Pakistan

Karachi Water Supply Improvement Project

External Evaluator : Chiyo Mamiya
Kaihatsu Management Consulting, Inc.

Field Survey : March to May 2009[1]

1. Project Description and Outline of the ODA Loan Assistance

Location of the project

Manghopir Pumping Station

1.1 Background

With a population of about 15 million in 2005, Karachi is the commercial and financial center of Pakistan. However, it has been plagued by chronic water shortages as well as deterioration of water quality as a result of rapid urbanization and population increases.

In 1994, Karachi supplied 1.6 million ㎥ of water per day, which is around 181ℓ /day per person. This amount is considerably lower than around the 340ℓ/day provided in Islamabad, the capital city of Pakistan and around the 250ℓ/day supplied in Delhi, India. In addition, out of 1.6 million ㎥ of water supplied per day, only 955,000 ㎥/day was treated while the remaining 645,000 ㎥/day was chlorinated as an emergency measure.

Based on a demand and supply forecast for water in Karachi until 2025, the Feasibility Study (F/S) conducted by Mott Macdonald of U.K. in 1985 proposed to increase water supply by 910,000 ㎥/day by 2000 and expand water treatment capacity at the existing facilities by 523, 000 ㎥/day.

1.2 Objective

[1] The two field surveys were carried out for 19 days between 8 and 26 March 2009 as well as for 8 days between 16 and 23 May 2009 respectively. The feedback seminar was held on 19 May 2009.

The objective of this project is to improve the water supply system in Karachi city by expanding the capacity of treatment works and pumping stations, thereby contributing to the prevention of diseases caused by drinking water and the improvement of public health.

1.3 Borrower/Executing agency

The Government of Islamic Republic of Pakistan/Karachi Water and Sewerage Board (KWSB)

1.4 Outline of the Loan Agreement (L/A)

Approved Amount / Disbursed Amount	10,300 million yen / 5,836 million yen
Date of Exchange of Notes / Date of Loan Agreement	November 1994 / November 1994
Terms of Conditions	Interest rate: 2.6% Repayment Period (Grace Period) : 30 years (10years) Conditions for Procurement: General Untied
Final Disbursement Date	August 2006
Main Contracts	Biwater International Limited (UK) / China Beijing Corporation for International Economic Cooperation(China) / China Liaoning International Cooperation (Group) Holdings Ltd. (China)
Main Consultants	Mot Macdonald Internationals Limited (UK)・Nippon Koei (Japan) (JV)
Feasibility Study (F/S) etc	Mott Macdonald of U.K conducted F/S and Detailed Design of the project facilities in 1985, as a part of World Bank project.
Related Projects	World Bank, Asian Development Bank and the Government of U.K. co-financed the Second Karachi Water and Sanitation Project.

2. Finding (Overall Rating: C)

2.1 Relevance (Rating: a)

The project has been highly relevant with the country's national policies and development needs at the times of both appraisal and ex-post evaluation, therefore its relevance is high.

2.1.1 Consistency with Policy/Measures

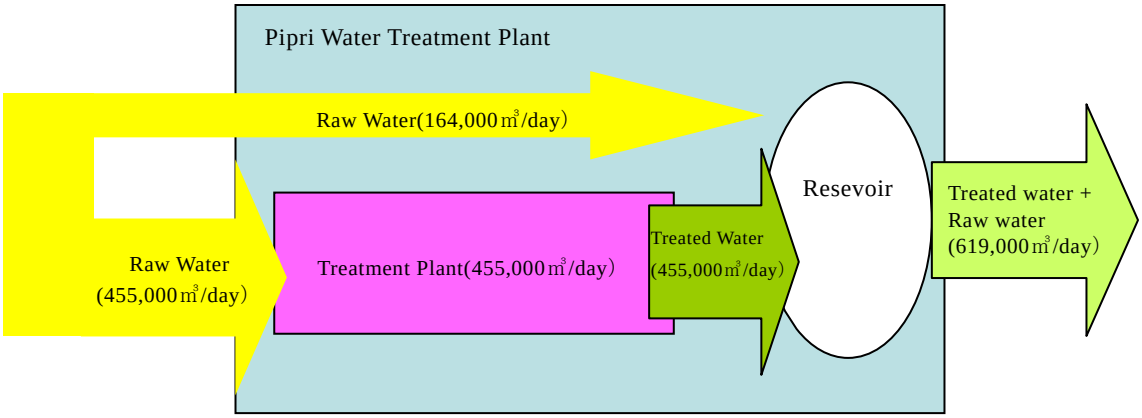
A high priority was given to the supply of safe drinking water due to its positive impact on not only health but also the economy and the environment in the Eighth Five Year Development Plan (1993-1998) at the time of appraisal.

At the time of post-evaluation, the Mid-Term Development Framework (MTDF) 2005-2010, which replaces the five-year development plan, stresses the importance of supplying safe drinking water by constructing more water treatment plants. In addition, both the National Drinking Water Policy (draft) and the Karachi Strategic Development Plan 2020 place high priority on the improvement of water quality. The objective of the project is still highly consistent with the relevant policies at the time of post-evaluation.

2.1.2 Consistency with Development Needs

Water shortages in Karachi were extremely serious compared with other cities. Increasing water supply as well as improving water quality was a pressing issue at the time of appraisal.

At the time of post-evaluation, out of 2.869 million ㎥/day of water supplied to Karachi at the end of FY 2006, 868,000 ㎥/day were not treated. This shows the high need for more water treatment plants. In fact, the supply of raw water exceeds the capacity of facilities constructed under the project. The surplus water after chlorination is mixed with treated water and supplied to the cities in Karachi.



Source: KWSB

Figure 1 Relation between raw water and treatment capacity at Pipri Water Treatment Plant

2.1.3 Relation with Other Donor-funded Projects

The project was originally a part of the Second Water Supply and Sanitation Project (KII), which was proposed in the F/S conducted in 1985 and co-funded by the

World Bank, the Asian Development Bank and the Government of United Kingdom. In 1993 the cost overruns in the KII project made it necessary to review the project scope, and the component of constructing water treatment plants was dropped due to the high possibility that other donors could finance this portion[2]. It is the component that JICA (then Overseas Economic Cooperation Fund [OECF]) decided to finance as a separate project.

The KII project, which added 455,000 ㎥/day of water supply in Karachi, was completed in 1998. This was followed by the Third Water Supply and Sanitation Project (KIII), which aimed to increase water supply in Karachi by 455,000 ㎥/day, started in 2002 and ended in 2006.

Although these two projects increased water supply in Karachi by 909,000 ㎥/day, no new water treatment plant has been constructed since the project was completed.

In Karachi, expanding water supply has been given higher priority than improving water quality due to serious water shortages. Consequently expanding water treatment capacity and improving the water distribution network have lagged behind. Therefore the importance of and need for the project in aiming to secure water safety are still high.

2.2 Efficiency (Rating: b)

Although the project period was significantly longer than planned, the project cost was lower than planned, therefore efficiency of the project is fair.

2.2.1 Output

Two water treatment plants (WTP) and a pumping station (PS) were constructed under the project. A comparison between the original plan and the actual results is shown at the end of the report. These facilities were not new constructions but the expansion of existing facilities. The conditions and planned work under the project at the time of appraisal are summarized below.

Table1 Conditions of project facilities and planned works at the time of appraisal

	Pipri WTP	Hub WTP	Manghorpir PS
Conditions at appraisal	A 227,000 ㎥/day water treatment plant taking raw water from Indus River	A reservoir which received water from Manghorpir PS and sent it after chlorination to Karachi City. Capacity of	A 405,000 ㎥ /day pumping station taking raw water from Hub Dam and sending it to a reservoir at Hub

[2] According to appraisal documents, the Government of UK, which had experience supporting construction of water treatment plants, showed its interest in supporting new plants.

		taking raw water is 405,000 ㎥/day.	
Bottleneck	Lack of treatment capacity	Absence of treatment plant	Lack of pumping capacity due to outdated facilities and design fault
Planned works under the project	Constructing additional facilities to increase the treatment capacity by 114,000 ㎥/day	-Constructing a water treatment plant with a capacity of 455,000 ㎥/day -Constructing staff housing	Constructing a new pumping facility with a capacity of 478,000 ㎥/day within the same premises

(Source) KWSB

However, there were the following two major changes in the project scope during the course of implementation:

1) The capacity of Pipri Water Treatment Plant was augmented from 114,000 ㎥/day to 227,000 ㎥/day due to the increase of raw water supply,
2) The capacity of Hub Water Treatment Plant was reduced from 455,000 ㎥/day to 364,000 ㎥/day due to the declining water availability at Hub Dam.

The adjustment of treatment capacities at Pipri and Hub is considered rational, taking into account the prevailing weather conditions between 1999 and 2003 when Karachi was suffering from historical drought, the technical evaluation of the Hub Dam as a sustainable water source by a JICA study[3], and the addition of raw water supply to Pipri in 1998[4].

2.2.2 Project Period

The project took 139 months between November 1994 and June 2006 against the original plan of 58 months between November 1994 and September 1999. That is 239.7% of the original plan. The major reasons for delays are summarized below.

① The original plan was unrealistic since it did not include the time required for tendering equipment/machinery suppliers, which normally takes around 20 months.

[3] According to the Study on Water Supply and Sewerage System in Karachi (JICA 2008), at the 95% level of reliability the corresponding yield from the Hub Dam is 340,000 ㎥/day.
[4] Although the change of project scope did increase the project cost, the increase was minimized by shifting equipment/ machinery procured for Hub WTP to Pipri WTP, low contract prices, and the weakening Pakistani rupee, which reduced the contract price in rupees (see 2.2.3). In addition, the delays caused by changes in design and specifications were not significant compared with other causes for delays (see 2.2.2). Therefore, it is considered that there were more benefits than demerits resulting from the changes of project scope.

The procurement package was divided between equipment/machinery and civil works in order to make the monitoring of project costs and schedules efficient and ensure competition among civil contractors. Since the equipment/machinery suppliers were supposed to develop the specifications for the facilities, the civil contractors should have been selected after the specifications for the facilities were developed by the suppliers. However, the original schedule assumed that the equipment/machinery suppliers and the civil work contractors would be selected in parallel. As a result, the project period delayed the time for the selection of civil work contractors.

② The project was suspended by the Government of Sindh for 14 months between February 1999 and March 2000 due to the non-availability of water at the Hub Dam resulting from severe drought. After the resumption of the project, the review of the project scope based on the lower water availability of the Hub Dam necessitated the review of the pre-qualification results for civil contractors. The review of the pre-qualification which was submitted in March 1999 was completed in September 2000.

③ Three civil works took 40 to 50 months to complete. In particular, the construction of the Manghopir pumping station, which was supposed to be completed in 30 months, took 50 months since the contractor had cash flow problems, necessitating the delay of the construction of staff housing.

④ The selection of equipment/machinery suppliers and civil work contractors took longer than planned since the appropriateness and credibility of bidders had to be carefully examined.

Although the original plan contained some weaknesses, an 81-month delay is considered inefficient. In particular, the division of the procurement package into four components, one for equipment/machinery and three for civil works, caused a prolonged tendering process and complicated and time-consuming project supervision and coordination.

2.2.3 Project Cost

The actual project cost was 55.7% of the original cost.

Planned	Actual
12,117 million yen (including Japanese ODA Loan of 10,299 million yen) （1PKR=3.71 yen）	6,725 million yen (including Japanese ODA Loan of 6,316 million yen）（1PKR=1.97 yen）

A comparison of project costs between the planned and actual costs is shown below:

Table 2 Comparison of project costs between planned and actual costs

	FC (million yen)			LC (million Rs)			Total（million yen）		
	Planned	Actual	Gap	Planned	Actual	Gap	Planned	Actual	Gap
1. Equipment/ Machinery	3,740	2,578	-1,162	557	342	-215	5,806	3,253	-2,553
2. Civil Work	644	0	-644	670	1,043	373	3,129	2,059	-1,070
Hub WTP	431	0	-431	449	528	79	2,096	1,042	-1,054
Pipri WTP	168	0	-168	174	312	138	815	616	-199
Manghopir PS	45	0	-45	47	203	156	218	401	183
3. Contingency	252	0	-252	96	0	-96	603	0	-603
4. Consulting Service	439	515	76	87	83	-4	763	678	-85
5. Interest during construction	735	735	0	0	0	0	735	735	0
Total	5,810	3,828	-1,982	1,410	1,468	58	11,036	6,725	-4,311

*Excluding tax of 1,080million yen
Exchange rate applied: 1Rs=3.71yen for planned costs, 1Rs=1.97yen for actual costs
（Source）JICA/KWSB

The reasons for the more than 20 % difference between the originally planned and actual costs are as follows:

- Equipment/ Machinery (about 2.5billion yen, 44% reduction): The cost was reduced due to competition among bidders. It is also possible that the quotation at the time of the appraisal was overly high.[5]
- Civil works of Hub Water Treatment Plant (1billion yen, 50% reduction): The cost was reduced due to competition among bidders. The capacity adjustment reduced the volume of work.
- Civil works of Pipri Water Treatment Plant（about 200 million yen, 24% reduction）: The cost was reduced due to competition among bidders. The increased cost in Pakistani rupees due to the capacity adjustment was absorbed by the depreciation of the rupee against the Japanese yen.
- Civil works of Manghopir Pumping Station (about 200 million yen, 84% increase) : The additional construction of staff housing increased the cost.

Since the actual project cost was significantly lower than the original estimate, it

[5]The project cost was estimated based on the unit costs of a similar project supported by the World Bank at the time of appraisal. Equipment and machinery for the treatment plant on which the cost of the project was supplied through direct procurement with UK suppliers.

can be said that the financial resources of the project were utilized efficiently. Although there were several factors which increased the project cost such as changes of the project scope and delay of construction, the financial management of the project was prudent and effective enough to minimize cost escalations.

2.3 Effectiveness (Rating: a)

The project has largely achieved its objectives, therefore its effectiveness is high.

2.3.1 Operation/ Effect Indicator

No targets for operation/effect indicators were set at the time of appraisal. The amount of water supplied/treated water, utilization capacity of the project facilities, and water quality were evaluated as basic operational indicators for water supply projects.

(1) Amount of Water Supplied and Treated

The project increased the amount of treated water by 590,000 ㎥/day against the planned amount of 546,000 ㎥/day. The amounts of supplied and treated water in Karachi, including the project facilities, are summarized below:

Table 3 Amount of water supplied and treated in Karachi

（Unit ：㎥/day）

Indicator	Base Year (1994)	Actual（2006）
Amount of supplied water	1,600,000	2,869,000
Amount of treated water	955,000	2,000,000

（Source）KWSB

(2) Capacity Utilization

There were no meters installed to measure the volume of water supplied to the facilities constructed under the project and thus no data on capacity utilization of the project facilities has been collected. The only data available at the time of the post-evaluation was the water volume pumped from the pumping stations to the water treatment plants between November 2008 and March 2009. In addition, since the amount of raw water supplied to the water treatment plants constructed under the project exceeds their design capacity, these facilities are considered to be fully utilized when the volume of pumped water exceeds the design capacity of the facility. Therefore, this report adopts the following formula as a substitute for a capacity utilization rate:

- If the amount of raw water exceeds the design capacity of the facility, the capacity utilization rate of the facility is100%.
- If the amount of raw water is lower than the design capacity of the facility, the

capacity utilization rate of the facility is calculated as follows:

the amount of raw water/ the design capacity of the facility×100

Average capacity utilization rates between November 2008 and March 2009 based on the above formula are shown below:

Table 4 Capacity Utilization Rate[6]

	Design Capacity	Average amount of raw water supply	Capacity Utilization Rate
Pipri WTP	227,000 ㎥/day	604,000 ㎥/day	100%
Hub WTP	364,000 ㎥/day	453,000 ㎥/day	109%
Manghopir PS	477,000 ㎥/day	453,000 ㎥/day	94%

（Source）KWSB

The capacity utilization rates for the Manghopir pumping station were low only in March when the main canal from the Hub Dam was closed for cleaning and the raw water supply was reduced. The capacity utilization rates for the Pipri and Hub water treatment plants exceeding 100 % in actuality suggests that these facilities are fully utilized.

(3) Water Quality

There was no target indicator for water quality at the time of appraisal. The average water quality at water treatment plants in Karachi between November 2008 and January 2009 is shown below.

Table 5 Quality of treated water at water treatment plants in Karachi

	Indus (including Pipri)		Hub		WHO standard	
	Min.	Max.	Min.	Max.	Min.	Max.
Turbidity (NTU)	1	1	1.7	2.5	5	10
Color (TCU)	2	2	4	6.3	10	20
PH	7.6	7.6	7.7	8.1	7	8.5
Chloride (mg/l)	40	42	72	82	200	250
Alkalinity (mg/l)	100	102	107	115	200	250
Total Solid (mg/l)	270	280	280	297	200	1500

[6] Although the design capacity of the Hub water treatment plant is 364,000 ㎥/day, the treatment of 400,000 ㎥/day was approved by the technical authority, including project consultants. Therefore, the maximum utilization rate at Hub is 109%.

Hardness (mg/l)	120	125	73	84	--	250

（Source）KWSB

Water quality at treatment plants satisfied the WHO standards, which are used as criteria by KWSB. KWSB conducts regular water quality checks at treatment plants and several points within the distribution network, so that it can take necessary measures whenever it detects any irregularities in water quality.

However, the shortage of chemicals which are necessary for water treatment due to the lack of budget is a serious concern. Owing to the improvement of raw water quality due to canal lining and other reasons, there have been no obvious problems to date. Nevertheless, there is a risk that the sudden deterioration of water quality may not be treated well.

2.3.2 Results of Financial Internal Rate of Return (FIRR)[7]

Financial Internal Rate of Return (FIRR) was recalculated at 12.33% against 10.77% at the time of appraisal[8]. However, if it is calculated to include salaries and electricity, which were not taken into account at the time of appraisal, the FIRRs become 9.98% at the time of appraisal and 5.58% at the time of post-evaluation. The latter post-evaluation FIRR decreased because of increasing electricity expenditures and salaries in recent years.

However, as the water charge revenue assumed as profit is not considered additional revenue produced by the project, even the recalculated FIRR including salaries and electricity cannot be accurate.

2.3.3 Qualitative Effect

The beneficiary survey was conducted to investigate users' satisfaction with water quality[9]. The survey consists of an interview for industrial users and a questionnaire

[7] Economic Internal Rate of Return (EIRR) was not calculated since it was considered difficult to calculate improvement of public health or prevention of water-born diseases, which were defined as economic benefits for the project.

[8] The benefit, cost and project life adopted for FIRR at the time of appraisal are as follows:

① Benefit: Relative percentage of water subject to quality improvement by the project to the overall water charge revenue of KWSB. Unaccounted-for water rate was 30%。

② Cost: Construction works, consulting services, annual operation and maintenance costs. The appraisal document did not specify the breakdown of operation and maintenance costs. However, the project documents from the Pakistani government with details of operation and maintenance costs showed that the amount specified in the appraisal documents for operation and maintenance corresponds to the sum for maintenance and chemicals costs in the project documents.

③ Project life : 30 years

[9] The accurate number of beneficiaries of the project is unknown. It is estimated that around 3.77 million people have been benefited from the project if the beneficiaries are defined as population with water main connections in the distribution areas of the project facilities as a relative percentage of water supplied from

survey for retail users.

(1) Interview of Industrial users

Interviews were conducted for six industrial users, three each in the distribution areas of the Pipri and Hub water treatment plants[10].

All users interviewed acknowledged the improvement of water quality after 2006. The outcome of water quality tests conducted by one user clearly showed that the water supplied to the company was suitable for drinking. Most of these companies install their own treatment facilities since the quality of water has a significant impact on the quality of their products. They noted that the improvement of water quality had a positive impact on their operations since it eased the burden on their treatment facilities and reduced the chances of water quality–related damage and the cost of operations.

The interviews with industrial users showed a clear recognition of the improvement of water quality compared with the perception before 2006. Since illegal tap-ins into the distribution system for industrial users are not as easy as those for retail users, there is less possibility for contamination within the distribution system. This enabled users to realize the benefit of the project more directly.

(2) Questionnaire Survey for Retail Users

Various documents suggest that the supplied water in Karachi is contaminated by ground water and nearby sewerage pipes due to the negative pipe pressure. Therefore, the area which is less affected by the negative pressure was selected for the questionnaire survey in order to exclude those factors other than the effects of the project influencing the perception of beneficiaries[11].

The outcome of the questionnaire survey does not show any clear recognition of the improvement of water quality as 147 persons (52.5%) answered that the water quality 'improved', while 133 persons (47.5%) answered that there was no change or water quality had worsened.

This unclear recognition may be because of factors such as contamination of storage tanks within the residential premises, deterioration of distribution pipes, and illegal tap-ins into the distribution network which prevent the supplied water from keeping its level of quality from the treatment plant to the end-user level. In addition,

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the project facilities to the total amount of water supplied to the areas.

[10] The users were selected in consultation with KWSB, on the basis of their water usage and the importance of water quality in their operation. The six users selected are two textile companies, one oil refinery, one pharmaceutical company, one beverage and one ceramic company.

[11] Based on the advice from KWSB, 280 households were selected in Landhi Town, Korangi Town, Malir Town, SITE Town, Baldia Town, and Sargani, and they were interviewed using a standardized questionnaire.

chronic water shortages and general mistrust among end-consumers towards KWSB[12] may also make it difficult to accurately assess the perception of consumers regarding water quality.

2.4 Impact

The project site is located far from the Karachi city center, and it has neither a major human settlement nor natural environment which is sensitive to development works. In addition, most of the project works were extensions of existing facilities and thus did not involve additional land acquisition, resettlement and major construction works.

The impact of the improvement of water quality due to the improvement of public health as well as the living environment was surveyed by the questionnaire described above. However, the survey showed no clear indication of the impact of the project[13]. It is not realistic to expect an impact, such as improvement of water quality at the end-user level and associated improvement of public health and living environment by the project without any improvement of the distribution network.

2.5 Sustainability (Rating: c)

Some problems have been observed in terms of the low financial sustainability of KWSB, therefore sustainability of the project is low.

2.5.1 Executing Agency

2.5.1.1 Structural Aspects of Operational and Maintenance

The Electrical and Mechanical department of KWSB is in charge of the daily operation and maintenance of the project facilities. Allocation of staffs at the project facilities is shown in the table below.

Table 6 Allocation of staffs at the project facilities

	Before Project	Proposed at appraisal[1]	Present situation
Pipri WTP	N.A	97	272[*2](50)
Hub WTP	N.A	131	50

[12] A Citizen Report Card on Water and Sewerage Services in Karachi conducted as a part of the Water Support Program supported by the World Bank indicated that the average satisfaction with drinking water distribution among households obtaining water through main lines was 6.74 out of 10. But it is reduced to 3.93 among households obtaining water outside the household.

[13] For instance, as for the question asking the frequency that interviewees suffer from water-borne diseases, such as diarrhea, typhoid, hepatitis and cholera, 125 persons (45%) replied 'reduced', while 155 persons (55%) replied 'no change/ increased'. For the question on the workload for obtaining safe water, 79 persons (28%) replied 'reduced', while 172 person（62%）replied 'no change' and 29 persons (10%) answered 'increased'.

Manghopir PS	N.A		101*2 (50)

（Source）KWSB

*1：It is not clear if this number includes staff for old facilities.

*2：Including those who work for non-project facilities. The number of staffs for the project facilities is 50.

All the project facilities are extensions of old facilities,[14] and the exact number of staffs for the project facilities could not be obtained. However, if the number of staffs proposed at the time of appraisal includes those staffs for old facilities, the present number of staffs at all the facilities is larger than that of proposed at the time of appraisal. There may be a possibility of overstaffing. The number of staffs at the project facilities is relatively large compared with other water treatment plant in Pakistan[15]. As there are several indications of political appointments at KWSB, the appointment of staff is considered to lack transparency.

2.5.1.2 Technical Aspects of Operation and Maintenance

Training sessions were organized by the equipment/machinery suppliers during the test operation of the project facilities and all staffs could join. However, since these sessions were conducted by foreigners in English, those who could not understand English did not always participate in them. No other training was provided to the staffs.

There have been no major accidents at the project facilities to date and all the facilities are in good operating condition. Nevertheless, additional efforts may be required to improve their operations and strengthen the staff capacity through basic data collection on operation and maintenance and the development of a mechanism to constantly improve the operation system.

2.5.1.3 Financial Aspects of Operation and Maintenance

Table 7 shows the financial situation of KWSB at the time of appraisal as well as for the last five fiscal years. Although the financial balance at the time of appraisal shows a surplus, huge losses have been recorded in the past five years. The reasons are two-fold:

① The Sindh Local Government Ordinance (SLGO) 2001 removed KWSB from the Government of Sindh and transferred it to one department of the City District Government of Karachi (CDGK). As a result, the subsidy from the Sindh Government, which had constituted an important part of revenue for KWSB, was abolished. CDGK is obliged to allocate 2% of its revenues to KWSB for its operating budget. However, it has not made any allocation to date.

② The increase of revenues from water charges could not keep up with the increase

[14] Only a reservoir had existed before the project.

[15] Kanpur water treatment plant in Islamabad has 0.4 staffs per 4,546 ㎥/day. Hub and Pipri treatment plants have 0.6 and 1.0 staffs per 4,546 ㎥/day in the project.

of expenditures, which rapidly increased due to the recent expansion of water supply. More in-depth analysis of KWSB's financial balance is shown below.

Table 7 Financial Balance of KWSB

(Million Rupees)

	93/94*1	01/02	02/03	03/04	04/05	05/06
Total Revenue	1,501	2,456	2,311	2,355	2,519	2,985
Income from water	1,075	2,405	2,272	2,331	2,232	2,664
Subsidy	366	0	0	0	0	0
Total Expenditure	1,046	3,296	3,820	3,689	3,745	3,999
Operational Balance	455	-840	-1,509	-1,334	-1,226	-1,014
Financial Charges	245	1,190	1,183	1,183	1,183	1,183
Total Balance	210	-2,030	-2,692	-2,517	-2,409	-2,197

(Source) KWSB

*1: Including sewerage

The table below shows the trends of major expenditure items:

Table 8 Trends of expenditures

(million Rs.)

	93/94*1	01/02	02/03	03/04	04/05	05/06	06/07*2
Total expenditure	1,046	3,296	3,820	3,689	3,745	3,999	3,375
Salaries	461	632	773	819	874	1,038	1,130
Electricity*3	300	1,232	1,368	1,621	1,641	1,687	500
Maintenance	243	134	108	185	161	237	618
Chemicals	12	24	29	16	29	27	63
Fuels	NA	60	62	39	45	54	54

(Source) KWSB

*1: No data for O&M. Data for 'Others' is indicated.

*2: Draft as of 16 March 2009

*3: Excludes arrears

Except for fiscal year 2006/07, salaries and electricity charges account for about 60% of total expenditures. Salary expenditures greatly increased in 2005/06 due to the revision of staff salaries. In 2008, unconfirmed information suggests that 6,000 staffs were newly hired[16]. If it is true, the salary expenditures may go up further.

Since the revenues from water charges have not been sufficient to cover all the expenses, there are accumulated arrears of electricity payments. In addition, the reduction

[16] There were multiple accounts on this issue. However, no written documents were obtained to prove various allegations. It has also been suggested that these staffs were politically appointed and some were appointed as engineers even though they did not have relevant qualifications.

of budgets for chemicals and fuels may impact on the smooth operation of facilities. In particular, although the need for chemicals increased after the start of the operation of project facilities in 2006/07, the actual budget allocation for chemicals has not been increased as required due to the financial crisis. This may have a negative impact on the smooth operation of the facilities.

The main factors leading to stagnated water charge revenues are the obsolete tariff structure and low recovery rates. Although the Government of Sindh approved a 9% annual increase of the water tariff in 2001, the decision has not been implemented. KWSB is planning to implement an accumulated 63%（9%×7 years）increase in the water tariff from 2009/10. In addition, it is also trying to install meters for bulk users, who account for 60% of total water charge revenues, to detect illegal tap-ins in order to improve recovery rates. Furthermore, KWSB has started discussions on a comprehensive tariff reform, which would enable KWSB to cover both investment and operation/maintenance costs.

Although the efforts for improving revenues are commendable, improving the financial situation requires not only improving recovery rates, but also strengthening the institutional capacity of KWSB, including human resources and operational efficiencies. Aiming for the sustainable operation of KWSB, the Study on Water Supply and Sewerage System in Karachi (July 2008), assisted by JICA, proposes institutional reforms consisting of the following components:

- Formulation of a business plan with a clear strategy, targets and indicators
- Separations of bulk and retail supplies and zone-wise management of retail supply
- Introduction of a volume-based tariff structure with the installation of meters
- Reduction of illegal tap-ins and water loss
- Implementation of a plan for the improvement of the distribution network to put KWSB on a financially sustainable footing
- Improvement of customer relations
- Introduction of equitable career progression and promotion based on merit
- Introduction of a formal policy and system for staff training

KWSB fully understands the needs for comprehensive reform and has taken several steps to implement the recommendations given by the JICA study, such as the setting up of a special committee. However, its efforts have not produced any concrete action plans, and the necessary coordination for the reforms involving the City Government of Karachi and Provincial Government of Sindh have yet to be made.

Since no clear direction for outcomes has been made for KWSB's institutional reforms, the sustainability of the project is considered unsatisfactory.

2.5.2 Current Status of Operation and Maintenance

The project facilities are operated and maintained based on the operation manuals provided by the suppliers. The facilities are in good conditions.

However, there was a case where the non-availability of an original part on the local market resulted in the delay of repairs when a mechanical part in the Manghorpir pumping station was damaged due to silt included in the raw water. The concerned part was manufactured locally due to the non-availability of foreign exchange for procuring the part on the international market. Since it is not possible to avoid silt mixing with raw water, similar damage can happen again. The difficulty of obtaining original parts due to a shortage of foreign exchange may hamper smooth operations. In addition, the lack of budget may also disrupt smooth operations by hampering procurement of necessary chemicals and fuel for generators.

Lack of budget is a serious concern since it affects various aspects of operation, including the procurement of chemicals, fuel and spare parts.

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

The relevance as well as the effectiveness of the project is highly satisfactory while the efficiency is satisfactory. However, there are several concerns about the sustainability of the project. In light of the above, this project is evaluated to be fairly satisfactory.

3.2 Lessons Learned

- Since the project separated the contract for equipment/machinery from that for civil works, the specifications for facilities to be constructed were decided by the supplier of the equipment/machinery. Therefore, the civil work contractors had to be selected after the equipment/machinery supplier was selected and the said supplier developed the specifications of the facilities. However, the original schedule assumed the equipment/machinery supplier and the civil work contractors would be selected in parallel. The unrealistic implementation schedule, which did not include the 20 months normally required for selecting an equipment/machinery supplier, became the major reason for the delay of the project. An implementation schedule should be formulated carefully taking into account the relation of the procurement package with construction procedures and the implementation schedule.

- The project separated the contract for equipment/ machinery from that for civil works to ensure efficient project supervision by the implementing agency and competition among bidders for civil works. However, this procurement method caused the delay in implementation since 1) the tendering process took longer since the specifications for the civil works were not decided until after the equipment/machinery supplier was selected; 2) implementation took longer since the project required extra time for mobilization and demobilization between the stage of the project handled by the equipment/machinery supplier and that by the civil work contractors. On the other hand, although the project cost was lowered, selecting a contractor with low financial capacity caused further delays. As KWSB has already done for the projects, the procurement package should not be separated between equipment/machinery and civil works for a project whose specifications for facilities to be constructed change depending on the equipment/ machinery supplied.
- The project cost and implementation schedule of the project were not carefully estimated and examined at the time of appraisal. It may be preferable to double check these elements from technical and financial viewpoints at the time of appraisal.
- In this project, there was a case where the non-availability of an original part on the local market due to a shortage of foreign exchange. Possibility and readiness of procured parts should be considered when selecting suppliers.

3.3 Recommendations

＜For the Executing Agency＞

- The project facilities have been put under the unusual circumstances where the treatment plants are being supplied with raw water exceeding their capacities. Although the priority is given to expanding the volume of water supply, the augmentation of water treatment capacity should also be considered in parallel with other urgent issues.
- In order to ensure the efficient and effective operation of the project facilities, recruitment and promotion procedures for human resources should be transparent, and the technical level of staffs should be upgraded through effective mechanisms for technical transfer.
- The effectiveness of the project will not be apparent if the water polluting factors at the end-user level, such as defects and deteriorations within the distribution network and illegal tap-ins, remain unsolved. Improving the distribution network as well as raising consumer awareness of appropriate water handling should be promoted. Since the chronic water shortages and lack of confidence in KWSB are the part of the reason consumers are engaged in the illegal tap-ins, attempts should be made to win

consumer confidence in KWSB through continuous efforts and long-term engagement.

- Lack of financial sustainability does have a serious impact on the smooth operation of project facilities such as by causing shortages of necessary chemicals and fuels. In order to increase revenue from water charges, consolidated efforts, including the planned tariff reform, improving tariff recovery and installation of meters necessary for introducing the volume-based tariff structure, should be implemented properly.
- In order to ensure the sustainability of project effectiveness in the long term, the planned institutional reform should be carried out with strong commitment as well as ownership at the top level of KWSB.

＜For JICA＞

None.

Comparison of original and actual project scope

Item	Original	Actual
(1)Project Output	＜Pipri water treatment plant＞ ・ Dosing Facility (before filtration): acid, alum ・ 6 Filters ・ Backwashing system ・ Wash water recovery system ・ Chemical storage facilities ・ Staff housing ・ Other related works ＜Hub water treatment plant＞ ・ Distribution chamber ・ Dosing Facility (before filtration): chlorine, acid and alum ・ 20 Filters ・ Backwashing system ・ Dosing Facility (after filtration): chlorine, lime ・ Wash water recovery system ・ Chemical storage facilities ・ Administration building ・ Laboratory equipment ・ Staff housing ・ Other related works ＜Manghopir pumping station＞ ・ Inlet Works and Screen Chamber ・ Pump house, Bar and Bank screens ・ 5 Pumps -capacity 159,000 ㎥/day each ＜Consulting service> ・International :124MM ・Local :226MM	＜Pipri water treatment plant＞ ・ Dosing Facility (before filtration): acid, alum ・ 10 Filters ・ Backwashing system ・ Wash water recovery system ・ Chemical storage facilities ・ Other related works ・ Treated water forwarding pumping system ＜Hub water treatment plant＞ ・ Distribution chamber ・ Dosing Facility (before filtration): chlorine, acid and alum ・ 16 Filters ・ Backwashing system ・ Dosing Facility (after filtration): chlorine, lime ・ Wash water recovery system ・ Chemical storage facilities ・ Administration building ・ Laboratory equipment ・ Other related works ＜Manghopir pumping station＞ ・ Inlet Works and Screen Chamber ・ Pump house, Bar and Bank screens ・ 6 Pumps - capacity 4x: 159,000 ㎥/day, 2 x: 57,000 ㎥/day ＜Consulting service> ・International :299MM ・Local :974MM
(2) Project Period	November 1994 ～September 1999 （58 months）	November 1994 ～June 2006 （139months）
(3)Project Cost Foreign Currency Local Currency Total ODA loan portion Exchange Rate	 5,811 million yen 6,360 million yen （1,7000 million PKR） 12,117 million yen 10,299 million yen 1PKR＝3.71 yen （As of February 1994）	 3,828 million yen 2,897 million yen （1,468 million PKR） 6,725 million yen 6,316 million yen 1PKR＝1.97 yen （ Average between Nov. 1994 and Aug. 2006）