the project, composed of Sewage Treatment Plant with the capacity of 300,000 m³/day, 24 km sewage interceptors with boosting pump station of 32,00 m³/day, was successfully completed and water conservation objective was substantially achieved according to the engineering research work for water saving and reduction of leakage.

Water works agency will continue for water conservation work in the future.

Completed interceptor is 24 km instead of original object of 32.7 km But the remained 8.7 km is associated with the housing development area, therefore, the housing development project is on the way to install interceptor as much as 12 km

Social and Environment Objective

Yongsan river water quality is substantially improved and contributes good environments to the people by sewage discharge treated more than environmental criteria intercepting all sewage produced.

2-3. Major Factors Affecting Implementation

Factors Subject to Government Control

The Government executed its work successfully including subloan of IBRD Loan to the city, local financial support and legal improvement process of the project.

Factors Subject to Implementing Agency Control

Water Quality Preservation Division :

The Division's works composed of planning finance provision, material supply and control of supervising consultant were successfully done and the project was satisfactorily completed. But the project period was extended 3 times to complete the construction work by December, 1996 and to start normal operation of the project by 1997 after full test operation. The suspensions of construction work were made by cold winter, irrigation water storage and weak foundation treatment for interceptors.

The financial rate of return (FRR) was lower than 3% which was recommended by the Bank due to less successful tariff levels during the project period. Therefore, the Sewage Agency got financial supports from city general accounts and local bank loan rather than increasing sewage tariff levels to meet the construction costs.

Supervising Consultant :

The consultant performed its role properly for supervising field construction works and test operation process to complete the project successfully.

2-4. Bank Performance

The Bank's performance was done satisfactory for the loan agreement, acceptance of counterpart's representative signature, preparation and approval of withdrawals, and field supervision to complete the project successfully.

Total withdrawal of the Loan amount is USD 5,632,042.72 instead of final settled amount of USD 5,610,823.19. The clear explanation was very difficult and complicated for the remainder of USD 21,218.91.

2-5. Borrower Performance

Borrower's performance was satisfactory in general for the project preparation, construction work, plant operation in initial stage and for transfer of the treatment plant operation and management to a private sector.

Sewage tariff was increased for 3 times up to 44.8% during the project period, but it was not possible to set at high enough levels to achieve appropriate FRR, because additional increase was affected by tax resistance and market price control.

2-6. Assessment of Outcome

As described on paragraph 2~2, the outcome of the physical objective is satisfactory.

2-7. Future Operation: Transfer of Plant Operation and Management to a Private Sector

The city planned to transfer the plant operation and management to a private sector aiming to achieve effective sewage treatment plant operation. Kwangju Sewage Treatment Plant, total capacity of

600,000 m³/day, was transferred to be operated by a private company from March, 1, 1998 as the first case in Korea.

The visual results of private operation are reducing the operating costs and restructuring operating organization cutting off 2 sections with 6 subsections and 113 operating staffs.

Present private operating staffs are 65 personnel with annual operating costs of 6,203 MW (city operating costs assumed up to 8,818 MW) reducing 2,615 MW per year. And it is expected that private idea and effective technologies could be applied to the management of basic environmental facilities and Kwangju case will be a model for other cities in Korea.

2-8. Key Lessons Learned

Steady increases of urban population and sewage amount resulted in shortage of sewage treatment plant, and extension of sewage treatment plant became necessary. Sewage treatment plant construction took time (up to 5 years) with high capital costs affecting city's financial situation to incur debts. Therefore, private sector investment is preferable for large scale urban infrastructures like sewage treatment plant.

Comments from Seoul Metropolitan Government

Chapter 1. Introduction

Seoul is the largest city of Korea, a hub of politics, economy, social affairs, culture and transportation. Since the 1980s, the amount of sewage has increased significantly due to rapid increase in population and the improved living standings of the people. This has created many problems that Seoul Metropolitan Government has to solve, including the worsened pollution of the Han River.

In connection with this, Seoul Metropolitan Government established a "Master Sewerage Improvement Plan" in 1984 to preserve water quality of the Han River and to improve urban environment to more comfortable level. The City Government divided Seoul areas into 4 sewerage treatment division in connection with the Han River development project, and constructed 4 treatment plants: Chunggrang, Tanchon, Kayang, and Nanji plants.

Starting in the 1990s, many apartment complexes were constructed in the southwest areas covering Kangso-gu, Kwangmyong city, and Buchon city. With continuous population growth and resulting increase in sewage, it became impossible for the existing 1,000,000 m³/day capacity Kayang sewerage treatment plant to handle the entire amount of sewage thus produced. To improve the situation, the Seoul City Government drew up a plan in 1992 to build another 1,000,000 m³/day sewerage treatment plant, and in preparation for this project, the Seoul City Government applied for a loan from IBRD to fill the shortage of the construction funds in 1991.

After a loan of US\$80,000,000 was approved on May 17, 1993 under agreement No.: LN-3590KO, part of the money was used to purchase major facilities and materials used in the construction of the sewerage treatment plant; however, due to change in the quantity of some facilities and exchange rate, the amount was changed to US\$34,200,000, and US\$514,000 left after the final expenditure was executed was cancelled.

When the construction of the 1,000,000 m³/day capacity treatment plant was completed at the end of 1998, the Seoul City Government became able to treat the entire amount of sewage generated from the southwest area of Seoul, contributing to the improvement of the Han River water quality and the prevention of environmental pollution.

We would like to take this opportunity to express our deep appreciation to IBRD for their full cooperation. This reports are annex documents which accompany the loan execution report prepared upon completion of the loan project, a borrower's report on evaluation and appraisal of the project execution covering Seoul areas.

Chapter 2. Assessment of Loan Project Achievement

A. Seoul Component Objectives

The following two goals were established for Seoul Areas, the B division of the loan agreement concluded for the major objects of the loan project - improvement of environmental situation, technical and systematic improvement in the sewage system, and the protection of water Pollution.

- The capacity of the existing Kayang (Anyang) sewerage treatment plant is to be expanded by 1,000,000 m³/day
- Carry out researches into water preservation ways

The Seoul Metropolitan Government has devoted itself to the successful completion of the above-said project. Construction started in December 1992 and completed in December 1998, and currently the system handles the entire amount of sewage generated. Research related to water preservation was carried out from January 1994 to December 1997, and the final report was submitted in March 1998.

Detailed evaluation on the achievement of goals will be described in the section: Achievement of goals

B. Achievement of Objectives

- Policy Improvement

The successful completion of this project has greatly contributed to the environment improvement by preventing water quality deterioration in the downstream of the Han River, and it is considered that goals have been successfully attained in terms of system and technology in the sewage treatment field based on studies carried out on commissioning private enterprises to operate the treatment plant and on the introduction of public corporation accounting system.

The studies carried out in respect to water pollution preservation have enhanced consciousness with respect to water quality and environmental pollution resulting in the reduction of sewage. Hence, the policy improvement goals are considered as having been successfully achieved.

However, failure to maintain more than ROR 2% due to the current domestic price policies and the delay in the enforcement of the public corporation accounting system are considered somewhat unsatisfactory.

○ Financial Objectives

To appropriate part of the budgets required to construct expanded part of Kayang sewerage treatment plant, a loan agreement was signed on May 17, 1993 between the Korean government and IBRD. The original plan called for the use of US \$ 80,000,000 according to the loan agreement; however, the total amount of loan was reduced to US \$ 34,200,000 after adjusting the amount four times due to the reduced quantity of facilities during the process, difference in the bid price, and the unrequired funds resulting from the rise in exchange rate. After the final amount was withdrawn in February 1992, an amount of US \$ 514,199.24 remaining after the project execution was cancelled. The actual amount of loan used was US \$ 33,685,800.76, indicating that the financial goals have been met successfully by saving contract commissions.

< Reduction of loans >

- . Original amount of loan: US \$ 80,000,000
- . 1st adjustment of loans (Feb. 23, 1994): US \$ 56,500,000 (reduced by US\$ \$ 23,500,000)
 - part of machines reduced
- . 2nd adjustment of loans (Aug. 8, 1995): US \$ 54,500,000 (reduced by US \$ 2,000,000)
 - final bid price based on contract
- . 3rd adjustment of loans (Dec. 30, 1997): US \$ 40,000,000 (reduced by US \$ 14,500,000)
 - unneeded amount resulting from the rise in exchange rate
- . 4th adjustment of loans (Jan. 13, 1999): US \$ 34,200,000 (reduced by US \$ 5,800,000)
 - unneeded amount resulting from the rise in exchange rate
- . Final loans withdrawn: US \$ 33,685,800.76 (₩32,393,708,000)
- . Cancellation of unexecuted loan requested (Mar. 15, 1999) : US\$ \$ 514,199.24

However, to maintain ROR 2% with respect to the Seoul City Sewerage project fund composed of transfers from special account and general account, the sewerage charges must be increased considerably. It is difficult to implement such requirements due to IMF and resulting change in the domestic economic situation.

The Seoul City plans to gradually raise sewerage charges to 90% of the sewage treatment cost; however, as the shortage of funds is supported by transfers from general account, it in effect carries the effect of raising ROR.

○ Organization

In October 1998, the Sewerage Bureau and the Road Bureau were incorporated into the Road & Sewerage Bureau, while the technical business related to sewerage was placed under the responsibility of the sewerage planning Division, and the administrative affairs including revenue and budget affairs were placed under the charge of the Construction Administration Division.

○ Physical Objectives

In June 1987, Kayang sewerage treatment plant began operation with a capacity of 1,000,000 m³/day to treat sewage produced in the southwest side of Seoul. As the amount of sewage generated from Kangso-gu, Kwangmyong city, and Buchon city grew resulting from the construction of large-scale apartment complexes in the area, the original capacity of the plant has far exceeded. As a result, large amount of sewage has flown in and the less treated sewage or untreated sewage was discharged into the Han River aggravating the Han River water quality and environmental pollution.

To solve such problem, the Seoul Metropolitan Government pushed ahead with the extension work (1,000,000 m³/day) of Kayang sewerage treatment plant, and has successfully completed the project under the support of IBRD.

Of the 1,000,000 m³/day capacity, facilities for 500,000 m³/day went into satisfactory operation starting in July 1998 through test operation, and the remaining 500,000 m³/day capacity facilities, starting from January 1999.

The Kayang sewerage treatment plant capacity was thus increased to 2,000,000 m³/day, enabling the plant to successfully treat the entire amount of sewage produced per day from the southwest part of Seoul (1,740,000 m³) prior to discharging, contributing to the prevention of water quality contamination at the lower stream of the Han River. In addition, jobs were created for a total of 450,000 workers during the period of this project, and therefore physical goals are evaluated as having been fully accomplished.

IBRD requested that Seoul Metropolitan Government carries out researches into water preservation project during the period of this project, and for 4 years during the period from 1994 to 1997, the Seoul City conducted researches on water preservation. Based on the results of such research activities, the Seoul City was able to implement systematic water supply management and computerization, prevention of water leakage, replacement of defective meters, and expanded supply of water saving devices, greatly contributing to the preservation of water.

○ Social Objectives

Until a while ago, the sewerage treatment plants were recognized as detestable facilities due to the foul smell produced from sewage, and were constructed in underdeveloped, suburban areas far from contact with the general public. For this reason, the achievement level of the external social goals can be regarded as being somewhat insufficient. To minimize the occurrence of foul smell by installing facilities and deodorizing equipment superior to those of other sewerage treatment plants, the Seoul City has constructed, and opened to residents, parks, sports facilities, parking lots, and publicity halls in the vicinity of the Gayang sewerage treatment plant. As a result, large apartment complexes were constructed near the Kayang sewerage treatment plant, and friendliness of the neighboring residents was induced by providing an opportunity to inspect the facilities, enhancing the awareness with respect to the protection of water pollution and environment. Hence, the internal goal achievement level is considered satisfactory.

○ Environmental Objectives

When the expansion plan was established in 1992, part of sewage could not be treated due to the lack of treatment capacity, and because the existing 1,000,000 ton/day plant was only a primary facility, such shortage of capacity has induced environmental pollution including the water quality deterioration at the downstream of the Han River.

In December, 1994, secondary treatment plant was completed to supplement the existing 1,000,000 ton/day plant, and when the 1,000,000 ton/day expansion work was completed in December, 1998, the total capacity became 2,000,000 ton/day which is capable of treating all sewage flowing into Ka-Yang Sewage Treatment Plant.

As a result, this is considered to have satisfied environmental objectives by greatly contributing to the prevention of water quality at the downstream of the Han River. Water pollution improvement after the completion of Kayang sewerage treatment plant is shown in the following Tab-1.

<Tab-1>

Item	As of May 30, 1992		As of Dec. 30, 1998	
	Influent Water Pollution	Effluent Water Pollution	Influent water Pollution	Effluent water Pollution
BOD	99	66	90	13
COD	53	47	47	10
SS	106	77	93	9

C. Major Factors Affecting Implementation

○ Factors subject to government control

Under a close cooperative system between the Ministry of Finance and Economy of the Republic of Korea, and the Seoul Metropolitan Government, the responsible party for the project planning and execution, the loan project was able to be successfully completed.

○ Factors subject to Implementing Agencies Control

There were no notable elements controlled by the working body during the process of implementation. However, due to collective civil petitions related to the compensation for farmers in the planned site; lack of investments in the initial construction; and the lack absolute construction period, the construction work was postponed for 2 times, adversely affecting the implementation of the project.

Revise construction period

(1) Jun. 15, 1995: 1st Revise of construction period

Original: Dec. 30, 1992 - Dec. 31, 1996

Revised : Dec. 30, 1992 - Dec. 31, 1997

Reason: Delayed civil works resulting from the collective civil petitions filed in relation to the compensation for farming, and the lack of initial investments.

(2) Sep. 6, 1996: 2nd Revise construction period

Original : Dec. 30, 1992 - Dec. 31, 1997

Revised : Dec. 30, 1992 - Dec. 31, 1998

Reason: Lack of absolute construction period

○ Factor Outside of Government

During the finishing process of the project, works were delayed due to facility change, reconstruction of some equipment, and additional works requested by the existing workers of Kayang sewerage treatment plant, the actual party taking over the facilities, in addition to control by the Government and executive body.

To prevent such phenomenon in future, the actual workers who take over, operate and maintain the treatment plant should be allowed to participate in the initial phase of work, not in the final phase of the work, to exchange opinions in advance.

D. Bank Performance

- As Seoul project objectives, IBRD has chosen 2 items: expansion of the capacity of the current Ka-yang sewerage treatment plant by 1,000,000 ton/day and researches into water preservation to improve Seoul city's environmental situation, systematically and technically improve sewage treatment system, and to preserve water. These items, while being simple and clear, are considered appropriately chosen as an important task to be performed by the Seoul Metropolitan Government.
- The high awareness and judgement of IBRD with respect to this project were particularly noteworthy in the administrative and financial roles, and each time the bank mission visited Korea, they checked the progress of the water preservation researches, and their evaluation was extremely satisfactory.
- The Seoul Metropolitan Government feels very satisfied with the fact that the mission visited Seoul and made detailed, repeated site inspections and provided guidance prior to making decision on loans, offering technical and systematic advice regarding the commissioning of private enterprises to operate the treatment plant, introduction of public corporation accounting system, and maintenance of ROR 2%.
- However, we feel it was somewhat unreasonable that the IBRD requested us to maintain ROR 2% which is difficult on the part of the Seoul Metropolitan Government due to price policy reasons and demanded introduction of the public corporation accounting system.

E. Borrower Performance

- The Kayang sewerage treatment plant extension project was implemented with an aim to increase sewage treatment capacity to 2,000,000 m³/day from the existing 1,000,000 m³/day level. The project was financed by the domestic capital 83.8% and the IBRD loan 16.2% (for machinery, electric and instrument and materials). Even though the project was completed 2 years later than the original plan, it can be regarded as a successful project in general.
- There have been some changes in the machinery, electrical facilities and materials originally requested to IBRD at the time of signing agreement, and part of the amount became unnecessary due to large level of exchange rate change, affecting overall plan of using the loans.
- The construction period has been delayed by 2 years due to delayed site acquisition resulting from collective civil petitions relating to compensation for farming, low level of initial investment in civil works, and shortage of absolute construction period; however, we feel satisfied about the successful execution of the project in terms of overall execution and operation.

F. Assessment of Outcome

- The successful completion of the project carried out to increase the capacity of Kayang sewerage treatment plant by 1,000,000 m³/day made it possible to treat the entire amount of sewage generated from the southwest part of Seoul, greatly contributing to the water quality improvement of the downstream of the Han River.
- Access to advanced technologies, system and technique was made through researches conducted to study ways of preserving water, converting to public business accounting system, and commissioning private enterprises to operate the treatment plant. In all, we believe that most physical goals have been achieved.

G. Future operation

- Facility capacity will be expanded annually until 2011 to enable treatment of the entire amount of sewage, and reduce inflow of ground water by readjusting pipeline.
- Ultimately, the Seoul Metropolitan Government intends to commission private enterprises to run the 4 sewerage treatment plants: Chungrang, Tanchon, Kayang, and Nanji directly controlled by the City, in order to achieve management efficiency, revitalize civilian market, and induce enhancement in the development of related technologies. First, the City plans to select one treatment plant and assign the operation of the treatment plant to civilian enterprises on a trial basis starting in 2000.
- Furthermore, the City plans to cover the upper part of the plant and use it as the site of parks and sports facilities to provide resting place for the residents and induce citizen's sense of intimacy. This will change citizen's awareness with respect to the treatment plants. To minimize the neighbor's sense of displeasure, deodorizing facilities will be installed in full scale along with the construction of museums so that citizens and students can use the area as a course of inspection.
- 1999 ~ 2003.s Financial plan is will be Ready and Submitted by mission when day Visit Seoul

H. Key lessons learned

- The fact that the project has been successfully completed through the use of IBRD loans to fill the shortage of the construction funds together with the bank's advanced technologies and systems, and by maintaining close cooperative systems between the bank and the domestic partner has greatly contributed to the preservation of water quality, earning affection of neighbors.

- Plans to commission civilian sectors to run the treatment plants and access to public business accounting system have provided an opportunity to realize salient development in terms of technologies and systems.
- Of the direct withdrawal system, special account system, and special agreement system related to the withdrawal of the loans for the purchase of materials, special agreement system was adopted and approved. This is believed to have simplified accounting system leading to the prevention of the waste of administrative manpower, and it is desirable to adopt such system in future loan projects.
- It is regrettable, however, that the project has been completed later than the original plan because the construction period was repeatedly delayed due to problems related to compensation for farming, frequent design changes, reduction of project cost and other lack of prior preparations, and through such lessons, we have actually experienced the necessity of making detailed prior arrangement.
- Some terms and conditions of agreement, such as the introduction of public business accounting system which was difficult to implement due to the domestic circumstances, and the maintenance of ROR 2% were some of the things difficult to observe.
- It seems desirable to conclude a loan agreement in the direction of encouraging or guiding advanced system so that the borrower can implement projects according to domestic situation, rather than providing loans under the performance conditions prescribed by the bank.

(b) Cofinanciers:

Not applicable.

(c) Other partners (NGOs/private sector):

Not applicable.

10. Additional Information

none

Annex 1. Key Performance Indicators/Log Frame Matrix

Outcome / Impact Indicators:

Indicator/Matrix	Projected in last PSR	Actual/Status/Estimate
Kwangju:		
Total treatment capacity	600,000 m3/day in 1997	600,000 m3/day constructed in 1997
Water conservation study	Completion and review of recommendations in July 1996	Study completed and recommendations reviewed in April 1996; NRW was reduced
Environmental monitoring program	Collect and evaluate data on wastewater treatment plant performance and impact of plant operations	Performance monitored six months before and six months after start of operations and found satisfactory
Reduction of organic pollution in Yongsan River	Reduction by 62 t/day expressed in BOD and 62 t/day of suspended solids in 1998	Pollution equivalent to 64 t/day of BOD and 82 t/day of SS achieved in 1998
Rate of return on fixed assets in operations	3% starting from 1993	Rate of return positive, but lower than required
Seoul:		
Kayang total treatment capacity	2,000,000 m3/day in 1997	2,000,000 m3/day constructed in 1999
Water conservation study	Completion and review of recommendations in July 1996	Study completion and reviewed in May 1998; NRW moderately reduced
Environmental monitoring program	Collect and evaluate data on wastewater treatment plant performance and impact of plant operations	Performance monitored six months before and six months after start of operations and found satisfactory
Reduction of organic pollution in Han River	Reduction by 200 t/day expressed in BOD and 220 t/day of suspended solids in 1998	Pollution equivalent to 152 t/day of BOD and 157 t/day of SS achieved in 1999
Rate of return on revalued fixed assets in operations	2% starting from 1993	Fixed assets were not revalued, RR values cannot be determined

Output Indicators:

Indicator/Matrix	Projected in last PSR	Actual/Status/Estimate
Kwangju:		
Preparation and timeliness of financial and operational reports	Gradual improvement	Timeliness and quality improved
Seoul:		
Introduction accrual accounting system	Conversion of wastewater agency to local public corporation (LPC) status in 1993	Wastewater agency was not converted to LPC

1 End of project

Annex 2. Project Costs and Financing

Project Cost by Component (in US\$ million equivalent)

Project Cost By Component	Appraisal Estimate US\$ million	Actual/Latest Estimate US\$ million	Percentage of Appraisal
Kwangju	133.01	125.92	95
Seoul	375.05	287.30	77
Total Baseline Cost	508.06	413.22	
Total Project Costs	508.06	413.22	
Total Financing Required	508.06	413.22	

Project Costs by Procurement Arrangements (Appraisal Estimate) (US\$ million equivalent)

Expenditure Category	ICB	Procurement Method ¹			Total Cost
		NCB	Other ²	N.B.F.	
1. Works	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	238.70 (0.00)	238.70 (0.00)
2. Goods	208.00 (107.50)	3.00 (2.50)	0.00 (0.00)	0.00 (0.00)	211.00 (110.00)
3. Services	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	13.40 (0.00)	13.40 (0.00)
4. Miscellaneous (Land)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	45.00 (0.00)	45.00 (0.00)
Total	208.00 (107.50)	3.00 (2.50)	0.00 (0.00)	297.10 (0.00)	508.10 (110.00)

Project Costs by Procurement Arrangements (Actual/Latest Estimate) (US\$ million equivalent)

Expenditure Category	ICB	Procurement Method ¹			Total Cost
		NCB	Other ²	N.B.F.	
1. Works	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	234.10 (0.00)	234.10 (0.00)
2. Goods	68.60 (39.30)	0.00 (0.00)	0.00 (0.00)	47.30 (0.00)	115.90 (39.30)
3. Services	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	10.90 (0.00)	10.90 (0.00)
4. Miscellaneous (Land)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	52.30 (0.00)	52.30 (0.00)
Total	68.60 (39.30)	0.00 (0.00)	0.00 (0.00)	344.60 (0.00)	413.20 (39.30)

^{1/} Figures in parenthesis are the amounts to be financed by the Bank Loan. All costs include contingencies.

^{2/} Includes civil works and goods to be procured through national shopping, consulting services, services of contracted staff of the project management office, training, technical assistance services, and incremental operating costs related to (i) managing the project, and (ii) re-lending project funds to local government units.

Project Financing by Component (in US\$ million equivalent)

	Appraisal Estimate			Actual/Latest Estimate			Percentage of Appraisal		
	Bank	Govt.	CoF.	Bank	Govt.	CoF.	Bank	Govt.	CoF.
Kwangju	30.00			5.63	16.07	104.22	18.8	0.0	0.0
Seoul	80.00			33.69	169.04	84.57	42.1	0.0	0.0
							0.0	0.0	0.0

a) Actual cost estimates of the water conservation studies at US\$0.31 million equivalent were financed by respective water agencies rather than project funds. The studies were not included in the initial project estimates on request of water agencies and also due to experimental character of the studies and uncertainty of cost estimates.

Annex 3: Economic Costs and Benefits

Key Assumptions:

- (1) During the investment phase, 10% of the cost is for tax and tariffs;
- (2) The level of recurrent cost will stay at 1999 level (constant price);
- (3) The value of wastewater treated is equal to the tariff charged; and
- (4) All costs and benefits are converted to 1999 prices.

Kwangju Cost Benefit Analysis Table (million won)

Year	Investment Cost	Recurrent Cost	Total Cost	Benefits	Net
1993	17,401	-	17,401	-	(17,401)
1994	11,253	-	11,253	-	(11,253)
1995	27,712	-	27,712	-	(27,712)
1996	22,044	-	22,044	-	(22,044)
1997	26,347	-	26,347	-	(26,347)
1998	2,070	-	2,070	-	(2,070)
1999	-	10,776	10,776	17,257	6,481
2000	-	8,082	8,082	17,257	9,175
2001	-	8,082	8,082	17,257	9,175
2002	-	8,082	8,082	17,257	9,175
2003	-	8,082	8,082	17,257	9,175
2004	-	8,082	8,082	17,257	9,175
2005	-	8,082	8,082	17,257	9,175
2006	-	8,082	8,082	17,257	9,175
2007	-	8,082	8,082	17,257	9,175
2008	-	8,082	8,082	17,257	9,175
2009	-	8,082	8,082	17,257	9,175
2010	-	8,082	8,082	17,257	9,175
2011	-	8,082	8,082	17,257	9,175
2012	-	8,082	8,082	17,257	9,175
2013	-	8,082	8,082	17,257	9,175
2014	-	8,082	8,082	17,257	9,175
2015	-	8,082	8,082	17,257	9,175
2016	-	8,082	8,082	17,257	9,175
2017	-	8,082	8,082	17,257	9,175
2018	-	8,082	8,082	17,257	9,175
2019	-	8,082	8,082	17,257	9,175
2020	-	8,082	8,082	17,257	9,175
2021	-	8,082	8,082	17,257	9,175
2022	-	8,082	8,082	17,257	9,175
2023	-	8,082	8,082	17,257	9,175
2024	-	8,082	8,082	17,257	9,175
2025	-	8,082	8,082	17,257	9,175
2026	-	8,082	8,082	17,257	9,175
2027	-	8,082	8,082	17,257	9,175
2028	-	8,082	8,082	17,257	9,175
2029	-	8,082	8,082	17,257	9,175
2030	-	8,082	8,082	17,257	9,175
2031	-	8,082	8,082	17,257	9,175
2032	-	8,082	8,082	17,257	9,175
2033	-	8,082	8,082	17,257	9,175
2034	-	8,082	8,082	17,257	9,175
2035	-	8,082	8,082	17,257	9,175
2036	-	8,082	8,082	17,257	9,175
2037	-	8,082	8,082	17,257	9,175
2038	-	8,082	8,082	17,257	9,175
2039	-	8,082	8,082	17,257	9,175
NPV	78,524	46,087	124,611	95,456	(29,155)
				ERR:	6.6%

Seoul Cost Benefit Analysis Table (million won)

Year	Investment Cost	Recurrent Cost	Total Cost	Benefits	Net
1993	43,870	-	43,870	-	(43,870)
1994	27,978	-	27,978	-	(27,978)
1995	78,484	-	78,484	-	(78,484)
1996	43,645	-	43,645	-	(43,645)
1997	31,707	-	31,707	-	(31,707)
1998	29,874	-	29,874	-	(29,874)
1999	16,868	-	16,868	-	(16,868)
2000		18,368	18,368	47,362	28,994
2001		19,965	19,965	47,362	27,397
2002		19,965	19,965	47,362	27,397
2003		19,965	19,965	47,362	27,397
2004		19,965	19,965	47,362	27,397
2005		19,965	19,965	47,362	27,397
2006		19,965	19,965	47,362	27,397
2007		19,965	19,965	47,362	27,397
2008		19,965	19,965	47,362	27,397
2009		19,965	19,965	47,362	27,397
2010		19,965	19,965	47,362	27,397
2011		19,965	19,965	47,362	27,397
2012		19,965	19,965	47,362	27,397
2013		19,965	19,965	47,362	27,397
2014		19,965	19,965	47,362	27,397
2015		19,965	19,965	47,362	27,397
2016		19,965	19,965	47,362	27,397
2017		19,965	19,965	47,362	27,397
2018		19,965	19,965	47,362	27,397
2019		19,965	19,965	47,362	27,397
2020		19,965	19,965	47,362	27,397
2021		19,965	19,965	47,362	27,397
2022		19,965	19,965	47,362	27,397
2023		19,965	19,965	47,362	27,397
2024		19,965	19,965	47,362	27,397
2025		19,965	19,965	47,362	27,397
2026		19,965	19,965	47,362	27,397
2027		19,965	19,965	47,362	27,397
2028		19,965	19,965	47,362	27,397
2029		19,965	19,965	47,362	27,397
2030		19,965	19,965	47,362	27,397
2031		19,965	19,965	47,362	27,397
2032		19,965	19,965	47,362	27,397
2033		19,965	19,965	47,362	27,397
2034		19,965	19,965	47,362	27,397
2035		19,965	19,965	47,362	27,397
2036		19,965	19,965	47,362	27,397
2037		19,965	19,965	47,362	27,397
2038		19,965	19,965	47,362	27,397
2039		19,965	19,965	47,362	27,397
NPV	196,988	99,444	296,432	237,674	(58,758)
				ERR:	7.4%

Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle Month/Year	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
	Count	Specialty	Implementation Progress	Development Objective
Identification/Preparation October 1991	3	Sanitary engineer, Municipal engineer, Financial analyst		
April/May 1992	6	Sanitary engineer (2), Procurement specialist, Water conservation specialist, Environment specialist, Financial analyst		
Appraisal/Negotiation November 1992	5	Sanitary engineer (2), Water conservation specialist, Environment specialist, Financial analyst		
Supervision March 1994	2	Financial analyst, Sanitary engineer	S	S
May 1996	3	Financial analyst, Sanitary engineer (2)	S	S
May 1997	2	Financial analyst, Sanitary engineer	S	S
May 1998	4	Financial specialist, Engineer Environmentalist, Sanitary engineer	S	S
January 1999	2	Financial specialist, Sanitary engineer	S	S
ICR August 1999	3	Financial specialist, Economist, Sanitary engineer	S	S

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US\$ (,000)
Identification/Preparation	89.20	247.50
Appraisal/Negotiation	5.10	18.20
Supervision	66.40	213.50
ICR	10.93	57.85
Total	171.83	537.05

Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

	Rating				
<input checked="" type="checkbox"/> <i>Macro policies</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA
<input checked="" type="checkbox"/> <i>Sector Policies</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input checked="" type="checkbox"/> <i>Physical</i>	<input checked="" type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input checked="" type="checkbox"/> <i>Financial</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input checked="" type="checkbox"/> <i>Institutional Development</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input checked="" type="checkbox"/> <i>Environmental</i>	<input checked="" type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA

Social

<input checked="" type="checkbox"/> <i>Poverty Reduction</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA
<input checked="" type="checkbox"/> <i>Gender</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA
<input checked="" type="checkbox"/> <i>Other (Please specify)</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA
<input checked="" type="checkbox"/> <i>Private sector development</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input checked="" type="checkbox"/> <i>Public sector management</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input checked="" type="checkbox"/> <i>Other (Please specify)</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA

Annex 6. Ratings of Bank and Borrower Performance

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

6.1 Bank performance

Rating

- Lending
- Supervision
- Overall

HS S U HU
 HS S U HU
 HS S U HU

6.2 Borrower performance

Rating

- Preparation
- Government implementation performance
- Implementation agency performance
- Overall

HS S U HU
 HS S U HU
 HS S U HU
 HS S U HU

Annex 7. List of Supporting Documents

1. ICR Borrower's contribution, Kwangju
2. Kwangju: Report of Post Construction Environmental Effects
3. Organization Chart of Kwangju Environment and Forestry Bureau
4. Kwangju River Quality Monitoring Data, by Kwangju Water Quality Conservation Department
5. ICR Borrower's contribution, Seoul
6. Seoul: Post-Environmental Impact Assessment Service Agreement
7. Seoul: Additional data submitted to ICR mission
8. Environment Monitoring Data from Kayang Sewerage Treatment Plant
9. Detailed Cost Tables
10. Calculation of Financial Rate of Returns
11. IBRD's ICR mission aide-memoire