Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No. 4327-PAK

STAFF APPRAISAL REPORT

PAKISTAN

KARACHI WATER SUPPLY PROJECT

May 2, 1983

Urban and Water Supply Division
South Asia Projects Department

PAKISTAN

KARACHI WATER SUPPLY PROJECT

Currency Equivalents

Currency Unit = Rupee (Rs)
Rs 1.00 = US$0.077
US$ 1.00 = Rs13.0

MEASURES AND EQUIVALENTS

mm	=	millimeter (1 millimeter = 0.039 inches)
m	=	meter (1 meter = 3.28 feet)
km	=	kilometer (1 kilometer = 0.62 miles)
km2	=	1 square km (km2 = 0.386 square miles)
ha	=	hectare (2.47 acres = 10,000 square meters)
G	=	Imperial gallon (Imperial gallon = 1.2 US gallons = 4.55 liter
MGD	=	Million Gallons Per Day (MGD = 4,545 m3/day)
gcd	=	Gallons per capita per day (gcd = 4.55 liters per capita per day (lcd))

PRINCIPAL ABBREVIATIONS AND ACRONYMS

ADB	=	Asian Development Bank
ADP	=	Annual Development Program
ARV	=	Annual Rental Value
GOP	=	Government of Pakistan
GOS	=	Government of Sind
IDB	=	Islamic Development Bank
KMC	=	Karachi Metropolitan Corporation
KWMB	=	Karachi Water Management Board
KJWB	=	Karachi Joint Water Board
KWSB	=	Karachi Water and Sewerage Board
KDA	=	Karachi Development Authority
SIDA	=	Swedish International Development Authority
USAID	=	United States Agency for International Development
UNICEF	=	United Nations International Childrens' Emergency Fund
WASA	=	Lahore Water and Sanitation Agency
WAPDA	=	Water and Power Development Authority

FISCAL YEAR

July 1 - June 30

This report is based on the findings of an appraisal mission to Pakistan in January 1982 consisting of Messrs. R. MacWilliam (Senior Sanitary Engineer) R. C. Mitchell (Senior Financial Analyst), and J. Creasor (Financial Analyst) and a follow-up mission in November 1982 comprising Messrs. R. MacWilliam and D. Graham (Senior Financial Analyst).

PAKISTAN

KARACHI WATER SUPPLY PROJECT

Table of Contents

List of Annexes

Map

CHAPTER I

THE WATER SUPPLY AND SEWERAGE SECTOR

Background

1.01 Pakistan, with an area of about 800,000 km2, had a population of about 87 million at mid 1982. Some 93% of the population live in the four main provinces of the Punjab, Sind, North West Frontier and Baluchistan with 20 million in the province of Sind where the proposed project is located. The general population growth rate during the decade 1971-81 has been somewhat less than 3% per annum while the urban rate of growth has averaged about 4.5% per annum.

1.02 The country terrain includes the western offshoots of the spectacular Himalaya mountains, the Baluchistan plateau and dry coastal areas with the densely populated Indus plain forming a central spine made fertile by irrigation water from the Indus River and its tributaries; the climate is semi-arid and with an average annual rainfall of less than 250 mm. The Indus, one of the world's great rivers, with a catchment area of 950,000 km2 and a length of 3,200 km, is dammed in its upper reaches by the huge earth dam at Tarbela and on the Jhelum River, a branch of the Indus system, by the high dam at Mangla. These impoundments, in addition to producing energy, are regulating discharges for the benefit of agriculture, industry and the potable water supply needs of a large segment of Pakistan's rural and urban population.

1.03 In essence the provision of water supply and sanitation service is regarded primarily as a local function, administered and controlled through budgetary provisions determined at the level of the Provincial Governments within the framework of a central national planning policy. The idea of planned economic development in Pakistan began with the formulation of a Six Year Development Program (1951-57) followed by subsequent planning periods; the current Five Year Plan is for the period 1978-83. To administer, among other things, the water and sanitation portion of the Plan, institutional improvements have been made, over a period of time; these include the establishment of separate Housing and Physical Planning Departments in the Governments of the Punjab, Sind, Baluchistan and North West Frontier Province while at the Federal level a separate Ministry of Housing and Works was created with a new division responsible for the Environment and Urban Affairs.

1.04 In each province water supply and sanitation projects are constructed through the efforts of one or more of the following: (a) Public Health Engineering Department (PHED); (b) Public Works Department; (c) Local Government Work Agencies; (d) Municipal Committees and, in the case of large cities, by Development Authorities. Completed schemes are handed over to local governments held responsible for their operation and maintenance except

in the larger cities such as Karachi, Lahore, Peshawar, Multan, Faisalabad, Hyderabad and Islamabad where autonomous authorities have overall responsibility for building and operating the systems.

1.05 Development of the water supply and sewerage sector is strongly influenced by allocations from the provincial annual development program (ADP). Presently the provincial governments are empowered to sanction local schemes through their own Provincial Working Parties up to a value of 20 million rupees (about US$1.5 million). Above this figure schemes must be sent to the Federal Government (GOP) for processing through a Central Development Working Party (CDWP) and the Executive Committee of the National Economic Council (ECNEC). The problems of obtaining sufficient support funding for the sector from federal and provincal levels are compounded by inadequate user cost recovery to pay for operating the systems, quite apart from the need to generate funds for necessary expansions. These difficulties are recognized and were fully discussed at a National Conference on Drinking Water Supply held in Islamabad in November 1981 in connection with the International Water Decade.

Water Resources and Sewerage

1.06 As a semi arid country, Pakistan depends on the Indus River system for its growth and sustenance. The river provides surface water for direct abstractions and, through normal infiltration, recharges a large portion of the underground aquifers from which water is drawn for irrigation and potable use. In general, the underground sources near natural water courses and surface irrigation areas are of good quality except in coastal regions where wells can be brackish and unsuitable for drinking. Lahore, for example, Pakistan's second largest city, situated on the southeast bank of the Ravi River, with about three million inhabitants, depends entirely on tubewells for its supplies; the water table in this area is about 15 feet below ground surface. Throughout the rural areas canals, shallow wells and tubewells are relied on for drinking water.

1.07 Most of Pakistan's large urban communities, where a comprehensive water supply system is in operation, are publicly sewered in some fashion, or else individual properties are served by septic tanks or soakaways. Where there is no flush system, sanitation is by pit latrines and soakways; in rural areas the latter or more informal sanitation measures are used. The installation of sewage plants to treat domestic effluents has lagged the provision of the sewer networks resulting in many of the receiving rivers and drainage canals becoming malodorous and foul. Efforts are being made to deal with the situation in some of the urban centers, planning and design of projects is continuing in others, but, usually, the problem is one of priorities and the allocation of funds; understandably the collection and removal of sewage to some point of discharge is considered more important than treatment from the health and nuisance point of view.

1.08 The situation with regard to liquid industrial wastes is also a problem. Many of these effluents are corrosive or toxic and are not allowed into the public sewers because of the structural damage they cause; a further reason for their exclusion is that, without pre-treatment they could inhibit the normal biological purification process which occurs when domestic sewage is subjected to even simple forms of treatment. As elsewhere, manufacturers are reluctant to add to their production costs by treating spent wastes and therefore dispose of them by the easiest, most convenient method possible without much regard for the environment. However, this situation is not peculiar to Pakistan and is one that must be tackled in a phased coordinated approach which avoids arbitrarily setting discharge standards unattainable at reasonable cost. So far as Karachi is concerned, the authorities are aware of the difficulties, and various proposals have been formulated, the implementation of which will be governed by availability of funds.

Served Population

1.09 A WHO mission visited Pakistan in November 1981 and prepared a sector report which was submitted to GOP in late 1982 and is under review. This report up-dates sector information and reviews possible strategies and objectives. The service coverage is indicated below; coverage proposed for 1990 by WHO in the sector report is indicated in brackets.

Sub Sector	1981 Population (Millions)	Population Served	Percent Served
Urban Water Supply	24.7	17.3	70 (100)
Rural Water Supply	62.3	12.2	20 (66)
Totals/Average	87.0	29.5	34
	=====	=====	==
Urban Sewerage	24.7	10.4	42 (58)
Rural Sanitation	62.3	1.1	2 (13)
Totals/Average	87.0	11.5	13.0
	====	====	====

1.10 The level of rural water supply service includes public hand pump service which accounts for about 50% of the total coverage. The remainder of the rural population and, to a much lesser extent, the urban dwellers obtain supplies from privately installed hand pumps, rivers, canals, dug wells and ponds, many of which are, to some extent, polluted. However, even between provinces and other areas there are considerable differences in current coverage as illustrated below:

Province	Percentage Covered			
	Water Supply		Sewerage/Sanitation	
	Urban	Rural	Urban	Rural
Sind	83	13	49	2
Punjab	60	18	43	1
North West Frontier	51	22	10	-
Baluchistan	87	13	7	-
Kashmir/Northern Areas	48	20	10	-
Federally Administered Areas*	95	25	91	-

* Includes the capital area.

The Pakistan authorities are committed to improving these percentages, particularly in the rural areas where the water supply coverage has fallen behind other developing countries. In conjunction with the recent population census, a housing census was carried out in November 1981 which is expected to provide more complete information on the type of water supply, sanitation facilities and the methods of waste disposal.

1.11 Stemming from decisions taken at the Decade Conference, referred to in para. 1.05, it is proposed by WHO in 1990 to increase water supply coverage from present levels to 100% in the urban areas and 66% in the rural areas; for sewerage and sanitation the figures would be increased to 58% and 13%, respectively. These are ambitious targets and if achieved would provide public water service to an additional 58 million and sanitation to another 29 million inhabitants. This target would imply increasing the water and sanitation share of the public sector budget to 5% from the current level of 3.4% and assumes about 30% (US$400 million) of the funding requirements will be available from external sources to cover mainly foreign exchange. The total investment over the period is estimated at Rs 14,300 million of which Rs 10,000 million is expected to be generated internally; this would include resources provided in the federal and provincial development plans and, increasingly, through cash raised by the local councils and development authorities. The water supply service level proposed in the urban areas is a house connection to standpost ratio of 60:40. For the rural areas 70% of the proposed coverage is to be by 260,000 additional hand pumps and 30% by pumped tubewells and reservoirs to provide 10-15 gallons per capita/day for consumers with house connections and somewhat less by standposts serving between 60 to 200 persons; rural piped water supplies would be limited to settlements of 2000-5000 population. These standards are appropriate and reasonable but, if they are to be achieved, will entail a concentrated technical effort, together with a determined approach to funding and operating the investments emphasizing increased community self reliance.

Constraints to Sector Development

1.12 Apart from a general scarcity of trained personnel and professional support staff, the main draw-back to sector development is a shortfall of funds for new construction coupled with the foreign exchange required for goods and materials not available in Pakistan; imported components include construction equipment, pumps, electrical units and controls, steel for fabrication, jointing materials and a variety of special equipment. A number of agencies have been providing assistance to the sector including USAID, UNICEF, WHO, UNDP, the Asian Development Bank and, more recently, help has been sought from the Islamic Development Bank (IDB). The bulk of the investment aid goes to the principal urban centers where the problems are acute and the inhabitants are more vocal and organized in making their demands known.

1.13 As previously stated (para. 1.05), the GOP exercises control of major expenditure in the sector through a well regulated approval procedure which involves the preparation of a Project Concept document called a PC1; among other things, this document provides a description of the project, a detailed cost estimate, including the need for foreign exchange, its operating costs and a budgetary justification. The process is time consuming but seen as necessary because the demands of the public sector far outstrip the resources available to meet them. In addition, there has been a growing perception that the urban communities consume a disproportionate share of these resources at the expense of the rural population and, as a consequence, more stress is now being placed on the need for full cost recovery beginning with the beneficiaries of the urban facilities. This will not be easy as operational control of the systems is sometimes fragmented, financial discipline weak, billing and collection poor and tariffs low, from which consumers will need to be weaned. A recent survey showed that the combined deficits of the cities of Karachi, Lahore, Rawalpindi, Islamabad, Faisalabad and Multan amounted to about Rs 121 million annually, equal to some 38% of their expenditures.

1.14 The current budget process centrally allocates funds to provincial governments in plan periods for specific purposes and projects, including provision for any required foreign exchange which may only later be secured. Problems in obtaining foreign exchange often delay project implementation and further exacerbate the water deficit situation. Presently, only the city of Lahore enjoys a 24 hour per day supply; the others mentioned in para. 1.13 receive water over periods ranging from 4 to 8 hours per day.

1.15 As a result of the Water Decade planning activities in Pakistan, a number of proposals were framed to help accelerate and improve sector development viz. (i) local involvement in the project planning stage with a selection of options according to available resources; (ii) the formulation of a fully representative action committee to co-ordinate the national development program; (iii) local authorities to share in the capital funding

of projects commensurate with their financial condition and not on the basis of a fixed contribution as at present; (iv) a review of the sales tax and duties on imported goods with a view to seeking appropriate reductions; (v) incentives to encourage local manufacture of goods now imported for use in the sector combined with standardization and quality control measures; (vi) the establishment of national quality standards for potable water; (vii) programs to impart training to tradesmen in vocational schools; (viii) promotion of pollution control legislation and, finally, a follow-up Conference every two years to monitor progress and review plans.

Government's Sectoral Approach

1.16 The GOP is anxious that equitable and effective use be made of all available funds throughout the sector and is striving for an even handed approach. In this effort it is encouraging local participation in the decision making process particularly where there are conflicting priorities between, and within, sectors and choices must be made against a background of scarcity. The choices are extremely difficult and while water supply and sanitation are a high priority, there are equal or more pressing demands for shelter, food, health care and education. It is for this reason that Government looks to the provincial authorities to make the initial judgement on priorities.

1.17 Until now GOP has been looked upon as the safety net for meeting financing gaps either for investment or operations but, more and more, it is seeking to discourage this attitude. Instead this is viewed as work for the provincial governments who are being encouraged to wield stricter control over municipal, development authority and local council spending and to promote full cost recovery for services rendered; water and sewerage operations are considered candidates for this approach.

1.18 This approach was started with the IDA assisted project in Lahore, which will be referred to later, and in the approval of the on-going extensions of the water supply system in Karachi made conditional on the responsible authority accepting an operating goal of "no profit, no loss" which required, as a first step, the acceptance of measures to improve operational efficiency and a tariff revision. The GOP takes the view that the urban systems must be operated efficiently and ultimately sustain their own financing requirements leaving subsidy for those least able to pay.

Performance in Previous Bank Operations

1.19 To date there have been two operations in the sector both in Lahore. The first was Credit 106-PAK which in conjunction with the Swedish International Development Authority (SIDA) made a start on institution building, some minor rehabilitation of water and sewerage facilities and prepared a development Master Plan for the city. The credit amounting to US$1.75 million was closed in July 1972, with its objectives met.

1.20 The on-going project in Lahore under Credit 630-PAK totalling US$26.6 million is a follow-up to the first credit and is directed at rehabilitating and substantially expanding the water supply and sewerage facilities in Lahore; the Credit included US$1.6 million for studies which helped prepare an urban project. This latter project, (total cost US$24 million) is being assisted by an IDA credit of US$16.0 million (approved by the Executive Directors on April 19, 1983) to finance 61% of the cost of urban improvements including upgrading the old city, sites and services, solid waste collection and disposal, training and studies.

1.21 Credit 630-PAK, signed June 8, 1976 and declared effective September 26, 1976 is about 80% disbursed. There has been a delay of up to three years in project execution, particularly with construction of the sewerage component because of difficult ground conditions and contractor unfamiliarity with the scope and type of work. The water supply component, however, was completed earlier and through additional tubewells and distribution extensions now provides Lahore with an uninterrupted supply of safe drinking water. A lesser factor also contributing to delays has been the time taken for the Water Supply and Sewerage Agency (WASA) to adjust and become familiar with the Bank's bidding and evaluation procedures. In the initial stages of the project WASA was heavily supported by consultant assistance to help with its execution through funding made available by UNDP but, because of delays in execution, this consultant effort was reduced to construction supervision. WASA is still receiving technical and management assistance from the UK Overseas Development Agency (ODA) for leak detection, stores and accounting. The current closing date of the project is December 1983, an extension of three years from the original date. Resulting from these delays, project costs are expected to be about 45% above the original estimates in current terms.

1.22 Two other important project objectives partially achieved are the institution building goal and the effort to make WASA's operations financially viable. An action plan was prepared by WASA, and reviewed by IDA, in 1982 to improve financial performance. This calls for greater emphasis on efficiency of operation including leak detection, increased domestic metering, follow-up on billing and illegal connections, automation of the tubewell operations, and a stepped series of tariff increases starting in July 1983 to achieve a 3.5% rate of return on revalued net fixed assets by 1986. This plan is now being implemented satisfactorily.

1.23 The Lahore water supply and sewerage project has been valuable in identifying problems and opportunities in the sector and the experience, both for the GOP and the Bank, will be applied in the Karachi project. Despite delays and some minor disappointments, the project is producing positive results both in institutional development and improved service to consumers and has set the framework for future sector operations in Pakistan.

IDA's Objectives for the Sector

1.24 A major objective of the proposed project is to further help the GOP in its efforts to establish in the sector viable, well operated, urban public water supply systems with the possibility of extending this effort to the rural areas. The thrust is to encourage long term planning for future needs and to implement and operate projects on a sound financial basis incorporating increased efficiency of operations and appropriate cost recovery principles. As the largest, and possibly the most prosperous city in Pakistan, Karachi should have been able to operate its public facilities efficiently and profitably to demonstrate to other municipalities the advantages of responsible prudent management but because of divided responsibilities for operations, in the past, this has not been possible. To overcome these difficulties, a new organization, the Karachi Water and Sewerage Board (KWSB), was created to combine operational responsibility for water and sewerage operations (see para 2.06).

1.25 The KWSB's responsiblity for sewerage and sewage disposal in Karachi, in addition to the water supply operation, will take time to absorb and control, and it is expected that this will provide IDA the opportunity for supporting Government's objectives in this subsector through the ongoing association with the water supply project. Until now there is no direct or adequate cost recovery for sewerage service anywhere in Pakistan, a situation which cannot continue indefinitely. In the long run, the cost of providing potable water and disposing of the resulting wastewater must be covered by adequate payment for these services and the KWSB, as the single operator of the facilities, will be able to consolidate billing and establish appropriate levels of cost recovery.

CHAPTER II

PROJECT AREA

General

2.01 Beginning two centuries ago as a small fishing village endowed with a fine natural harbor, Karachi today has grown to a bustling city of about 5.7 million inhabitants. It has excellent port facilities serving Pakistan and the sub-continent and it plays an important role in the East/West shipping trade link. The climate is generally moderate but with periods of high humidity; temperatures can reach 110 F degrees in May and June while in January may drop to 40 F degrees. The city lies in the monsoon belt and generally receives its main rainfall in July and August, with a mean of about 180 mm annually (see Map IBRD 16904R).

2.02 Karachi was the capital of Pakistan until 1959 when the seat of Government was transferred to Islamabad; since that time the population has tripled and continues to grow at about 5% per annum, somewhat greater than

the 4.5% national urban average. The city remains the capital of Sind Province and contains about 29% of the entire provincial population in one million dwellings covering a metropolitan area of 3530 km^2.

2.03 The economy of Karachi is mainly based on trade, industry and commerce. There are over 1800 formal industrial units producing a wide range of goods namely, textiles, paper and cardboard, leather, glass, rubber and plastics, garments, pharmaceuticals, soap, food and beverages, etc; the heavy industry is in shipbuilding, ship wrecking and repairs, steel making, vehicle assembly, electrical goods and machine tools. The city is also a center of learning with two universities (one engineering), five polytechnics, over fifty colleges and more than 2300 primary, middle and high schools. Health care is delivered by some nine hospitals, 56 clinics and about 450 dispensaries.

2.04 The physical characteristic of the area on which the city is built is one of flat topped parallel hills devoid of vegetation, with wide intervening plains between the two dry river beds of the Malir and Lyari rivers; these only flow for short periods of the year and act year round as recipients for the city's wastewater. The highest elevation of the greater city area barely exceeds 80 m above sea level (ASL).

2.05 The predominant impression of the city is of a mixture of fine civic buildings, modern office blocks and hotels, high rise apartments, spacious villas, medium to high density housing developments randomly interspersed with low income or slum type dwellings. It is estimated that about one-third of Karachi's population live in such slum areas known locally as "katchi abadis"; efforts are constantly being made by KDA and KMC to upgrade and regularize these areas and some control is beginning to emerge.

Institutional and Financial Background

2.06 The supply and distribution of water to Karachi has been undertaken by a variety of agencies in the past. The agency made responsible for the first major production expansion of Karachi's water supply system from the Indus river source was the Karachi Joint Water Board (KJWB), formed in 1953. Project execution was later entrusted to the Karachi Development Authority (KDA) and work on the system commenced when this organization was established in 1957 (para 2.12). Distribution and retailing of the treated water was, however, the responsibility of Karachi Metropolitan Corporation (KMC) and some 22 other independent agencies and bulk users (para 6.01). Over the years, division of responsibility for production and distribution proved increasingly difficult to integrate and manage, and it was subsequently decided to form a new authority to operate the entire water supply system and to extend its jurisdiction to include wastewater management. Accordingly, the Karachi Water and Sewerage Board was established on February 1, 1983 to carry out this function (see para 5.02).

2.07 The financial viability of the water supply and distribution entities has for long been precarious, due principally to the reluctance to establish a pricing system that reflected the costs of service provision. Between 1967 and 1981, water tariffs were not revised, being based on outdated annual rental values of properties, and there has never been any cost recovery for sewerage. The agencies concerned were only able to continue operations by means of cross subsidies from municipal taxation and other activities. Since 1981 there have, however, been more concerted efforts to address financial issues, with changes in the tariff structure (para 5.11), increases in tariffs (para 6.13) and, more recently, improvements in billing and collection procedures which are starting to be implemented (paras 5.12-5.15).

Water Supply Sources

2.08 The water supply system of Karachi goes back over many years. It began with the development of wells at Dumlotti, then 20 miles from the city. This source was developed over a period and by 1923 delivered water to three reservoirs at elevations between 20m - 30m ASL, for house to house distribution. Today the yield from this source, still in use, is between 1-3 MGD but improvements are in hand to bring its capacity back to 5 MGD.

2.09 When demand outstripped the Dumlotti availability it became necessary to develop a source from further afield. Thus, a scheme was developed in 1941 to bring potable water to Karachi from a point on the Indus river over 100 miles away. This involved the construction of an artifical lake at Haleji with a capacity, at that time, of 3000 MG to be filled by what was called an inundation canal from the Indus river. From Haleji a 20 MGD conduit and pumping system was built to deliver water to a treatment plant at Gharo from where it was conveyed by gravity to the city in a concrete conduit 34 miles long. At the termination of the conduit the portion of this supply not used en-route is pumped twice to a 10 million gallon (MG) capacity service reservoir at an elevation of 46 m ASL. This system is still in use with the exception of the Haleji lake connection which is virtually abandoned but used about two weeks in the year during maintenance; the lake is now badly silted up and has become a bird sanctuary, although plans are being considered to dredge the accumulated silt and reactivate the reservoir. Presently, Gharo treatment plant receives water from another canal source developed later from Gujjo.

2.10 The phenomenal growth of Karachi since independence in 1947 and its infrastructural demands called for further action and, accordingly, the Government commissioned a consultant study to prepare a Master Plan for the city and a separate study by other consultants to look into and plan for its long-term water supply and sewerage needs. Based on this work a Central Engineering Authority in 1951 prepared a scheme for water supply source development and distribution called the Karachi Bulk Water Supply Scheme. This involved abstraction of 280 MGD in a separate canal system from the

Indus river supplied through the Jam Branch Canal including main line pumping, new filtration capacity and trunk distribution, to be constructed in four phases of 70 MGD each. Today three phases of the main conveyance system are in operation delivering 210 MGD; a substantial portion of the fourth phase conveyance system is also in place and can be readily brought into full operation by duplication of certain pipeworks, pumping and filtration capacity.

2.11 The Karachi water supply system draw-off at Gujjo headworks no longer depends on the general purpose Jam Branch canal but now off-takes from a specially built independent canal with a total capacity of 650 MGD. From this point water is conveyed through a lined canal 10.9 miles long (from which Gharo now draws) to Dhabeji, from where it is pumped in three 72 inch diameter pipes through a combined head of 220 feet to a high level 36 mile long conduit (including siphons) gravitating supplies to filter stations at Pipri, and COD Hills. Just beyond Pipri a tunnel, 7000 feet long driven through the hills, was designed and built for the full development of 280 MGD. After the tunnel the carrying capacity of the system reduces to 140 MGD. From Gujjo to Pipri 14 triple 84 inch diameter siphons were built to carry 210 MGD; the completion of the fourth line of siphons would bring the system to its full capacity of 280 MGD. Recently, a new filtration plant, also drawing on this system through pumping, was commissioned at North East Karachi. Karachi's water supply facilities are illustrated on IBRD Map 16904R.

2.12 It was soon realized that the Indus scheme was a major undertaking requiring a new organizational structure and this led to the creation of the KDA (para 2.06) to execute the project, to plan city growth and to generally regulate and aid orderly development of the city. Several of the Indus project components (filtration, pumping plants, etc.) were supported by substantial amounts of external assistance provided by USAID and the Governments of France and the Federal Republic of Germany. Under Colombo Plan Aid the Australian Government helped set up a pre-stressed concrete pipe factory for the manufacture of pressure pipes used in the system and this continues to make a significant contribution to on-going water supply projects.

2.13 The combined design capacity of the four existing treatment plants is 210 MGD but, due to bottlenecks in the conveyance system and current demands from the recently opened Pasmic steel mill of 10 MGD, their current combined output is about 190 MGD; the ultimate requirement of the steel mill is 22 MGD. Allowing for transmission losses the total available water from the Indus Scheme and Dumlotti is 206 MGD but recently additional supplies of untreated, but disinfected supplies, are being injected into supplies from the new Hub source (described below) by temporary pumping in amounts of up to 24 MGD.

Hub Development

2.14 The rapid growth of north west Karachi made it necessary for the authorities to consider whether the Indus system was the most economic method of supplying water to this area within the context of a proposed dam development on the Hub River for irrigation and potable water use. Using an appropriate discount rate and considering all costs related to chemical use, pumping and capital works, a comparison was made between an expansion of the Pipri treatment facility or a new facility at Mangho Pir supplied from the Hub dam (see IBRD Map 16904R). The consultant established the latter as the most economic solution and of first priority.

2.15 The first phase of this work is about 70% completed with construction of a 100 MGD maximum capacity pumping station from the end of a main supply canal to the site of an 89 MGD treatment plant for which funds are yet to be budgeted. In addition to a twin 66 inch diameter rising main, (the first line is laid), a 15 MG reservoir is being constructed together with trunk mains to connect with existing distribution. A later second phase will include a 6 MG reservoir at Baldia and 15 miles of trunk mains of up to 48 inch diameter. Temporary pumping by 20 submersible pumps will continue until such time as the permanent pumping station is completed. Because of the severe shortage of potable water, the system is delivering only chlorinated water into the Karachi system from this source until such time as local funds can be budgeted for building the treatment plant associated with this system. Water from the Hub source has been tested and found suitable for potable purposes and is now being regularly monitored.

2.16 The Hub dam was completed in 1978/79 and has a "live" capacity of 760,000 acre/ft (207,000 MG). In addition to Karachi (for which 60% of the annual yield is reserved) it reserves water for downstream irrigation on the right and left banks of the river, and for domestic use in Baluchistan. The reservoir has been filling over the past two years and presently holds about 30% of its full capacity filled during a period of poor rainfall. A probability analysis used in conjunction with mass-inflow calculations showed that the possibility of failure to provide the 89 MGD for Karachi would occur once every 75 years, whereas for all water use the return period could be every four years; in such instances domestic water for Karachi would be given priority.

2.17 The Hub is a 46 m high earthen dam 6.5 km long with a catchment area of 8,830 km^2 designed and built solely by Pakistani engineers. The dam, has also been inspected by several international experts who made some recommendations with regard to safety, particularly on monitoring pore pressures and measures to avoid the possibility of shear slippage at certain elevations. Additional gravel is to be placed on the downstream toe and extra monitoring devices have already been installed. As well as the regular inspection of the dam by the responsible project staff, an inspection by a team of top

Pakistani dam engineers from the National Water and Power Development Authority (WAPDA) takes place annually.

Production Availability

2.18 The disposition of the supply sources is indicated below:

Location	MGD Rated Capacity	MGD Actual Production
Gharo Treatment Plant	20	20
Pipri Treatment Plant	50	37.5
North East Karachi Treatment Plant	25	17
COD Hills Treatment Plant	115	116
Dumlotti Wells	5*	3
Hub source (partly constructed)	89	24
Total	304	217.5

* When upgraded.

In addition to the above actuals, about 12.5 MGD+ of untreated Indus water, when turbidity is low, is injected into parts of the trunk system, after Pipri, for a total availability of 230 MGD. The current availability represents a 30% deficit on the estimated maximum daily demand of 327 MGD.

Water Quality and Treatment

2.19 The water drawn from the Indus and Dumlotti sources is of good quality and amenable to treatment; the small amount of well water used from Dumlotti is generally higher in total solids and of lower turbidity than the river water and, with mixing, is suitable for distribution without treatment. The main characteristics of the sources are given below with the overall quality, after treatment, given. The raw water quality of the Hub source is similar to the Indus with low turbidity.

Parameter	Dumlotti	Indus Sources	Quality Of Supply
Color (Hazen Scale)	2-6	35-75	Clear
pH	7.9-8.6	7.9-9.1	7.5-8.4
Turbidity	1-5	3.5-100	5
Chlorides (ppm)	146-320	26-78	20-60
Alkalinity (ppm)	100-560	113-148	78-150
Total Solids (ppm)	270-560	140-340	130-250
Coliforms (MPN/100 ml)	150-1800	250-1800	0-3

* ppm: parts per million.
ml: milliliters.
MPN: most probable number.

The treated water put into supply is thus of good drinking water quality free from excessive levels of iron, zinc, lead, manganese, copper or other potentially harmful substances, properly disinfected with residual chlorine levels varying from 1-2 ppm. Treatment is carried out in conventional plants i.e., primary sedimentation, chemically assisted, followed by rapid gravity filtration with pH adjustment and chlorination; the plants are of different designs, depending on the period constructed, but operate on similar principles.

2.20 For about ten months of the year, outside the main monsoons, little or no chemicals are used in the primary clarification process as the river supply is less turbid and further settlement of suspended material occurs in the long supply canals which require regular desilting. The standard of maintenance and operation of all treatment plants is excellent, including the first units built at Gharo about 40 years ago. Fully equipped laboratories are installed at each plant and quality control is exercised by trained qualified staff maintaining a continuous record of the results. Unfortunately, because daily demand generally exceeds productive capacity many of the secondary distribution mains are unpressurized over periods of the supply cycle and contamination frequently occurs by the ingress of polluted groundwater into the system. While no direct correlation can be established between contaminated water and health statistics, the increase in reported cases of dysentary and enteric fever in Karachi from 13.7 per thousand in 1979 to 27.2 per thousand in 1980 (about the same for 1981) may have some significance in this regard.

2.21 Responsibility for water production is now under the control of the KWSB which continues to receive advice and assistance from senior staff of the KDA, the previous operator. The KDA, as a general development agency

operating in the public housing market, appears to have been always able to allocate adequate funds and manpower for effective operation of the filtration plants, main pumping stations and conveyance system, and this is reflected in the high standard of maintenance at the treatment plants. It is also engaged in completing the new supply source from the Hub River and would be entrusted with executing the production enlargement works to be executed under the IDA project on behalf of KWSB.

Distribution

2.22 Karachi's primary distribution system consists of about 150 miles of trunk mains in diameters up to 72 inch, 27 miles of large diameter force mains, six main pumping stations with an installed capacity (including standby) of 330 MGD and 14 boosters. The combined length of the source water transmission canals and conduits used exlusively for Karachi is about 80 miles. It was from this system that KDA acted as the bulk supplier to KMC and other agencies. KDA's billing of metered amounts of bulk supplies were often in dispute and it only received partial payments; out of the total of 116 bulk meters 28, or more, are not working. It may also be noted that of 82 main meters provided through earlier Dutch aid to help overcome this problem only 18 have so far been installed. During negotiations, assurances were obtained that KWSB will undertake a program to check repair and recalibrate existing meters on bulk consumers with faulty meters by June 30, 1984 (see Action Plan para 4.09).

2.23 The secondary distribution consists of over 1920 miles of mains in varying diameters, 42 pumping stations and boosters, house connections numbering about 350,000 and 11,335 community standposts. As mentioned earlier, because demand exceeds production large portions of this system are regularly unpressurized and supplies become polluted. The difficulty of pressurizing mains is aggravated by the fact that nearly all consumers have invested in "on premise" storage both at ground and elevated level, to take advantage of all available water and to regulate their own supplies over each 24 hour period; many have even installed suction devices to draw from the mains when gravity flow conditions persist. This pattern of consumption is not conducive to equitable or economic use of water in a situation of scarcity and, furthermore, individual underground storage units are also a potential source of pollution.

2.24 The city, divided into three main pressure zones - high, medium and low - for management of water delivery, is provided with 78 MG of service reservoir storage and 46 MG of storage at the filter plants which are all close to the supply areas. The adequacy of the total storage of 124 MG and its disposition was examined by the Dutch Consultants, Haskoning, in a study they completed in 1978 and it was concluded that there was some redundancy certainly exacerbated by the present pattern of consumption; this, however, will eventually rectify itself when the gap is narrowed between production and demand. Adopting the consultant's estimate of storing 25% of the maximum

daily demand the existing storage is sufficient until about 1990 when further augmentation might be required. The entire hydraulic balance of the system, using peaking factors of 1.38 and 2 was analyzed by a computer which helped identify the areas where strengthening was necessary, and, more particularly, sections of the system in need of repair or replacement. A component included in this project is for essential repairs or replacement on about 21 km. of the system as part of a long term effort by KWSB to reduce losses and generally improve pressure throughtout the city. In furtherance of this effort, assurances were obtained during negotiations on the implementation of a comprehensive leak detection and repair program on an agreed schedule. KWSB was also asked to agree to the formation of a leak detection cell, which has now been established (see Action Plan para 4.09).

2.25 Some preliminary work on leak detection was done by consultants in 1979 which suggested an average distribution leakage factor of about 20% and somewhat less on the primary system. This percentage seems low compared with similarly sized utility operations and may be explained by the current supply and demand pattern which prevents any significant build up in system pressure; on the other hand, consumers who have acquired regular supplies may have little interest in preventing waste since their premises are unmetered; the consultants put household waste, in some instances, at over 50%, a contributing factor being a non-volume related water tariff.

2.26 It was found that most leaks in the large diameter locally manufactured pre-stressed concrete pipes are at joints where the rubber rings have become misplaced and worn or where concrete has been subject to attack by corrosive soil which exposes the reinforcing steel. With the problem highlighted the KDA and its pipe making section have reviewed with the suppliers of the pipe making equipment what precautions, improvements and modifications to its manufacturing and laying procedures are necessary and are understood to have applied to the GOP for aid to upgrade the factory (see para 2.12).

Other Developments

2.27 Even while plans for expansion of the Hub system continued it was felt necessary to proceed with further measures to bring more water to Karachi from the Indus, the only source from which supplies are available in any quantity. An application was made by KDA to the GOP in 1974 to allocate Karachi 1620 MGD for potable use, based on availability from the Tarbela dam regulation, but never formally agreed to although the request is under study by a Commission. Anticipating the obvious need for more water, and approval to an increase in its current allocation from the Indus, the KDA obtained funds and proceeded with the construction of a new independent Canal of 650 MGD capacity from Lake Kinjher to Gujjo. The financing of this canal and the repayment of the associated debentures is referred to in more detail in para 6.07 of this report. This canal is completed but cannot be fully utilized until a new conveyance system is installed from Gujjo and additional water treatment capacity built. It presently delivers about 35% of its capacity to

Gujjo and under the expansion proposed in this project would operate at 50% of capacity.

2.28 Further development of the next tranche of production from the Indus, however, is now at the stage where it requires comprehensive study to ensure that the most economic solution is found to meet Karachi's long-term water supply needs. Such a study of the water supply alternatives will be carried out to help prepare a suitable development program which may attract external financing. This study has been included as a component in this project. In the past the Dutch Government has provided technical assistance to Pakistan for similar activities and may be willing to do so again; should the GOP obtain such external technical assistance it would be proposed that the allowance for this component be re-allocated to provide additional equipment. Outline terms of reference for the water supply study have been discussed with the authorities and are given in Annex 6. During negotiations, KWSB agreed to recruit consultants for this study by not later than January 31, 1984, to have the study completed within a year and to review the findings with GOS and IDA (see Action Plan para 4.09).

Sewerage

2.29 Karachi is sewered by some 1,025 miles of lateral and secondary sewers with about 130 miles of trunk and rising mains. There are over 160,000 sewer connections, only part of which drain to a system terminating in treatment; much of Karachi's domestic sewage thus finds its way untreated to the most convenient water course. It is estimated that 29% of properties are connected to the main system, 4% to a local system or septic tanks, 25% served by non-effective systems and some 42% completely unserved.

2.30 Before the establishment of the KWSB, the KMC was responsible for sewerage and sewage disposal but other agencies, such as KDA, built sewer systems to service their housing developments and then handed them over to KMC for maintenance. The costs of operating the system were met from the general revenues of KMC, from which Rs 27 million is provided for operations and Rs 124 million for improvement and development in FY 82/83.

2.31 A serious problem with the operation of the sewerage system is the lack of sufficient quantities of water for flushing purposes, resulting in numerous blockages. The system was designed on a conventional hydraulic approach assuming self-cleansing velocities which in many instances are difficult to obtain because of the overall water shortage. However, recent KMC improvements to the system through cross-connections and additional pumping have improved the situation and increasing quantities of sewage are now arriving at the two existing sewage treatment plants, which have recently been upgraded.

2.32 No industrial liquid waste is permitted into the public sewers for reasons already referred to (para 1.08). The unregulated discharge of

industrial pollutants is a problem which must eventually be tackled in conjunction with the domestic sewage discharges, once industry can be induced to pretreat its wastewater. KMC has been considering framing discharge regulations and conditions which would make it a practical proposition for industry to have their discharges accepted in the public areas. The chief chemist of KMC already possesses a set of model regulations which need review and possibly modification to make them workable in Karachi. The objective would be to achieve a gradual clean-up, over a reasonable period of time, without disrupting the level of industrial activity, and through IDA's links with KWSB, this aspect will be reviewed during project implementation (see para 6.14).

Sewage Treatment

2.33 A consultant report, prepared as far back as 1962, proposed the division of Karachi into four sewerage districts, each with a trunk system leading to a sewage treatment plant. At that time, Karachi's population was forecast to reach three million by 1980 but actually topped five million the same year. The continuing growth rate called for a reappraisal of the whole treatment capacity and the KDA master plan department in 1974 began to envision a need for eight sewage works to cope with a population of seven million. This is the plan which was tentatively reviewed in 1978 when consultants began to look at the costs of alternative systems of disposal. For the moment, however, a severe local funding restraint precludes any major expansion of the sewerage facilities.

2.34 There are two existing 20 MGD sewage treatment plants in Karachi, No. 1 commissioned in 1963 and No. 2 commissioned in 1967, both built, with assistance from USAID, to conventional designs which include screening, primary settlement, biological filtration and final clarifiers. Although the combined design capacity of both plants is 40 MGD, during 1981 they treated only 31 MGD on average. Efforts are under way, and some success is being achieved, by KMC in bringing more sewage to these plants through improving links in the connecting sewers and the pumping arrangements; also the No. 2 plant has undergone extensive repairs on its scraper equipment and filter beds. Similar work is on-going at the No. 1 plant for which a total allocation of Rs 100 million was approved in 1981 by the GOS.

2.35 The wastewater in Karachi has a valuable potential for reuse. The treated effluent from the No. 1 plant is already being used for irrigating about 25 ha of land which, with the sale of sludge, yields an annual revenue of nearly Rs 1 million; there is potential for irrigating another 810 ha on adjacent land.

CHAPTER III

DEMAND ASPECTS

Population

3.01 Based on the results of the 1981 census it can be projected that Karachi's population will grow from a current 5.7 million to over 14 million by year 2,000; even by the time this project is completed another million inhabitants will have been added to the population. Considering Karachi's role in Pakistan's economy and its strategic position as a communications center on the Arabian Coast it is likely that the city will continue to grow and prosper.

3.02 The KDA is the principal agency preparing sites and services for the public and private housing sectors. To help sustain this growth, KDA prepares plots for housing to the extent of 60,000 - 75,000 per annum for income brackets as follows: 10% high, 50% medium and 40% low income families (see para 3.05). In addition the KMC has an annual development program to expand roads and other services and is also responsible for operation and maintenance of these facilities. The KMC is also involved in providing services and making improvements in the "katchi abadi" areas where some 1.9 million of Karachi's inhabitants live. There are about 312 "katchi abadis" in eleven main districts, the largest of which are at Lyari, Gulbahar, Baldia, Gulshan-e-Igbal, City, Orangi and Landhi Korangi accounting for 1.65 million of the total slum population. About 12% of KMC's annual budget is devoted to improvements in the slum areas and, city-wide, 31% for water and sewerage services which includes the provision of standposts and water delivered by tanker to those areas completely without water supply.

Demand Forecasts

3.03 Projections of water demand are best derived from historical patterns of consumption but this approach is difficult in Karachi because (i) domestic supplies are unmetered and (ii) the suppressed water demand created by the overall water shortage cannot be adequately measured without a proper pricing policy related to volumetric use. The only broad reference to adequacy is the relationship of production at the treatment plants to the population served. Leaving aside system losses, non-domestic and industrial use, less than 20 gallons per day is available to each head of population; even when variable patterns of use by different social classes are taken into account the overall domestic availability is low for a metropolis the size of Karachi.

3.04 In preparing the project a consumer attitude survey was undertaken in 1981, which looked at, among other things, consumptive use by household

categories; this confirmed that many households were receiving between 10 - 15 gallons per capita/day (gcd) equivalent to 45-68 liters/caput/day (lcd). While about 33% of the 920 households interviewed received water from tankers as an alternative supply, another 15% relied on water carriers with water delivered in 4 gallons containers costing the equivalent of between 125 - 375 rupees per 1,000 gallons (equivalent $9-29/1000 gallons). The total survey sample of 1,010 premises, which included commercial and industrial users, revealed much about consumers' attitude to the present levels of service and the need for improvements but produced ambivalent responses on their willingness to pay more for water because of a basic skepticism about the expectation of any changes in the supply situation. However, the general appeal was more equitable distribution of available water and qualified acceptance of higher charges on some tangible proof of service improvements.

3.05 An earlier project identification report reviewed population trends by household income groups and consultants, in 1978, used this as the basis for projecting water demand as a surrogate for housing categories. The overall per capita allowances applied then were higher than might be considered justified in a situation of water scarcity but this was offset, to some extent, by generally lower estimates of losses if a pressurized system is assumed. Para 2.25 suggests reasons for the current level of loss in the distribution system. An updated estimate of demand has been prepared, adjusting income groups for inflation which projects progressive levels of consumption in lcd's as indicated below.

Category		Monthly Household Income (Rs)	Year 1980	1985	1990	2000
			lcd			
I		(up to 600	50	60	65	75
II	Low	(601 - 1,000	75	80	90	100
III		(1,001 - 2,000	100	110	120	150
IV	Medium	(2,001 - 4,000	150	160	170	200
V	High	above 4,000	200	225	250	300

3.06 To arrive at an overall estimate of demand the non-domestic demand has been taken as a percentage of the domestic consumption and the large consumers are based generally on known metered amounts. Implicit in the projections is the assumption of a transfer of the expanding population from lower to higher income groups. Categories I-III, inclusive, currently representing about 90% of the total population, demand 80% of domestic availability; the population/demand ratio for these categories will change in

future years as follows 1985: 88%/77%, 1990: 85%/74%, 1995: 82%/71%, and 2000: 79%/68%. The estimated demand in MGD is indicated below.

Demand (MGD)	Years					
	1980	1982	1985	1990	1995	2000
Estimated Daily Average	231	272	329	419	548	750
Estimated Daily Maximum (20% above average)	277	327	395	503	657	900

In addition to the above, the Pasmic Steel mill will ultimately demand 22 MGD of raw water and this amount is reflected in the overall estimate of demand indicated in Annex 3.

3.07 These projections assume an overall distribution loss of 30% of total production in 1982 reducing to 26% in 1985 and 20% in 1995 as a result of the leak detection measures (para 2.24) and improvements proposed to be carried out by the KWSB and also that KWSB will have some measure of success in carrying out a proposed 'pilot' metering program of its larger consumers and in the high income areas of the city to monitor household consumption with a view to setting tariffs related to volumetric consumption. For this purpose, 5,000 domestic water meters have been included as a project component. The 'pilot' metering program was available for review during negotiations and the KWSB agreed to an implementation schedule at negotiations and will report on the results of the program and its application for improved cost recovery and the regulation of consumer demands (see Action Plan para 4.09). The KWSB already has about 8,500 domestic meters of different country origins in store which can be used to initiate the program, once they have been tested and calibrated in new facilities to be provided as a component of the project.

3.08 Annex 3 also illustrates the projected water demand against production availability, together with population growth. The net effect of the works to be implemented under this project will be merely to reduce the accelerating gap between production and demand; as will be seen, additional production capacity will be required in the immediate future to meet demand for which the study referred to in para 2.28 will be undertaken.

CHAPTER IV

THE PROJECT

Project Objectives

4.01 The aim of the project is to assist the KWSB in improving water supply service to all its consumers through a net 60 MGD increment of production, better control of its distribution through loss reduction and by introducing system and household metering to monitor patterns of demand with a view to ultimately achieving more rational water use through proper pricing. The project will also support and strengthen the new water supply entity in its effort to become operationally and financially viable by providing it management assistance to improve management information systems, accounting procedures and billing and collection and provides funds for studying and engineering needed system expansion.

4.02 The operational improvements which it is hoped will result from the project should make more drinking water available to the poorer segments of the community, especially the large number of inhabitants living in "katchi abadis". This will be achieved mainly by obtaining a general increase in system pressure through the leak detection and repair program, added production and by reducing wasteful consumption by the larger consumers through selective metering. The project, which will provide additional drinking water, should encourage the authorities to focus on the complementary question of wastewater collection and disposal and to examine the possibility or need for phasing in direct charges for sewerage as part of the long term development of KWSB as an efficient public utility operator.

Project Scope

4.03 The project will augment the supply of raw water from the Indus source starting at the Gujjo intake where supply is now delivered from the new independent canal referred to in para. 2.27. The capacity of the Gujjo canal, over a length of 17 km, will be increased from 280 MGD to 315 MGD by raising its embankments. This increased capacity will allow up to 280 MGD capacity to be delivered through the existing covered conduit to Dhabaji pumping station after allowing for losses in transmission in the open canal and the 20 MGD abstraction required for the Gharo water treatment plant. In the covered conveyance section, after the Gharo off-take, two additional 84" diameter siphons will be constructed to complete a fourth line of siphons to give an additional carrying capacity of about 70 MGD.

4.04 Dhabeji pumping station presently has a total of 15 pumps installed with a rated output of 370 MGD but restricted because of limitations in the power supply and the need for another 72" diameter force main; both items will be provided under the project. With 12 of the 15 pumps in operation (3

acting as standby), the output of Dhabeji wll be raised to about 272 MGD, or more, from a current output of 210 MGD.

4.05 Twelve 84" diameter siphons will be provided to add to the existing triple line of siphons on the conveyance between the header discharge from Dhabeji pumping station and the Pipri water treatment plant. The increased available water in the Pipri conduit will be 62 MGD out of which the steel mill demands 22 MGD of raw water.

4.06 The additional water provided by the project will enable the existing Pipri water treatment plant to again operate at its design capacity of 50 MGD and includes the possibility for some limited overloading. In a consultant study of this plant it was suggested that, with modifications in the hydraulics, up to 5% overloading might be possible without loss of finished water quality. Meanwhile, this project will provide an extension to the treatment plant to include a 25 MGD clarifier, pumping and auxiliary facilities; the provision of full treatment is not immediately possible because of local funding restrictions. Thus the 62 MGD made available by the project is allocated as follows: (i) raising existing plant to full capacity and overload (15 MGD); (ii) the new clarifier (25 MGD); and (iii) the steel mill raw water demand (22 MGD).

4.07 The project provides for about 21 km of mains replacement in diameters ranging from 18" to 54". The faulty sections were identified by an extensive consultant study of the distribution system. In the event that repairs of some of the mains can be satisfactorily effected without complete replacement, then the KWSB will utilize any resulting savings to extend the repair program up to the amount allocated for this purpose.

4.08 As already mentioned in para 3.07, 5000 domestic meters are provided in the project funds to start a "pilot" metering program which will be augmented by meters already in store; these stock meters require to be checked, serviced and calibrated and funds are therefore also included for establishing and equipping a new meter workshop at the authority's C.O.D. Hills water treatment plant where limited facilities are already in place.

KWSB Operational Action Plan

4.09 There are a number of interrelated project activities to be undertaken by KWSB with a common aim of improving its operating efficiency and financial viability. These are discussed elsewhere in this Report and, because of their importance, have been grouped into an Action Plan. The components of this plan were discussed during appraisal and the timing of their implementation was reviewed and agreed during negotiations. Progress on this plan would also be reported in KWSB's normal quarterly reports and annually reviewed and updated in a manner satisfactory to IDA. Assurances to this effect were obtained during negotiations. The plan contains the following elements:

OPERATIONAL ACTION PLAN

		Due Date
A. Operational Improvements		
1.	(a) Establish leak detection cell (para 2.24);	Completed
	(b) Prepare a leak detection program and submit to the Association for review. (para 2.24);	By March 31, 1984
	(c) Commence leak detection program (para 2.24);	By June 30, 1984
2.	Prepare and start implementing a meter recalibration program (para 2.22)	By June 30, 1984
3.	(a) Prepare pilot metering program (para 3.07);	Completed
	(b) Commence agreed pilot metering program (para 3.07);	By January 1, 1984
4.	(a) Appoint consultants to study further system expansion; (para 2.28)	By January 1, 1984
	(b) Complete study and review findings with the Association (para 2.28);	By December 31, 1984
B. Institutional Improvements		
1.	(a) Employ consultants to provide financial management assistance to KWSB including revaluing KWSB's fixed assets. (paras 5.08 and 5.09);	By September 30, 1983
	(b) Review consultants' recommendations with the Association and agree on implementation schedule. (paras 5.08 and 5.09);	By March 31, 1984
	(c) Implement recommendations including double entry bookkeeping system and management information system (paras 5.08 and 5.09);	By December 31, 1984

2.	Prepare and implement staff training program (para 5.07);	By December 31, 1983
C.	Financial Improvements	
1. (a)	Prepare plan for register of consumers and improved billing and collection systems (para 5.13-5.15);	Partially completed; 50,000 completed at February 1983
(b)	Implement first phase of plan including extension of register of consumers and partial computerized billing and collection (para 5.15);	By June 30, 1983 About 40% of billings projected by this date.
(c)	Implement second phase of plan, including completion of register of consumers, fully computerized billing and collection system (para 5.15);	By June 30, 1984
(d)	Review financial performance and revise tariffs and/or take other measures as necessary to achieve following financial targets for KWSB water supply operation (para 6.13);	March 31, 1984 and annually thereafter.
	(i) produce gross revenues sufficient to cover operating expenses and debt service requirements in each of the fiscal years beginning on July 1, 1985.	
	(ii) produce internal funds equivalent to not less than 10% of KWSB's estimated capital expenditures for the fiscal year beginning on July 1, 1986, not less than 20% for the fiscal year beginning July 1, 1987 and not less than 30% thereafter 1/.	

1/ Estimated capital expenditures shall be the average of KWSB's estimated capital expenditures for the fiscal year in question, the preceding fiscal year and the following year.

Project Description

4.10 The project elements are listed in Annex 1 and the principal features are shown on IBRD Map 16904. The components are summarized below:

(i) Raw Water Conveyance:

(a) Increasing capacity of open canal offtake by raising enbankments; length about 17 km;

(b) Providing about 3.7 km 84" diameter pipes in fourteen siphons to raise carrying capacity of existing conduits to a total of up to 280 MGD;

(c) Providing an additional force main from Dhabeji pumping station about 4.5 km long, 72" diameter, to deliver raw water to Pipri high level conduit.

(ii) Pumping:

(a) Modification to Dhabeji pumping station piping arrangement to increase capacity;

(b) Provision of about 3.2 km 11 KV. electrical connection to increase power supply to Dhabeji.

(iii) Treatment Capacity:

(a) Provision of additional 25 MGD clarifier at Pipri to interconnect with existing station capacity;

(b) Provision of two stage pumping at Pipri including buildings, electrical connections and ancillary works;

(iv) Trunk Main Rehabilitation:

(a)	North University block main 48" diameter	-	6.46 km
(b)	Federal T main 48" diameter	-	0.92 km
(c)	Karachi main 33" diameter	-	2.74 km
(d)	Karachi main 48" diameter	-	2.56 km
(e)	Mauripur main 18" diameter	-	3.84 km

(f) Pipri/Landhi main 48" diameter - 3.12 km

(g) Pipri/Landhi main 54" diameter - 1.04 km

(v) Metering, Vehicles and Equipment:

(a) Provision and installation of about 5000 water meters in the following sizes: 3/4" (3000) 1" (1700) 2" (200) 3" (70) 4" (30);

(b) Provision of meter store and workshop at COD Hills and equipment for testing and calibration;

(c) A total of twelve vehicles and equipment for operations;

(vi) Services:

Consultant Services for:

(a) Assisting with project implementation, including design and supervision of construction;

(b) Preparing a Feasibility Study for future water supply expansion from the Indus source;

(c) Management assistance to KWSB to improve accounting procedures and improve billing and collection procedures; and

(d) Training.

Cost Estimates

4.11 Cost estimates (base cost at June 1983) for the project are summarized below. Cost details and the proposed IDA financing share are detailed in Annex 1.

Item	Rs Million			US$Million			% of total
	Local	Foreign	Total	Local	Foreign	Total	Project Cost
Canal enlargement	8.41	3.12	11.53	0.65	0.24	0.89	2.4
Siphons No. 14	33.08	11.18	44.26	2.54	0.86	3.40	9.3
Dhabeji pumping stn. alterations	3.11	4.42	7.53	0.24	0.34	0.58	1.6
Dhabeji force mains	33.83	23.40	57.23	2.60	1.80	4.40	12.1
Pipri pumping station	31.02	34.32	65.34	2.39	2.64	5.03	13.8
Pipri 25 MGD clarifier	19.76	10.40	30.16	1.52	0.80	2.32	6.3
Pipri force main	6.57	3.90	10.47	0.50	0.30	0.80	2.2
Electrical conn.	3.79	9.10	12.89	0.29	0.70	0.99	2.7
Distribution rehabilitation	33.03	28.60	61.63	2.54	2.20	4.74	13.0
Domestic metering	3.09	3.90	6.99	0.24	0.30	0.54	1.5
Meter repair workshop	2.30	2.08	4.38	0.18	0.16	0.34	0.9
Miscellaneous services	6.70	5.20	11.90	0.52	0.40	0.92	2.5
Base Cost Subtotal	184.69	139.62	324.31	14.21	10.74	24.95	68.3
Physical contingencies	23.71	17.94	41.65	1.82	1.38	3.20	8.8
Final design and supervision	22.94	2.60	25.54	1.77	0.20	1.97	5.4
Vehicles and equipment	1.00	3.38	4.38	0.08	0.26	0.34	0.9
Management assistance	2.00	-	2.00	0.15	-	0.15	0.4
Preparation of billing record	3.00	-	3.00	0.23	-	0.23	0.6
Manpower training	0.78	0.52	1.30	0.06	0.04	0.10	0.1
Indus Stage V Study	3.90	1.30	5.20	0.30	0.10	0.40	1.1
Subtotal	242.02	165.36	407.38	18.62	12.72	31.34	85.6
Price Conting.	37.98	29.64	67.62	2.92	2.28	5.20	14.4
Total Cost	280.00	195.00	475.00	21.54	15.00	36.54	100

4.12 The overall cost estimates of US$36.54 million, including US$5.14 million equivalent in duties and taxes, are considered reasonable and are based on construction costs and equipment prices established by KDA from its current construction program which includes the on-going development of the Hub water supply scheme. Base costs have been adjusted to reflect costs at the end of June 1983. The execution of the conveyance expansion will entail some degree of difficulty and it will also be necessary to ensure the existing facilities continue to operate while construction proceeds. Accordingly, 15% has been added as physical contingencies for civil works and 10% for

equipment supply for a weighted average of 12.8% on the base cost. To provide for inflation through the expected dates of project completion, the following price escalation rates have been used; for civil works expected to be undertaken by local consortia, 10% from 1983 through 1987; and for imported equipment 8% for 1983, 7.5% for 1984, 7% for 1985 and 6% for 1986 and onwards.

Status of Engineering

4.13 As executing agency for KWSB, preliminary plans have been prepared by KDA for the expansion of the Pipri treatment facilities and the modifications to the pumping station at Dhabeji. Detailed drawings exist from previous completed contracts for the additional siphons and the canal enlargement to be provided under the project and these bid documents can be quickly updated to comply with IDA's ICB requirements. The mains to be repaired or replaced have been identified and will be executed by KWSB. However, the executing agencies may require to augment their design and supervisory capacity for implementing the major works and, accordingly, provision has been made in the project for the employment of consultants. KWSB confirmed that the KDA will be responsible for execution, on its behalf, of the components itemized in para 4.10 (i) to (iii) inclusive, KWSB will execute all other components in para 4.10, except that KWSB and KDA will jointly execute the feasibility study in para 4.10 (vi)(b). During negotiations, agreement was reached that consultants would be employed for project implementation on terms and conditions acceptable to the Association.

Procurement and Project Implementation

4.14 All major equipment supply and civil works would be awarded on the basis of international competitive bidding in accordance with the Bank Group guidelines, the only exception being the minor contracts referred to in para 4.17. Local manufacturers participating in international bidding would be accorded a preference in bid evaluation of 15% or the prevailing import duty, whichever is lower. KDA and KWSB will coordinate the procurement of consultant services for which they will seek proposals; outline terms of reference for the Indus feasibility study, referred to in para 2.28, will be used as the basis for inviting proposals. A total of 200 man months of local consultancy and 23 man months of foreign consultant support is provided under the project at a total cost of Rs 11.55 million. The average man month cost for the local consultants is Rs 43,000 (US$3,350), while the average man month cost for expatriate consultants, including salary costs, fees, international travel and subsistence is Rs 124,000 (US$9,500). For the civil engineering and building work to be executed under the project, it is expected that experienced and highly competitive Pakistani contractors will participate in the bidding; local contractors have been and are still engaged in contracting similar works in Karachi in connection with the city's expansion program. The estimated total value of the civil works contracts is

equivalent to US$20 million and the equipment supply about US$13 million to be let under ICB.

4.15 The contracts to be bid under the project, suitably grouped, include the supply of pumps, pipes and fittings, water meters, water treatment plant equipment and vehicles. For the 84" diameter siphons, it is the intention to prepare the bidding documents as a supply and lay contract. Pressure pipes in this diameter are locally available from the KDA's pipe factory but contractors will also be able to seek an alternative competitive source of supply if such can be located.

4.16 The Pipri treatment plant addition is likely to be bid against a performance specification combining the evaluation of the equipment supply with the civil works to determine the least cost; for this purpose the operating costs would be capitalized for the purposes of comparison. The KDA is completely familiar with water treatment plant bidding and evaluation procedures having previously bid plants on the basis of "turnkey" and performance specifications when, in the latter case, the equipment supply and civil works are evaluated and constructed separately. All major contracts will be bid among experienced pre-qualified contractors. Prior review by the Association of invitations to bid and of proposed awards and final contracts would be required for all civil works and goods contracts over US$500,000. This would cover about 80% of total contract value.

4.17 In the interests of efficiency and economy, a selected number of minor contracts may be awarded after inviting local bids from at least three reliable contractors or suppliers or carried out by the KWSB through force account. This would apply to meter installations, the construction of the meter workshop and parts of the rehabilitation work; the individual value of such contracts would not exceed US$200,000 and be restricted to US$0.5 million for equipment, vehicles and materials and US$0.5 million on force account. To maintain the momentum of project preparation, and to accelerate improvements in operational efficiency and financial performance of KWSB, retroactive financing from November 1, 1982, not exceeding US$500,000 is recommended for project related expenditures for the following consulting services (a) updating the register of consumers, (b) the management assistance program and (c) final design of project components.

Construction Schedule

4.18 The schedule for design, procurement and construction is shown in Annex 2. The rehabilitation works would be completed by December 1985 and the treatment plant, pumping and conveyance between mid-1986 and the end of 1987. The entire project, including the meter installation, would be completed by the end of 1987 in a four and one-half year period starting in July 1983. Preliminary work has already started on the preparation of bid documents and it is expected the first contracts could be awarded early 1984; bidding for the rehabilitation work could take place by December 1983.

Project Financing

4.19 A credit of US$25 million is proposed to finance US$15 million (100%) of foreign exchange and US$10 million (61%) of local costs. Net of taxes and duties, the credit would finance about 79% of the project cost or 69% of the total. The credit would be made available to the Government on standard IDA terms. GOP would bear the foreign exchange risk and would pass the credit on to GOS. GOS would onlend to the KMC at a lending rate of not less than 11% for a period of 25 years, including five years' grace, through a subsidiary loan agreement to be concluded between GOS and KMC. The execution of a subsidiary loan agreement between GOS and KMC satisfactory to IDA, would be an additional condition of credit effectiveness. The KMC would pass on the proceeds of the credit to KWSB and KDA for the implementation of the project.

Disbursements

4.20 The proposed IDA Credit of US$25 million would be disbursed over approximately five years in the following categories:

(1) Civil works for transmission canal, pipelines treatment plant, pumping, mains rehabilitation and meter installation	75% of total expenditure
(2) Equipment and materials including pumps, electrical goods, meters and vehicles	100% of foreign expenditures. 100% of local expenditures ex factory and 65% of goods procured locally.
(3) Consultant Services for project implementation and a feasibility study to prepare for future expansion of the water supply system, installing management systems, billing and collection systems and training abroad.	100%

Disbursements will be fully documented except civil works performed under force account which will be disbursed against Statements of Expenditure (SOE) certified by the General Manager of KWSB. The documents will not be submitted to the Association but retained by the KWSB and made available to the Association's representatives for review. Disbursements under SOE will be audited annually by independent auditors acceptable to the Association.

4.21 The proceeds of the proposed credit (para 4.19) is allocated as follows against three main components: (i) civil works Rs 172 million (US$13.23 million); (ii) equipment and supplies Rs 130 million (US$10.00 million); and (iii) consultant services Rs 23 million (US$1.77 million). The estimated disbursements of the IDA Credit are shown in Annex 5. The known capability of the KDA - the agency which will implement major works on behalf of KWSB - for executing this type of construction is expected to lead to more rapid execution and disbursement than occurred on the more complex water supply and sewerage project in Lahore (para 1.21). The major reason for delays in Lahore was the difficulty in executing the sewerage component as previously described; the water supply component was completed much earlier. Since there are only water supply components on this project, and some of the work forms part of a repeater contract, complete disbursement is expected in a little over five years instead of about seven years for Lahore. These periods may be compared with eight years for the Bank wide profile for the sector and six years for the urban projects in the region.

Monitoring Criteria

4.22 The project will be monitored by performance and program indicators which will be useful to KWSB in controlling and developing the efficiency of its operations. The monitoring criteria, set out in Annex 4, were discussed during negotiations and agreement was reached that such information as is to be reported will be sent to IDA for review within six months of the end of each quarter. The KWSB would continue to report for about five years after project completion. KWSB would be responsible for preparation of the project completion report. KWSB and KDA would report jointly and maintain records on the execution of the project and KWSB will report on its overall operations.

Land Acquisition and Water Rights

4.23 The land required for the addition to the Pipri water treatment plant is already in the possession of the KDA, together with the sites of the water facilities to be expanded or augmented under the project. The currently approved abstraction from the Indus source of up to 280 MGD will be increased by about 12% to allow for transmission losses. As ample supplies are available from the regulated Indus River, no difficulties are expected in obtaining approval of this fractional increase. The KWSB however will need to reactivate the application made by KDA for a much larger abstraction (para 2.27) in anticipation of its future needs.

CHAPTER V

KARACHI WATER AND SEWERAGE BOARD

Organization

5.01 It had for long been recognized that the separation of responsibilities for water supply and distribution between KDA and KMC was not working satisfactorily (para 2.06). Apart from the difficulties raised by this arrangement for coordinating investment programming in the water supply sector, it had serious repercussions on the financial viability of the whole water supply operation, since neither institution was willing to accept responsibility for full cost recovery from the ultimate consumer. The KDA, with a monopoly on the sale of bulk water supplies, had little incentive to reduce costs and improve efficiency, while KMC had little incentive to attack the real problem of improving service to, and cost recovery from, consumers when it could readily blame its own service deficiencies on disputes with KDA over quantities of water delivered and refuse to pay the full cost of water. The formation of an elected municipal council in 1979 exacerbated the differences between the two institutions and intensified the search for a solution.

5.02 In 1981, the Karachi Water Management Board, KWMB, was created to redress the situation, with responsibility for distribution throughout the metropolitan area and with enhanced powers of cost recovery. KWMB, however, never really got off the ground - its staff was seconded from KMC and KDA, although their salaries continued to be paid by their parent organizations, and it had no independent source of income, relying on KMC to collect on its behalf. Despite these weaknesses, some improvements were made, particularly a change in tariff structure and doubling of tariffs. But the means of imposing these tariffs was still not available (see para 5.08-5.10 below) and KWMB was not able to pay KDA the full cost of water supplied. Thus the establishment and growth of KWMB was hindered by funding problems as it had no revenue base of its own on which to draw and was reliant on KMC for support. It was therefore decided that an authority should be established to operate under the wing of KMC with source to tap responsibility. A new authority, the KWSB, was established on February 1, 1983 under a revision of the Sind Local Government Ordinance of 1979.

Functions and Powers

5.03 Under its charter, the KWSB is responsible for production, treatment and distribution of water as well as disposal and treatment of wastewater. It thus takes over functions that were performed previously by the KDA (water production), the KWMB (water distribution) and the KMC (sewerage and sewage treatment). As well as enabling it to operate and maintain the system and engage in new capital works, its powers also provide for the establishment

and adjustment of tariffs for water supply and sewerage, subject to approval by KMC.

Assets and Liabilities

5.04 GOS has set up a committee comprising senior officials of KDA and KMC to value the assets and liabilities to be taken over by KWSB. The committee will appoint external auditors to prepare a report on the transfer and the transfer arrangements. Meanwhile, interim funding of Rs 30 million has been approved by KMC for the current financial year and revised budgets for the current and next financial years are under preparation.

Organization and Management

5.05 The organization structure of KWSB is shown in Annex 7. The Board, consisting of six members - the Mayor (Chairman), Deputy Mayor, two elected councillors, a GOS appointee and the Managing Director - is very much smaller than the previous KWMB Board of 26 members. This should make for a much more streamlined decision making process and resolve one of the problems that plagued KWMB - the conflicting views of its many Board members. The KWSB Board would meet monthly to resolve major issues, but the Managing Director would be the Chief Executive and would have full power to carry out the regular operations of the authority. The Authority's budget requires approval each year by the Council of KMC in full session.

Staffing

5.06 The new authority will take over the staff of the entities it replaces; that is about 3,000 personnel from KWMB, a further 2,000 from KDA and about 1,000 from the sewage department of KMC. All staff retain their previous ranks and entitlements and there are expected to be few refusals to transfer. In effect, the operation and maintenance of the system and installations will be undertaken by the same personnel. The Managing Director of KWSB has been appointed.

Training

5.07 Studies carried out during project preparation included assessment of the technical training needs of individuals employed in the water and sewage sector in Karachi. The project provides for a training program to be drawn up and implemented by KWSB during project execution. The program would include:

(a) technical training on leak detection, equipment and preventive maintenance, metering and operational management procedures. The Lahore Water and Sanitation Authority is already equipped with a leak detection training yard and can offer other basic

facilities for training. Overseas training for senior staff, as appropriate, will also be followed up; and

(b) management training for senior officers in modern management techniques, both within Pakistan and overseas. The management assistance program (para 5.08) would also provide on-the-job training.

Management Assistance

5.08 The KWSB, as a newly established entity, will need to install a comprehensive accounting and management information system. A preliminary review had already been carried out by its predecessors from which terms of reference have been prepared for consultants to carry a management assistance program including design and installation of a double entry bookkeeping system in the KWSB; the date by which this system is expected to be installed will be discussed at negotiations. This would bring KWSB into line with its associated organization, the KMC, which is in the process of changing from a single entry to a double entry system. It should also enable management to receive meaningful financial data on a timely basis and enable an independent audit to be undertaken. The program of management assistance would include the following components:

(a) development of accounting, budgeting, billing and collection procedures and financial and management reporting systems;

(b) assistance in the implementation of systems, procedures and manuals through a detailed phased program;

(c) review of the financial organization of KWSB, job descriptions and training programs in the accounting and management information fields; and

(d) assistance with recording the transfer of assets to KWSB, the preparation of opening balances and the valuation of fixed assets on a replacement cost basis.

5.09 During negotiations, assurances were obtained that suitably qualified consultants would be employed not later than June 30, 1983, to carry out the management assistance (see Action Plan para 4.09).

Billing and Collection

5.10 The billing and collection system used by the previous water supply entities has been the weakest part of the whole operation and has resulted in gross underrecovery of costs. On the bulk water sale side, representing

about 30% of all water consumed, the biggest problem has been faulty bulk meters (see para 2.22) leading to disputes between supplier and consumer over quantity delivered. Frequently, bills are based on meter readings taken several years previously and do not reflect growth in consumption. Under the project, priority would be given to repair and maintenance of bulk supply meters.

5.11 Unmetered supplies to individul consumers account for about 70% of total consumption. Until recently, these customers were billed for water on the basis of the annual rental value (ARV) of the property occupied. The register of consumers' properties and the valuation were based on records compiled by the KMC taxation department, which in turn based its data on information derived from the GOS Department of Excise and Taxation, the authority responsible for valuation of properties for tax purposes. KMC collected taxes on property for conservancy (5% of ARV), Water Rate (6-1/2% of ARV) and Fire Rate (2% of ARV), there being one bill for all three services, while GOS collects the property tax (20% of ARV) and transfers 85% of its receipts to KMC. Apart from representing a wasteful duplication of effort by GOS and KMC, the yield from the system falls far short of its potential as property values have not been revalued for the past fifteen years. It was largely to counteract this last problem that the water tariff was changed in FY1981/82 to one based on floor area and plot sizes, thus delinking the water tariff from property values and opening up the possibility of making regular revisions to the tariff.

5.12 The register of consumers and the method of billing and collection, however, remained unchanged. The bills were still handwritten, delivered by hand by KMC collectors and collected by the same staff. The bills were inaccurate, many never reached their proper destination and of those that did, many were never collected. There was no system of accounting for arrears and the receipts could not be balanced with billings. Moreover, surveys carried out by KWMB in the latter half of 1982 revealed that only about half of all consumers in a specific area were included on the register of consumers.

5.13 The KWSB is energetically tackling the problems of the consumers' register and its billing and collection procedures as a matter of the highest priority. Prior to negotiations, KWSB prepared a detailed action plan for implementation by June 30, 1984 to cover the following activities:

(a) field surveys of every building in Karachi to assess their tariff categories and compile a complete register;

(b) conversion of manual billing procedues to a fully computerized system; and

(c) overhaul of the collection system operated by KMC, including incentives for billing and collection.

5.14 The surveys of buildings in Karachi will cover the whole city, including "katchi abadis" and will provide information on the occupant, the floor area of the building, and whether or not there is a water connection and/or a sewer connection. The information will then be placed on a computer for calculation of billable values and preparation of bills. A separate bill will be prepared for water charges in future, which should enhance the prospects of payment as it will no longer be associated with conservancy and fire rates, items which appear to have a relatively low priority for payment amongst the citizens of Karachi. It will also open up the possibility of billing more than once a year, which is planned for the later stages of program implementation. At present, computerized data is being stored on one of the commercial banks' computers, but this may be switched to the KMC's recently installed computer system, when it becomes fully operational in July 1983. The intention is that KWSB should have its own independent billing and collection system which will keep a record of arrears and reduce bad debts.

5.15 The first phase of the action plan (para 4.09) should be ready for implementation by July 1983; this would consist of extending the register of consumers in part of the city. During the following year, the second phase would involve completion of a new register covering the entire city and computerization of the billing system. Consultants are already engaged in the survey of buildings and funds are provided under the project for completion of the surveys The management assistance program (para 5.08) will assist in the computerization of billing and collection procedures and the objective is to have the new system fully operational by July 1984. This is a tight schedule which will require the full cooperation of all concerned, but should substantially alleviate the losses currently being sustained in the water supply operation and lessen the need for future tariff increases (see chapter 6 below).

Audit

5.16 The accounts of KWSB and of KDA will be subject to audit by independent auditors acceptable to IDA. The auditors will submit a commercial audit report including financial statements (Income Statement, Fund Flow Statement and Balance Sheet) together with certifications as to fairness of these statements. The first year to be audited will be the fiscal year 1983/84. The audit reports will be submitted to IDA within six months of the end of the fiscal year under audit.

Insurance

5.17 KDA and KWMB have in the past restricted the coverage of risks by external insurance agencies to those related to vehicles, and KWSB will follow the same practice. As the remainder of the water supply properties are the types which are not normally subject to damage other than by major

disaster, KWSB will adopt the practice, followed in most government undertakings, of self insurance with government providing funds for major losses from general funds if, and when, major losses occur. This concept appears reasonable in these circumstances and is acceptable.

CHAPTER VI

FINANCIAL ANALYSIS

Past Financial Performance

6.01 Prior to the reorganization of the water supply sector in Karachi (see para 5.02), KDA was responsible for the production of potable water and for its bulk distribution to the various distribution entities and bulk users in Karachi. KMC was the largest of these entities. 1/

6.02 KDA billed these various entities for the water supplied to them utilizing a rate per thousand gallons that was supposed to cover the costs of KDA's Water Wing. The quantity of water supplied was determined by bulk water meters installed on the distribution mains. However, the bulk water rate authorized and used did not include the costs of servicing all KDA's water related debt (see para 6.07). The bulk users also challenged the accuracy of KDA's meters and water billings and withheld their payments. The result, as summarized below, was that KDA in the past was unable to collect revenues sufficient to cover its full costs.

1/ There were twenty-three water distribution entities and bulk users in Karachi of which KMC was the largest, distributing about 75 to 80% of the water volume to its final consumers. The other distribution entities included, to name a few; Civil Aviation Department, Defense Ministry, Karachi Port Trust, Pakistan Railways, Pakistan Steel Mills, Public Works Department, Sind Industrial Trading Estate, Varika Mills and various cantonment boards and housing societies.

KDA (Water Wing) - Summary Income and Expenditure Statements

Fiscal Year	1980	1981
	(Rs Millions)	
Operating Revenues	84.91	130.28
Operating Expenses - exclusive of depreciation	65.40	98.87
Estimated Depreciation	13.09	14.73
Total Operating Expenses	78.49	113.60
Operating Income (Loss)	6.42	16.68
Interest Expense /1	78.27	79.24
Net Loss	(71.85)	(62.56)

/1 Mainly interest on debentures which was not in fact paid after 1979, see para 6.07.

6.03 KMC had not revised its tariff since 1967 (prior to July 1, 1981) and the revenues produced by it have been significantly less than KMC's related costs including the costs for bulk water supplied by KDA. Proforma income statements have been prepared reflecting the past operating results of the retail distribution, the function which was assumed by KWMB in FY1982 and which now falls under KWSB. These results are summarized as follows:

KMC Water Distribution Department - Summary Income and Expenditure Statements

Fiscal Year	1980	1981
	(Rs millions)	
Operating Revenues	57.98	55.62
Operating Expenses - exclusive of depreciation	90.42	106.30
Depreciation	2.60	4.32
Total Operating Expenses	93.02	110.62
Operating Loss	(35.04)	(55.00)
Interest Expense	2.75	2.63
Net Loss	(37.79)	(57.63)

6.04 KWMB after assuming responsibility for water distribution for Karachi, revised the structure of the retail tariff from an Annual Rental Value (ARV) Computation Base to a Covered Area Computation Base in 1981/82 (see para 5.11). This revision, although aproximately doubling the revenues in the old KMC distribution area, still did not cover the costs of providing these services. Estimated results of operations of KWMB for FY1982 were as follows:

Fiscal Year	1982 (Rs Millions)
Operating Revenues	115.86
Operating Expenses - exclusive of depreciation	236.68 *
Depreciation	5.28
Total Operating Expenses	241.96
Operating Loss	(126.10)
Interest Expense	3.70
Net Loss	(129.80)

* Operating expenses include the cost of purchased water which increased mainly due to an increase in KDA's bulk tariff.

Present Situation

6.05 The merging of these two loss making operations presents the new operating entity, KWSB, with a serious financial problem, but one that it is better equipped than its predecessors to deal with through its unified management structure, the backing of KMC and an action oriented recovery plan (see para 4.09). The combined income and expenditure statements for the water supply and distribution operation (sewerage is excluded) are shown in Annex 9 and can be summarized as follows:

	1980/81	1981/82	1982/83	1982/83
Sales of Water				
Quantities MGD	144.20	144.20	179.28	-
	----------Rs Million---------			Rs per 1000 ---gallons--
Operating Revenues	71.33	115.86	181.54	2.77
Production Cost	113.60	166.22	242.02	3.70
Distribution Cost	59.72	65.11	78.14	1.19
Total Cost	173.32	231.34	320.17	4.89
Operating Loss	101.99	115.48	138.63	2.12

6.06 The overall operating loss has increased steadily over the past two years, despite large increases in tariffs and changes in the charging base in 1981 and 1982 which have brought about a two and a half times increase in revenue. As described in para 5.12, the impact of the tariff increases was reduced by the problems with the register of consumers and billing and collection systems, and will only become fully effective as these systems are improved in future. Meanwhile, production costs have escalated sharply, with a threefold increase in pumping costs resulting from KESC having to switch from low price natural gas to imported oil. The staffing of a new division for operating the Hub water facility has also increased costs, although the Hub source will not reach full capacity until FY84.

Debentures

6.07 An issue that has proved to be even more financialy embarrassing to KDA than recovery of its operating expenses, has been the repayment, or non-repayment, of short-term debentures issued by KDA from 1976 to 1981 for loans from commercial banks in Pakistan. These debentures were issued to finance the construction of a new 650 MGD independent supply canal from the Indus River to Gujjo at a cost of Rs 785 million. The terms of the debentures, seven years at 12 1/2% interest including a two-year grace period, were totally inappropriate for the financing of such a long lived asset. To make matters worse, the canal itself has not yet provided any additional water to Karachi (it requires an expansion of the conveyancing system between Gujjo and Karachi to do that, as proposed under the present project) and the principal beneficiaries are farmers who are receiving increased water for irrigation from the Jam Branch canal which formerly conveyed both irrigation

and drinking water. The full capacity of the canal will not be fully utilized for Karachi before 1997 (para 2.27). The cost of servicing these debentures has never been included in KDA's tariffs as it was hoped that GOP might convert this liability into equity. The settlement of the debenture issue has been a subject of considerable debate between the various parties in Pakistan for some considerable time.

6.08 The current position regarding the debentures can be summarized as follows:

(a) KDA owes a total of Rs 874 million in principal and interest, the legal liability for which has been transferrd with the assets to KMC, with GOS as guarantor; and

(b) The commercial banks which lent the funds expect to be reimbursed and had taken preliminary steps to press KDA for repayment of the obligation;

6.09 Since no clear resolution of the matter is in sight, it is proposed to leave the debenture issue meanwhile in abeyance. During negotiations it was explained to the Association that, in a memorandum of understanding between the GOS and KMC dealing with the take-over of the water supply assets it was agreed that, in the event of any part of the debt related to the Greater Karachi Water Supply, Phase III (of which the canal is a part) becoming a liability, suitable arrangements would be made for its resolution. At negotiations it was noted and agreed that if the KMC is required to discharge any part of the liability on behalf of KWSB, it would be considered new debt, the servicing of which, together with servicing of other debt, would be subject to a ceiling of 1.5 times KWSB's net revenues.

Financial and Operational Targets

6.10 The problems facing the newly established KWSB call for an immediate action plan to cut losses and reduce the financial drain on KMC and in the medium and long term to provide resources to plan and develop water supplies for the future. The objectives of such an action plan need definition in terms of financial and operational targets. One of the targets put forward by the KMC is that the KWSB should operate on a "no profit-no loss" basis, to include provision for maintenance and expansion of the system. This is a very ambitious target, reflecting as it does 100% self financing. On the other hand, given the scarcity of funds in the ADP and the reluctance of GOS to lend for water supply to Karachi, it may be realistic to assume that in future the system will have to be increasingly self sufficient. An additional constraint is that there is at present no capital market in Pakistan for provision of long term loans to municipalities, which are unable to borrow from sources other than the ADP, despite the fact that many are creditworthy. Nevertheless, in the case of KWSB, it should be possible to

rely on the resources of KMC to finance part of its expansion program. KMC currently spends 55% of its Rs 1,028 million budget (1982/83) in development expenditures and should be in a strong position to provide loans to KWSB in future for part of the expansion of the water supply and distribution facilities. A realistic medium term financial target for KWSB would therefore be to meet its cash operating, maintenance and debt service expenses and to contribute towards its investment needs.

6.11 The attainment of the overall financial target will depend upon the effective implementation of the Operational Action Plan referred to in para 4.09, including:

(a) The leak detection and loss reduction program (para 2.24 which is expected to reduce wastage from the current level of 30% to 22% by 1990. The water thus saved will provide additional revenue to the extent that it is sold to metered consumers and postpone the need for further investments by two to three years.

(b) The metering and meter repair program (paras 2.22 and 3.07) will have an immediate impact on improving revenue collection from bulk consumers (para 5.10) and will provide a basis for developing a more equitable, use oriented, tariff in future.

(c) The billing and collection program (para 5.10-5.15) should increase receipts from the floor area tariff category by about 70% over the two years 1983/84 and 1984/85.

6.12 Further savings should arise from the more efficient use of existing resources, particularly labor, though the integration of the whole system and consolidation of services, e.g. billing, that were duplicated under KDA and KWMB. Improved management techniques resulting from the training elements included under the project and the management assistance program (para 5.07) would also play a role in cost saving.

6.13 Additionally, tariff adjustments will be needed to ensure the financial viability of KWSB, although the extent of increases can be reduced by successful implementation of the programs outlined above. The current tariffs imposed by KWSB are shown in Annex 10. The unmetered tariff basis was changed from ARV to floor area during 1981/82, which more than doubled receipts from this source, while the metered rates were increased from Rs 1.96 to Rs 4.50 per 000 gallons (domestic) and from Rs 4.50 to 6.00 (industrial and commercial) in July 1982. It would not be feasible to increase tariffs again so shortly after these large increases; nor would it be very effective until the new billing and collection system is in place. On the other hand, there is a need to stop the financial drain on KMC, which has to fund the deficits, as soon as possible. For this last reason, an

interim target of meeting cash expenses (including debt servicing) in 1985/86 was agreed during negotiations. To meet this target, KWSB will have to improve its annual revenue flow by about Rs 325 million in current terms. It is expected that the actions described above (para 6.11) will generate about 55% of the necessary cash flow, leaving about Rs 140 million to be provided through tariff increases, which would require a tariff increase of about 40% in July 1985 (See Annex 8 and 9). Thereafter, it was agreed at negotiations that KWSB will gradually start to contribute towards its investment needs, to the extent of 10% in 1986/87, 20% in 1987/88 and 30% in 1988/89 and following years. To meet these financial targets, tariff increases equivalent to about 7% per annum in current terms will be necessary. The measures required to meet these targets, including those outlined in the action plan and tariff increases, would be reviewed annually and, if appropriate, the financial objectives themselves may be adjusted to reflect changes in KWSB's operating environment and, in particular, to incorporate the revaluation of KWSB's fixed assets and additional information on long term investment requirements to be derived from the study of further system expansion (para 2.28).

6.14 The above actions and financial targets relate to the water supply and distribution operations of KWSB. KWSB has also taken over responsibility for operation and maintenance of the sewerage system in Karachi. KMC has for some time been studying the question of sewerage tariffs to recover the cost of operating, maintaining and developing the service. It should therefore be feasible for KWSB to develop sewerage tariffs over a period of time and this aspect of KWSB's operations was discussed at negotiations. Because of the linkage of KWSB's sewerage and water operations, IDA would wish to monitor its overall performance and targets. KWSB has confirmed that separate accounts would be kept for each part of its operations and that there would be no transfer of funds from the water supply operations to support its sewerage activities; any support required for the latter would come from KMC. During project implementation, KWSB will exchange views with the Association on the practicality of its proposals for implementing sewerage tariffs, particularly on timing and the initial levels at which they will be set.

6.15 Financial projections for the water supply and distribution operations of KWSB are shown in Annex 9 and the assumptions on which they are based in Annex 8. These estimates, which are based on pro forma financial statements prepared by consultants for the KWMB and water wing of KDA, indicate that, in addition to the efficiency improvements described above and summarized in the action plan (para 4.09), tariff increases of about 40% in July 1985, and about 7% per annum thereafter will be needed to reach the financial targets. Asset values in the projections are on a historic cost basis; the actual assets and liabilities to be taken over by KWSB are to be assessed by external auditors (para 5.04) and consultants to be appointed under the project (paras 5.08 and 5.09) will assist in the revaluation of these assets. The rate of return on net fixed assets by project completion

(FY1987/88) is tentatively estimated at between 2 and 3% on a replacement cost basis (6.3% on a historic cost basis).

CHAPTER VII

ECONOMIC AND SOCIAL ASPECTS

Health Benefits and Environmental Impact

7.01 The present level of public water supply service in Karachi is unsatisfactory as, over much of the city, water is available for only four to six hours during the day. The inability of the production capacity to meet demand has led to a situation where distribution mains are intermittently unpressurized allowing polluted groundwater to infiltrate the system; this in effect nullifies the treatment process, particularly the disinfection which is carried out prior to distribution. The authorities are aware of this phenomenon and regularly test the distribution water but reports of public ill health usually provide the first indication of when pollution has occurred.

7.02 For the above reasons, the first priority for the supply authority is to make more production water available and this is an important part of this project through the expansion being provided on the Indus system; the development on the Hub (para 2.14) is also part of the overall expansion program. In the longer term, the study of the Indus (para 2.28) is intended to provide the basis for a regular expansion program to meet future needs. Important ingredients in the project are the leak repair program and the beginnings of a domestic meter program to limit excess consumption (para 3.07). All of these measures are aimed at providing a continuously pressurized delivery system.

7.03 The additional water supplies will add to Karachi's wastewater disposal problems; these have recently been receiving increasing attention (para 2.31) and plans are being made for further expansion of the sewage treatment capacity (para 2.33). It is IDA's intention to work closely with KWSB and KMC in the development of a wastewater action plan and be ready to help support this activity once the local funding constraints moderate.

Least Cost Solution

7.04 Karachi's water problems have been studied in depth and the conclusion was come to that surface supplies from the Indus and an impoundment on the Hub River were the only feasible sources; groundwater sources are unsuitable both as to quality and quantity. The decision to fully develop the on-going Hub project, before the fourth stage of the Indus, was taken at a time when an engineering evaluation indicated this to be the least cost solution for the next tranche of production related to the location of the growth areas in the north and northwest of the city; this was again confirmed in the 1978 (para 2.24 and 3.05) study. As demand has continued to outstrip supply, the fourth stage Indus expansion, which this project consists of, is the next logical extension and is the least cost in terms of raw water supply, treatment, bulk distribution and tertiary distribution. Further abstractions from the Indus (para 2.28) will be the subject of economic evaluation as earlier discussed.

Economic Analysis

7.05 The average incremental cost (AIC) of water provided under the project is calculated in Annex 11 on the basis of the additional water supplies resulting from the project. This additional water includes not only the extra water produced as a result of the project's investment in production facilities, but also the additional water available for consumption as a result of the project financed mains rehabilitation and leak detection activities, which will reduce losses. The AIC of Rs 3.90 per thousand gallons is less than the tariff for domestic bulk consumers (Rs 4.50) and considerably less than the present tariff for industrial bulk consumers of Rs 6.00 per thousand gallons. It is however substantially more than the average receipt per thousand gallons of about Rs 2.00 from consumers on the floor area tariffs, reflecting the need described earlier (para 5.08-5.13) to improve billing and collection and also to further increase the tariff level. The AIC is also higher than the overall average revenue per 1000 gallons of Rs 2.85.

7.06 The AIC derived from the project is estimated to be less than the long run marginal cost of water supply. This is because:

(a) loss reductions to be achieved under the project may be more difficult to achieve in future as the level of losses gets progressively lower;

(b) the project represents the final phase of an existing supply system and utilizes several existing investments, which may have to be duplicated or expanded in future projects;

(c) the cost of the 650 MGD independent canal from the Indus to Gujjo, which has sufficient capacity to supply Karachi up to the year 1997 is treated as a sunk cost.

The least cost method of augmenting supply in future will be studied (para 2.28) by consultants financed under the project, but indications are that long run marginal costs are likely to rise rather than fall and that real tariffs should follow this trend.

7.07 Using incremental revenues, based on present water charges, as representing consumers' minimum willingness to pay for services and thus as a proxy for benefits derived from the project, an incremental economic rate of return of 8.2% is obtained (or 14.6% if shadow prices of 70% and 80% of cost are applied to labor and foreign exchange items). This tends to understate the real economic rate of return, as unquantifiable benefits, such as health benefits described above, are excluded. Even so, the rate of return for this project is relatively high compared with other projects in the water supply sector. As mentioned in para 7.06 above, this is due to the existence of facilities that do not have to be duplicated under this project, which are treated as sunk costs, and also to the inclusion of the costs and benefits of the mains rehabilitation and leak detection programs, which are expected to achieve a significant reduction in losses.

Poverty Impact

7.08 The consumers most affected by the current deficiencies in supply are the inhabitants living in the low income areas of the city. The general increase in pressure expected ultimately to result from the project, will make more safe water available to perhaps about a half million of the 1.9 million in this category. The improvement in service coverage should also mean less reliance on obtaining supplies from public tankers (a burden on the municipality as supplies are given free of charge) and reduce the incidence of the poor having to buy from private vendors at high cost (para 3.04). The tariffs referred to in para 6.13 are considered affordable. The current tariffs represent 0.7% of household income for the lowest income group and less than 2% for the middle income group. Future tariff increases, in real terms, are expected to fall mainly on the medium and high income groups and the 'pilot' metering program, referred to in paras 3.07 and 4.09, will provide the information for making such tariff adjustments as are necessary.

Risks and Safeguards

7.09 The main risks in the project will be the capacity of the KWSB to take over and effectively operate the production and distribution facilities from the former operators and the timely provision of funds for operations. The KWSB has had transferred to it almost all the trained staff and labor formerly employed by the KDA and the KMC on water service and the role and

development of the new authority was addressed in an institutional study completed in 1981 and its recommendations accepted for implementation. In the meantime, the KWSB has moved very rapidly on the installation of its computerized billing system and has identified areas where the 'pilot' metering program will be installed. For the present, the KMC is acting as revenue collection agency for KWSB and providing it the necessary financial support until such time as it can bill its own customers. The assistance provided by IDA on billing and collection will help accelerate this process.

7.10 The KDA will act as agency for KWSB for the execution of the major works under the project. The KDA is experienced in the design, tendering and building of works similar to those included in the project and delays in execution are not anticipated. The KWSB is now responsible for the entire water supply operation for which it has the financial backing of KMC. A project risk is that the target dates in the Action Plan, referred to in para 4.09, may slip resulting in the financial objectives not being met as projected. The review process is directed at minimizing this risk and the financial support KMC has agreed to provide KWSB will ensure that the new entity is operationally viable. The provision of consultant services to prepare and implement the project, and to assist with the billing and training of KWSB staff will minimize risk and ensure the objectives are met; accordingly the risks are rated as medium.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

8.01 During negotiations, agreement was reached with the GOP, the GOS, KMC and KWSB that:

(a) KWSB will discuss and review progress on the implementation of an agreed Action Plan satisfactory to IDA to improve operational, institutional and financial performance and enable KWSB to comply with, inter alia, the agreed financial targets, said Action Plan to be reviewed and updated annually between KWSB and IDA (para 4.09);

(b) KWSB will produce gross revenues sufficient to cover operating expenses and debt service requirements in each of the fiscal years beginning July 1, 1985 (paras 4.09 and 6.12);

(c) KWSB will produce internal funds equivalent to not less than 10% of KWSB's estimated capital expenditures for the fiscal year beginning July 1, 1986, not less

than 20% for the fiscal year beginning July 1, 1987 and not less than 30% thereafter (paras 4.09 and 6.12);

(d) KWSB will appoint consultants for project implementation as necessary (para 4.13);

(e) The subsidiary loan agreement will include terms and conditions as described (para 4.19);

(f) KWSB and KDA will report jointly on the project and KWSB will maintain records on progress with its operations (para 4.22); and

(g) KWSB and KDA will submit within six months from the end of each fiscal year, starting in fiscal year 1983/84, audited financial statements (para 5.16);

8.02 An additional condition of Credit effectiveness will be the signing of a subsidiary loan agreement, satisfactory to IDA, between the Government of Sind and the Karachi Metropolitan Corporation (para 4.19).

8.03 The proposed project constitutes a suitable basis for an IDA credit of to the Government of Pakistan of US$25.00 million.

PAKISTAN

KARACHI WATER SUPPLY AND SEWERAGE PROJECT

Additional Information in Project File

A1	Statistical Pocketbook of Pakistan
A2	Statistical Pocketbook of Sind
A3	National Conference on Drinking Water Supply, Islamabad 16-19 December 1981. Papers (10 volumes) on aspects of water supply and sanitation in Pakistan and conference recommendations.
A4	Pakistan Water Supply and Sanitation Sector Study (2 volumes) Karachi Metropolitan Water Supply and Sewerage Study (B1-B8): 1978 Consultants' Reports plus four volumes of drawings.
B1	Final Report: Text Part 1, Sources, Demand and Transportation
B2	Final Report: Text Part 2, Pumping, Filter Plants and Primary Distribution
B3	Final Report: Test Part 3, Secondary Distribution and Pipe Factory
B4	Final Report: Text Part 4, Cost Estmates, Sewerage and Procurement
B5	Final Report: Annexes Part 1 to Text Part 1
B6	Final Report: Annexes Part 2 to Text Part 2
B7	Final Report: Annexes Part 3 to Text Part 3
B8	Final Report: Annexes Part 4 to Text Part 4
B9	Special Report: Investigations for Mains Replacement
B9A	Special Report: Investigations for Mains Replacement (Annexes)
B10	Detailed Report for Rehabilitation of No. 1 Sewage Treatment Plant
B11	Karachi Metropolitan Corporation: Explanatory Memorandum 1981-82
B12	Karachi Metropolitan Corporation: Finance Facts and Figures 1981-82
B13	Karachi Consumer Water Supply Attitude Survey 1981
B14	Urban Water Systems: Karachi - A Case Study
B15	Karachi Water Management Board: Institutional Study, Volume 1
B16	Karachi Water Management Board: Institutional Study, Volume 2
B17	Hub Dam: Planning Report 1977
B18	KDA - Review Financial Performance Water Supply Operations
B19	KDA - Review Financial Performance Prestressed Pipe Factory
B20	Karachi - Review Financial Performance Municipal Operations
B21	KDA - Forecast of Revenue Requirements February 1978
B22	KDA - Report on Demand Estimates and Tariffs
B23	KDA - Review of Accounting and Financial Control Systems
B24	KDA - Report on a Review of Data Processing Requirements
B25	Appendices to B24
B26	Appendices to B22
B27	KDA - Review of Project and Monitoring Control System
B28	Appendices to B27
B29	KDA - Water Tariff Study 1979

PAKISTAN

KARACHI WATER SUPPLY PROJECT

ANNEX 1

Estimates and IDA Allocation

	Local	Foreign	Total	Local	Foreign	Total	Percentage Basis	Proposed Allocation of Credit Rs	Proposed Allocation of Credit US$
	--------Rs Million-----			-----US$ Million-------					
Item I - Civil Works									
Water Production (A)									
Canal Improvements	2.88	8.65	11.53	0.222	.665	0.887	75%	8.65	.665
Siphons (No. 14)	10.94	32.83	43.77	0.842	2.525	3.367	75%	32.83	2.525
Dhabeji Rising Main 72" dia.	5.75	17.26	23.01	0.442	1.328	1.770	75%	17.26	1.328
Dhabeji Pumping Station Alterations	0.10	0.29	0.39	0.007	0.023	0.030	75%	0.29	0.023
Dhabeji Electrical Conn.	1.19	3.54	4.73	0.091	0.272	0.363	75%	3.54	0.272
Pipri 25 MGD Clarifier	5.52	16.55	22.07	0.424	1.273	1.697	75%	16.55	1.273
Pipri Pumping Station	3.86	11.61	15.47	0.297	0.893	1.190	75%	11.61	0.893
Pipri Rising Main	1.80	5.41	7.21	0.139	0.416	0.555	75%	5.41	0.416
Pipri Electrical Connection	2.04	6.12	8.16	0.157	0.471	0.628	75%	6.12	0.471
Miscellaneous roads/services	1.66	4.98	6.64	0.128	0.383	0.511	75%	4.98	0.383
Subtotal (A)	35.74	107.24	142.98	2.749	8.249	10.998	75%	107.24	8.249
Distribution (B)									
Rehabilitation of Trunk Mains	10.94	32.76	43.70	0.841	2.520	3.361	75%	32.76	2.520
Meter Repair Workshop	0.51	1.53	2.04	0.039	0.118	0.157	75%	1.53	0.118
Installation Domestic Meters	0.19	0.60	0.79	0.015	0.046	0.061	75%	0.60	0.046
Subtotal (B)	11.64	34.89	46.53	0.895	2.684	3.579	75%	34.89	2.684
Subtotal I	47.38	142.13	189.51	3.644	10.933	14.577	75%	142.13	10.933
Item II - Equipment									
Water Production (A)									
Siphons (No. 14)	0.21	0.28	0.49	0.016	0.022	0.038	1/	0.28	0.022
Dhabeji Rising Main	16.63	17.59	34.22	1.279	1.353	2.632	1/	17.59	1.353
Dhabeji Pumping Station Alterations	2.78	4.36	7.14	0.214	0.335	0.549	1/	4.36	0.335
Pipri 25 MGD Clarifier	3.16	4.93	8.09	0.243	0.379	0.622	1/	4.93	0.379
Pipri Pumping Station	19.46	30.41	49.87	1.497	2.339	3.836	1/	30.41	2.339
Pipri Rising Main	1.27	1.99	3.26	0.098	0.153	0.251	1/	1.99	0.153
Miscellaneous Services	2.05	3.21	5.26	0.158	0.247	0.405	1/	3.21	0.247
Subtotal (A)	45.56	62.77	108.33	3.505	4.828	8.333	1/	62.77	4.828
Distribution (B)									
Rehabilitation of Trunk Mains	1.00	16.93	17.93	0.077	1.302	1.379	1/	16.93	1.302
Meter Repair & Calibration	0.72	1.62	2.34	0.055	0.125	0.180	1/	1.62	0.125
Domestic Meters (5000)	2.48	3.72	6.20	0.191	0.286	0.477	1/	3.72	0.286
Subtotal (B)	4.20	22.27	26.47	0.323	1.713	2.036	1/	22.27	1.713
Subtotal II	49.76	85.04	134.80	3.828	6.541	10.369	1/	85.04	6.541
Subtotal I & II (Base Cost at June 1983)	97.14	227.17	324.31	7.472	17.474	24.946	1/	227.17	17.474
Item III - Physical Contin.	13.50	28.15	41.65	1.039	2.165	3.204	1/	28.15	2.165
Item IV - Final design, Supervision, Admin.	13.99	11.55	25.54	1.076	0.889*	1.965	2/	11.55	0.889
Item V - Vehicles	1.09	3.29	4.38	0.084	0.253	0.337	1/	3.29	0.253
Item VI - Management & Organization Assistance	2.00	-	2.00	0.154	-	0.154	2/	2.00	0.154
Item VII - Preparation of Billing Record	3.00	-	3.00	0.231	-	0.231	2/	3.00	0.231
Item VIII- Manpower Training	0.80	0.50	1.30	0.062	0.038	0.100	2/	1.30	0.100
Item IX - Indus 5th Stage Feasibility Study	3.90	1.30	5.20	0.300	0.100	0.400	2/	5.20	0.400
Subtotal I-IX	141.42	271.96	407.38	10.418	20.919	31.337	-	281.66	21.666
Item X - Price Conting.	14.57	53.05	68.62	1.120	4.081	5.201	-	43.352	3.334
TOTAL	149.99	325.01	475.00	11.538	25.000	36.538	-	325.01	25.000

1/ 100% of c.i.f. foreign expenditure, 100% ex-factory, and 65% of goods procured locally.

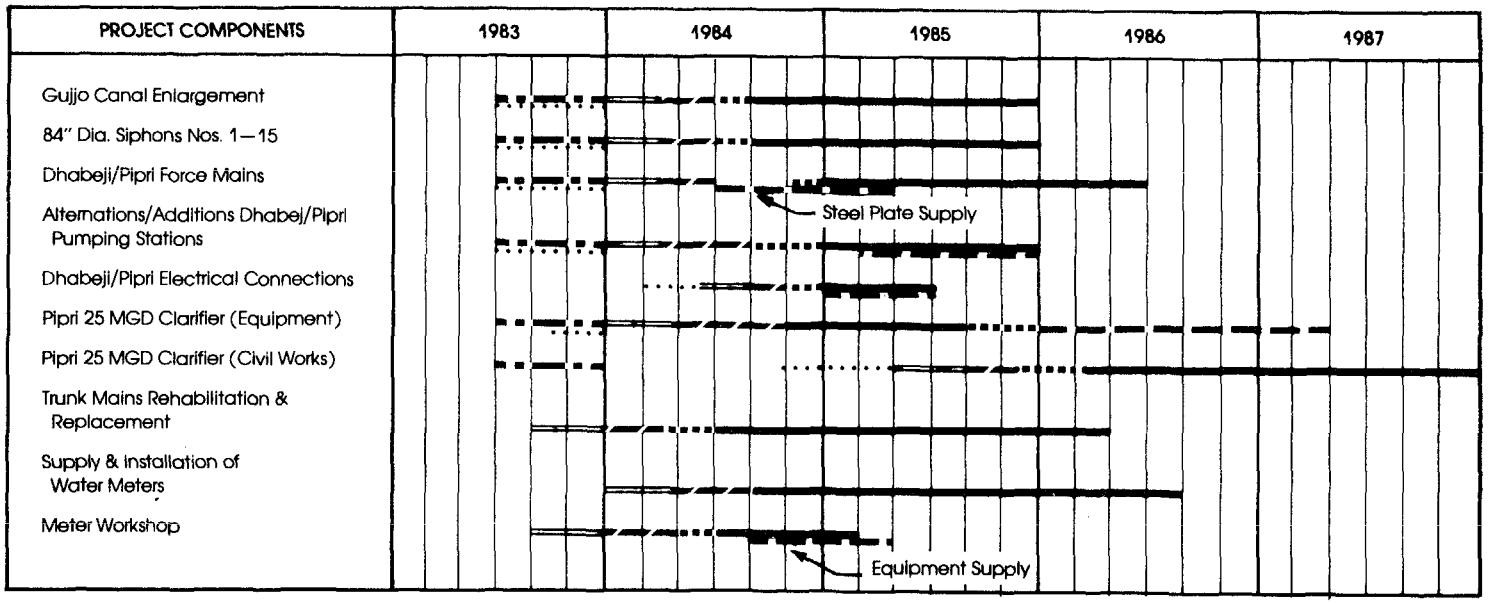
2/ 100% of local and foreign consultancy expenditures.

- Not Applicable.

* Includes Local.

ANNEX 2

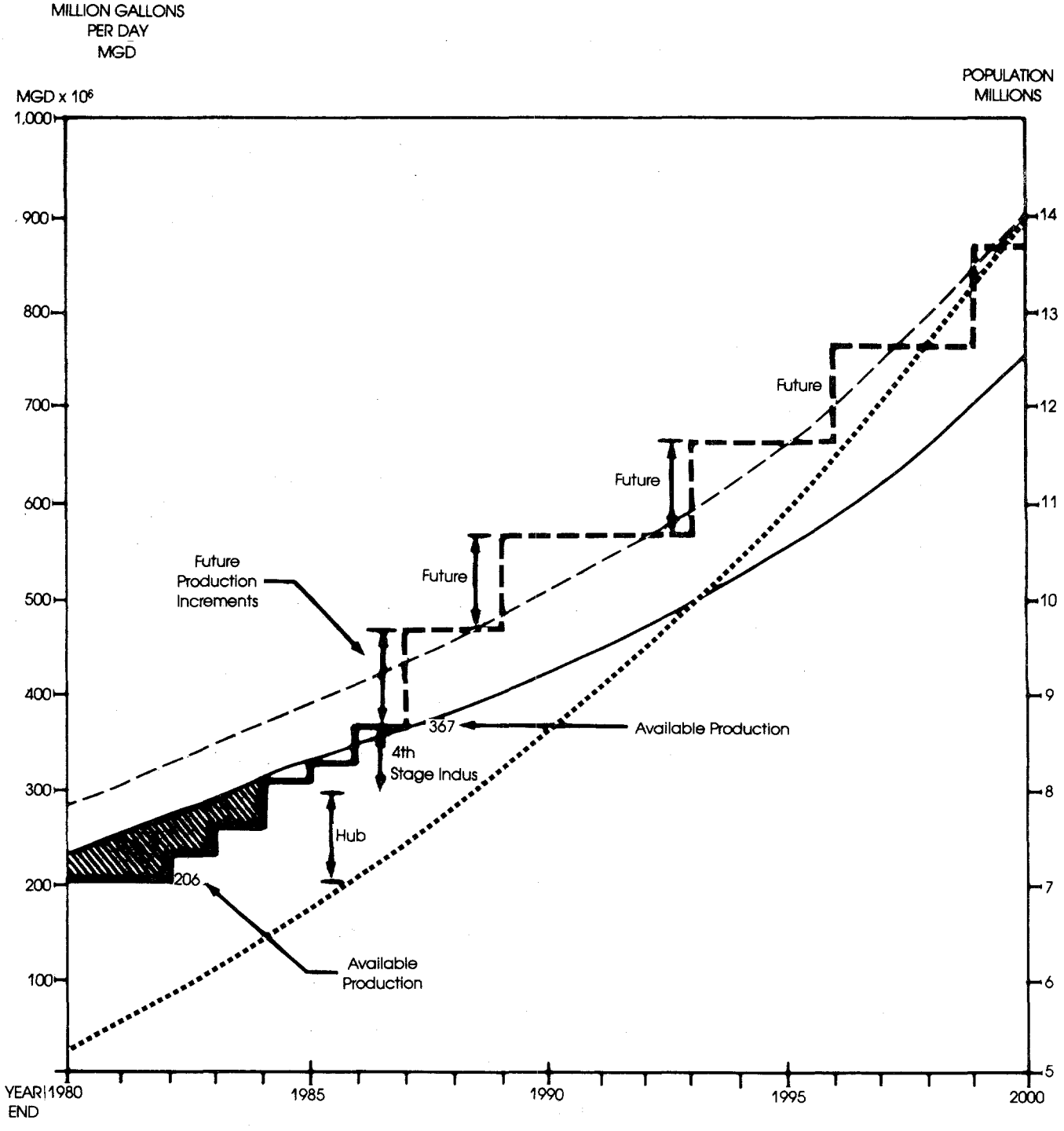
PAKISTAN
APPRAISAL OF KARACHI WATER SUPPLY PROJECT
Construction Schedule



Prequalification
Final Design
Bidding
Evaluation & Award
Mobilization
Construction/Supply
Equipment Erection

World Bank—24603

PAKISTAN
APPRAISAL OF THE KARACHI WATER SUPPLY PROJECT
Population, Production and Demand Projections



Deficit
MAXIMUM DAILY DEMAND 1.2 x AVERAGE
POPULATION PROJECTION
ESTIMATED AVERAGE DAILY DEMAND

January 1983
World Bank—24602

PAKISTAN

KARACHI WATER SUPPLY PROJECT

Monitoring Indicators

1. The following indicators will be monitored, on a quarterly basis, during and after the execution of the project to measure the achievement of the technical, financial and administrative goals set for this project. The beneficiary will be requested to include the required data in its Quarterly Progress Reports to IDA. In each case, figures will be shown for the quarter and the corresponding quarter one year earlier.

Physical Criteria

2. (a) Water Production

(i) average daily production from all sources for each month of the quarter;

(ii) total production during the quarter and a cumulative total production for the year;

(b) Water Quality

(i) chlorine residual leaving treatment plant. Daily/hourly frequency;

(ii) chlorine residual in the distribution area. Sampling pattern and frequency in accordance with WHO recommendations.

(iii) raw and finished water quality at each of the production facilities;

(c) Water Consumption

(i) metered consumption for each month of the quarter;

(ii) total metered consumption during the quarter and a cumulative total consumption for the year;

(iii) same as for (i) and (ii) except indicating volumes sold detailed as per consumer categories (domestic, standpipes, industry, trade and institutions).

(iv) estimate of unmetered consumption.

(d) Connections

(i) number of new connections (metered or unmetered) for the quarter;

(ii) cumulative total connections as above at end of quarter.

(e) Public Standpipes

(i) number of public standpipes in operation for the quarter;

(ii) cumulative total number of standpipes at end of quarter.

(f) Meters

(i) number of new meters installed during quarter and to end of quarter since beginning of installation program;

(ii) number of meters identified for repair or replacement during quarter and to end of quarter since beginning of repair program;

(iii) number of meters repaired or replaced during quarter and to end of quarter since beginning of repair program.

(g) Leaks

(i) number of major leaks investigated for repair during quarter and to end of quarter since beginning of repair program;

(ii) number of major leaks repaired during quarter and to end of quarter since beginning of repair program;

(iii) lengths and diameters of mains repaired or replaced during the quarter since beginning of repair program.

Staffing

3. The number of permanent employees at end of quarter detailed as follows:

(a) headquarters (top management, engineers, accountants and others);

(b) operational districts (management, engineers, accountants, operation and maintenance, metering and collection and others).

Financial Indicators

4. (a) average cost/1000 gals delivered;

(b) average water revenue per 1000 gals of water sold to connected consumers;

(c) estimated income per 1000 gals for water supplied to unmetered consumers;

(d) operating ratio;

(e) debt service ratio;

(f) value of accounts receivable at the end of quarter as a percentage of billing.

General Indicators

The following indicators relating to population and service level will be monitored on a yearly basis:

(a) total population of served area in Greater Karachi;

(b) population in urban areas;

(c) population in outlying supply areas;

(d) total population served by private connections in both urban and outlying areas;

(e) estimated total population served by public standpipes in total area.

ANNEX 5

PAKISTAN

KARACHI WATER SUPPLY PROJECT

Estimated Schedule of Disbursements

US$ '000

IDA Fiscal Year	Quarter Ending	Cumulative Disbursements
1984	September 30, 1983	-
	December 31, 1983	250
	March 31, 1984	700
	June 30, 1984	1,500
1985	September 30, 1984	2,500
	December 31, 1984	3,750
	March 31, 1985	4,800
	June 30, 1985	6,000
1986	September 30, 1985	7,200
	December 31, 1985	9,000
	March 31, 1986	11,250
	June 30, 1986	13,000
1987	September 30, 1986	15,000
	December 31, 1986	16,850
	March 31, 1987	18,500
	June 30, 1987	20,500
1988	September 30, 1987	21,000
	December 31, 1987	22,000
	March 31, 1988	23,000
	June 30, 1988	24,500
1989	September 30, 1988	24,800
	December 31, 1988	25,000

PAKISTAN

KARACHI WATER SUPPLY PROJECT

Feasibility Study for Fifth Stage
Development of the Indus Source

Outline Terms of Reference

Background

1. A diversion from the Indus River is Karachi's principal source of domestic water. This has been developed in stages and with the completion of Indus stage IV transmission, supplies will be met until about 1987; the total available water includes a supply from the Hub source, which became operational in 1982, and a few wells.

2. In anticipation of future demand, a new independent drinking water canal was completed in 1982. This makes available a considerable quantity of additional water at Gujjo a point about 45 miles east of Karachi. The transmission of this water (and its treatment) to the supply area constitutes the 5th stage of Indus development.

The Study

3. The study is proposed in two parts (i) an evaluation of the alternative methods of bringing the additional water to the growth points where it is needed and (ii) the preparation of preliminary designs and estimates and a phased program for its execution taking account of known budgetary constraints.

4. The study would be completed within 12 to 15 months and the result should enable the authorities to frame proposals suitable for attracting external financial assistance for orderly project implementation.

Part One

5. The new canal, referred in para 2, will make available a 335 MGD balance at Gujjo from where the current supply arrangements involve a raw water canal and conduit, with a high lift to three existing water treatment plants, a gravity line and secondary pumping. This part of the study will examine in detail the following matters:

(a) Growth in metropolitan Karachi and the probable future demand patterns on a district by district basis, including industry.

(b) The alternative methods of bringing supplies to the areas identified in (a) and an identification of the least cost solution using an appropriate discount rate.

(c) Solutions investigated should include low level transmission and high level pumping and the effect of each on the location of new treatment facilities and on existing and proposed pressure zones.

(d) Detailed analyses of the type of conduit to be used, evaluating the losses in an open, lined canal or enclosed conduit as factors in the capital and operating costs.

(e) Economic evaluation of proposed methods of water treatment using available information on current practices and the possibilities for installing processes amenable to treating water of generally low turbidity.

(f) A topographic survey of the proposed routing of the conveyance system to prove its viability including sufficient and adequate soils investigation.

(g) A review of the alternatives in both conveyance system and treatment facilities to enable staged development and construction.

(h) A comparison of the present value of the recommended system with the effect on the internal pumping and storage arrangements for effective operation of the entire distribution system.

(i) The need for, or the desirability of, physically integrating the proposals with the existing conveyance and water production treatment facilities.

This phase should result in a comprehensive report accompanied by drawings and other relevant information to enable the water supply authority to decide on the adoption of a project which will meet the future demand of its consumers.

Part Two

6. The preparation of the study in part one will be subject to periodic review. This will ensure that the final recommendations of the consultant are closely aligned with the client's requirements and will enable the consultant to proceed to preliminary final designs which will include the following as Part Two:

(a) Preliminary engineering designs of the agreed components to be included in the project.

(b) Structural and hydraulic design of the components and drawings and diagrams sufficiently detailed as to allow quantities to be taken off and estimates prepared.

(c) A detailed estimate of the project with allowances for physical contingencies and price escalation over the period of construction; and

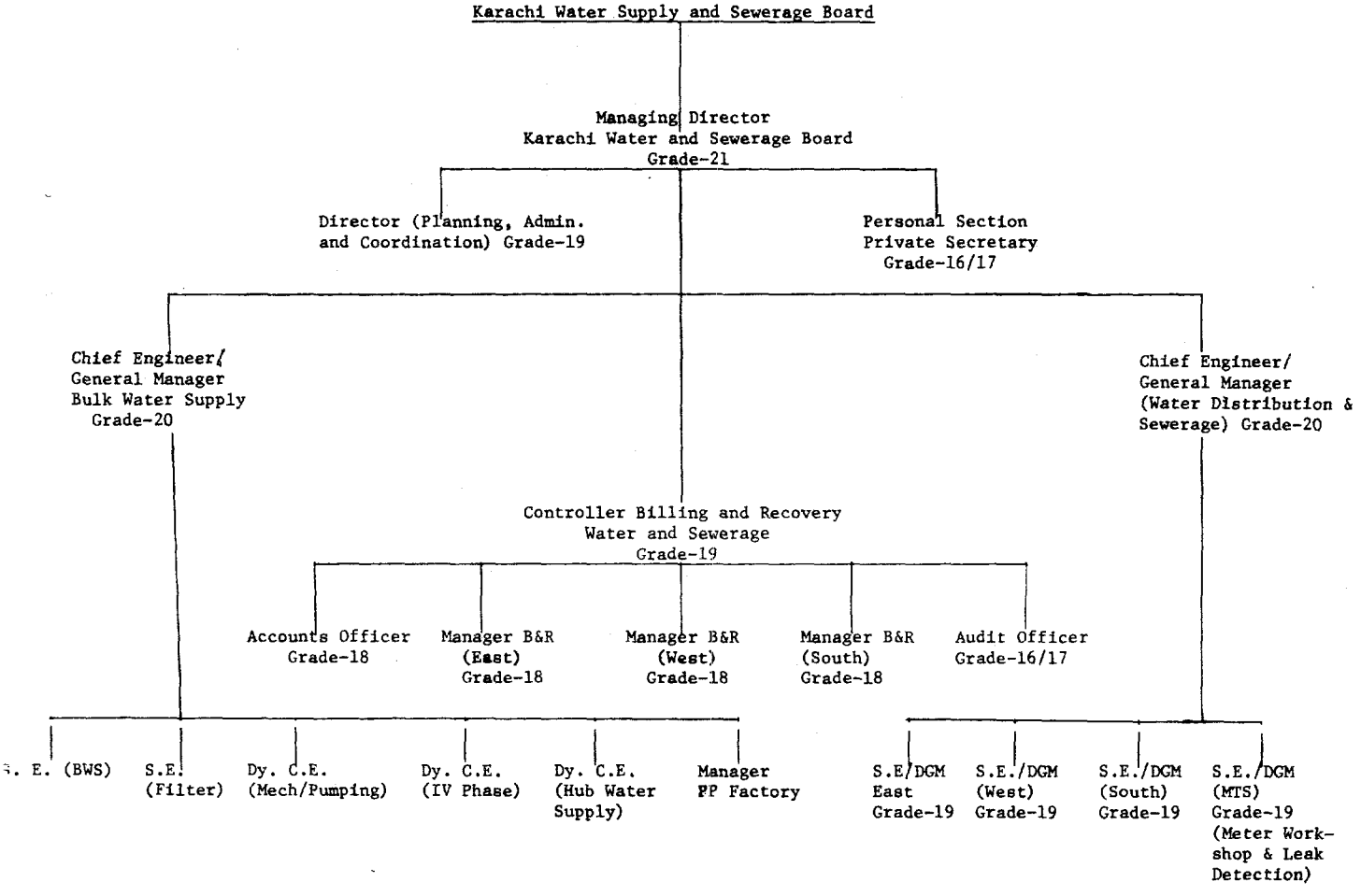
(d) An implementation plan together with a conception report to be used as the basis for approaching external agencies for financial assistance and would include an appropriate presentation on the financial aspects of the project.

PAKISTAN

ANNEX 7

KARACHI WATER SUPPLY PROJECT

Karachi Water Supply and Sewerage Board



PAKISTAN

KARACHI WATER SUPPLY PROJECT

Assumptions for Financial Projections

Financial projections for KWSB have been prepared on the basis of estimated consolidated proforma balance sheets and income and expenditure statements of two of the entities whose activities will be transferred to KWSB, namely KWMB and the water wing of KDA. Sewerage is excluded.

A. INCOME STATEMENTS

1. Production

(a) Hub supply starts: 1982/83 with 43 MGD; i.e. 5 months at 50 MGD plus 3 months at 89 MGD. In all following years 89 MGD would be supplied.

(b) The final phase of Indus 4 starts supply in 1984/85 with an additional 12 MGD, in 1985/86 a futher 37 MGD and in 1986/87 a further 11 MGD. An additional 12 MGD is provided from Dumlotti wells and other sources in 1986/87.

2. Losses

Decrease by 2% in 1982/83 and by about 1% per annum thereafter. By 1990 loss savings are providing an additional 28 MGD.

3. Consumption

Additional water goes mainly to metered consumers, whose share of consumption increases as repair of bulk meters and the pilot metering program increases the share of water being metered, which by 1990 will be about 50%.

4. Revenue

Revenue from floor area tariffs increases by 5% per annum as a result of additional connections (population growth). In 1983/84 and 1984/85 revenue from this category increases by a further 30% per annum due to improved billing and collections.

(a) On July 1, 1985, all tariffs increase by 40%.

(b) Thereafter, all tariffs increase by 7% per annum.

5. Production Costs

(a) Variable production costs consist of (i) operating staff pay, (ii) fuel and power and (iii) chemicals. These vary directly with the volume of water produced, while the unit cost is assumed to increase by 8% per annum due to inflation.

(b) Hub water cost varies directly with the volume purchased from WAPDA at Rs 1.75 per 000 gals.

(c) Fixed establishment costs include repairs and maintenance and are assumed to increase by 8% per annum.

(d) Depreciation is based on asset lives.

6. Distribution Costs

(a) Variable distribution costs consist of repair and maintenance and fuel and power, these vary directly with the volume of water consumed, while the unit cost is assumed to increase by 8% per annum due to inflation.

(b) Fixed establishment costs include all personnel and are assumed to increase by 8% per annum due to inflation. Implicitly, efficiency is assumed to improve, as there is no increase in staff as a result of increased consumption.

(c) Depreciation is based on asset lives.

B. SOURCES AND APPLICATIONS OF FUNDS STATEMENTS

1. Sources

(a) Loans, which include financing of interest during grace periods, represent borrowings from the Provincial Government for the IDA project, the Hub Phase I project and part of the Hub Phase II and Indus V projects.

(b) Grants from KMC will be necessary in FYs 83 to 85 to cover part of the deficits arising from operating and debt service requirements and to maintain a minimum cash balance equivalent to approximately one month's operating expenses.

2. Applications

(c) Investments represent the planned phasing of the IDA and Hub Phase I projects, with more tentative estimates of the Hub Phase II and Indus V projects.

(d) Interest during construction is capitalized.

(e) Debt service represents interest and principal repayments on existing debt and on new debt to be incurred for planned projects.

(f) Increase/(Decrease) in working capital represents the change in net current assets other than cash (see Balance Sheet).

C. BALANCE SHEETS

1. Opening Balance Sheet

Balance sheets were prepared by consultants for the previous operating entities and consolidated balance sheets have been prepared on the basis of the consultants' estimates. These estimates are considered as being indicative only while the actual opening balance sheet of the newly formed KWSB is being prepared by an independent firm of chartered accountants.

2. Fixed Assets

Fixed assets used in the water supply operations are valued at cost plus additions at cost including capitalized interest during construction. Plant is transferred from work in progress to fixed assets in operation when commissioned.

3. Curent Assets and Liabilities

(a) Cash is maintained at a minimum level of approximately one month's operating expenses, which requires subsidies from KMC in FYs 83 to 85.

(b) Accounts receivable increase in absolute terms but as a proportion of gross revenues decrease gradually from the present level of about six months' billings to two and one-half months' billings by FY 1990 as billing and collection procedures are improved under the action plan.

(c) Inventories increase by 10% per annum.

(d) Other current assets, which represent mainly receivables from the Urban Development wing of KDA, remain unchanged pending settlement of these items.

(e) Current liabilities are assumed to increase in absolute terms but as a proportion of external expenses decrease gradually from their present level as the time lag in payments to suppliers is reduced.

4. Equity and Liabilities

(a) Equity includes debentures in FY 83 and thereafter and also grants from KMC.

(b) Long term debt consists of existing borowings plus future borrowings less principal repayments.

PAKISTAN

KFIN6
M175
APRIL13

KARACHI WATER SUPPLY PROJECT
KARACHI WATER AND SEWERAGE BOARD
INCOME AND EXPENDITURE STATEMENTS (RS.MN.)

	--ACTUAL----		-EST-	----------FORECAST------						
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
INDUS PRODUCTION MGD	206.00	206.00	206.00	206.00	218.00	255.00	278.00	278.00	278.00	278.00
HUB MGD	0.00	0.00	43.00	89.00	89.00	89.00	89.00	89.00	89.00	89.00
TOTAL PRODUCTION MGD	206.00	206.00	249.00	295.00	307.00	344.00	367.00	367.00	367.00	367.00
LOSS %	30.00	30.00	28.00	27.00	26.00	25.00	24.00	24.00	23.00	22.00
CONSUMPTION MGD	144.20	144.20	179.28	215.35	227.18	258.00	278.92	278.92	282.59	286.26
OF WHICH:										
DOMESTIC METERED %	16.00	17.00	18.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00
INDUSTRIAL METERED %	11.00	12.00	13.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00
FLOOR AREA TARIFF %	73.00	71.00	69.00	61.00	59.00	57.00	55.00	53.00	51.00	49.00
ANNUAL CONSUMPTION:										
DOMESTIC METERED,BGY	8.42	8.95	11.78	18.08	19.90	23.54	26.47	27.49	28.88	30.30
INDUSTRIAL,BGY	5.79	6.32	8.51	12.58	14.10	16.95	19.34	20.36	21.66	22.99
FLOOR AREA,BGY	38.42	37.37	45.15	47.95	48.92	53.68	55.99	53.96	52.60	51.20
TOTAL CONSUMPTION,BGY	52.63	52.63	65.44	78.60	82.92	94.17	101.81	101.81	103.15	104.48
METERED TARIFFS:										
DOMESTIC PER 000GAL	1.96	1.96	4.50	4.50	4.50	6.50	6.90	7.40	8.00	8.50
INDUSTRIAL PER 000GAL	4.50	4.50	6.00	6.00	6.00	8.50	9.10	9.70	10.50	11.10
DOMESTIC METRD REVENU	15.68	16.66	50.35	78.91	86.87	148.44	177.16	197.31	228.74	254.98
INDUSTRIAL REVENUE	24.75	27.00	48.49	73.19	82.04	139.76	170.65	191.58	225.16	252.60
FLOOR AREA TARIFF REV	30.90	72.20	82.70	112.89	154.09	226.51	254.48	285.91	321.22	360.89
TOTAL REVENUE	71.33	115.86	181.54	264.99	323.00	514.70	602.29	674.80	775.12	868.47
PRODUCTION COST:										
VARIABLE COST 000GAL	0.65	1.12	1.24	1.25	1.35	1.46	1.57	1.70	1.84	1.98
VARIABLE COST	48.87	84.21	112.70	134.59	151.27	183.07	210.93	227.81	246.03	265.71
HUB WATER COST			27.47	56.85	56.85	56.85	56.85	56.85	56.85	56.85
FIXED ESTABLISHMENT	50	62.12	74.23	75.5	81.54	88.06	95.11	102.72	110.93	119.81
DEPRECIATION	14.73	19.89	27.63	31.13	32.43	36.13	40.13	42.13	44.13	47.13
TOTAL PRODUCTION COST	113.60	166.22	242.02	298.08	322.10	364.11	403.02	429.50	457.95	489.50
DISTRIBUTION COST:										
VARIABLE COST 000GAL	0.38	0.41	0.44	0.48	0.52	0.56	0.60	0.65	0.70	0.76
VARIABLE COST	20.00	21.60	29.00	37.63	42.87	52.58	61.39	66.30	72.55	79.37
FIXED EESTABLISHMENT	35.40	38.23	41.29	44.59	48.16	52.01	56.18	60.67	65.52	70.76
DEPRECIATION	4.32	5.28	7.85	10.85	11.31	13.33	15.36	15.36	17.15	18.95
TOTAL DISTRIBUTION	59.72	65.11	78.14	93.07	102.34	117.92	132.93	142.33	155.22	169.08
TOTAL OPERATING COST	173.32	231.34	320.17	391.15	424.44	482.04	535.95	571.83	613.17	658.59
SURPLUS /DEFICIT	-102	-115	-139	-126	-101.4	32.67	66.35	102.96	161.95	209.89
INTEREST	15.13	15.76	28.94	27.68	26.30	51.60	54.27	80.68	110.89	117.78
NET INCOME	-117.1	-131.2	-167.6	-153.8	-127.7	-18.93	12.074	22.284	51.062	92.109
Rate of Return %	-11.85	-11.89	-13.25	-11.01	-8.01	2.34	4.31	6.31	9.41	11.46

KARACHI WATER SUPPLY PROJECT

KARACHI WATER SUPPLY AND SEWERAGE BOARD
SOURCES AND APPLICATIONS OF FUNDS STATEMENTS (RS.MN.)

	ACTUAL		ESTIMATED	FORECAST						
YEARS ENDING JUNE 30	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
SOURCES:										
OPERATING SURPLUS	-102.0	-115.5	-138.6	-126.2	-101.4	32.668	66.346	102.96	161.95	209.89
DEPRECIATION	19.05	25.17	35.48	41.98	43.74	49.46	55.49	57.49	61.28	66.08
INTERNAL CASH FLOW	-82.94	-90.30	-103.1	-84.17	-57.69	82.13	121.84	160.46	223.24	275.97
LOANS		539.43	110.27	141.89	163.62	176.87	167.32	131.98	101.35	137.40
GRANTS FROM KMC			50.00	130.00	100.00					
TOTAL SOURCES	-82.94	449.13	57.12	187.72	205.92	259.00	289.16	292.43	324.58	413.37
APPLICATIONS:										
IDA PROJECT				77.00	131.50	153.00	94.00	19.50		
HUB PHASE 1			110.27	50.00						
HUB PHASE 2							70.00	100.00	90.00	63.00
INDUS 5									50.00	100.00
OTHER PROJECTS		135.00								
TOTAL INVESTMENT		135.00	110.27	127.00	131.50	153.00	164.00	119.50	140.00	163.00
INTEREST DURING CONS				14.89	32.12	23.87	38.32	28.48	11.35	14.40
DEBT SERVICE:										
INTEREST	15.13	15.76	28.94	27.68	26.30	51.60	54.27	80.68	110.89	117.78
PRINCIPAL	25.00	28.13	13.95	15.21	16.59	22.85	25.18	26.12	38.40	38.46
TOTAL DEBT SERVICE	40.13	43.89	42.89	42.89	42.89	74.45	79.45	106.80	149.29	156.24
INCREASE/(DECREASE) IN WORKING CAPITAL		197.10	3.51	1.27	3.19	7.12	9.89	5.98	6.83	2.70
TOTAL APPLICATIONS	40.13	375.99	156.67	186.05	209.70	258.43	291.66	260.76	307.47	336.34
NET CASH FLOW	-123.1	73.136	-99.54	1.67	-3.78	0.56	-2.50	31.68	17.11	77.03
Debt Service Cover	-2.07	-2.06	-2.40	-1.96	-1.35	1.10	1.53	1.50	1.50	1.77
Internal Funds Flow	-123.1	-331.3	-149.5	-128.3	-103.8	0.56	32.50	47.68	67.11	117.03
Contrib to Invest %				-92.60	-64.54	0.31	18.49	28.51	42.23	71.20

KARACHI WATER SUPPLY PROJECT

KARACHI WATER SUPPLY AND SEWERAGE BOARD
BALANCE SHEETS (RS.MN.)

AS AT JUNE 30	ACTUAL 1981	ACTUAL 1982	ESTIMATED 1983	ESTIMATED 1984	FORECAST 1985	FORECAST 1986	FORECAST 1987	FORECAST 1988	FORECAST 1989	FORECAST 1990
ASSETS:										
FIXED ASSETS	1099.1	1234.1	1234.1	1409.3	1474.3	1659.3	1859.3	1959.3	2059.3	2209.3
LESS DEPRECIATION	238.41	262.69	298.17	340.15	383.90	433.36	488.85	546.35	607.63	673.71
NET PLANT IN OPERATN	860.69	971.41	935.93	1069.1	1090.4	1225.9	1370.4	1412.9	1451.6	1535.5
W.I.P.	0.00	0.00	110.27	77.00	175.62	167.48	169.80	217.78	269.13	296.53
NET FIXED ASSETS	860.69	971.41	1046.2	1146.1	1266.0	1393.4	1540.2	1630.7	1720.8	1832.1
CURRENT ASSETS:										
CASH	61.65	134.79	35.24	36.91	33.14	33.70	31.20	62.87	79.99	157.02
ACCOUNTS RECEIVABLE	29.88	84.53	90.77	106.00	113.05	133.82	150.57	161.95	174.40	182.38
INVENTORIES	26.59	24.65	27.12	29.83	32.81	36.09	39.70	43.67	48.04	52.84
OTHER	694.03	390.03	390.03	390.03	390.03	390.03	390.03	390.03	390.03	390.03
TOTAL CURRENT ASSETS	812.15	634.00	543.16	562.77	569.02	593.64	611.50	658.52	692.46	782.27
LESS:										
CURRENT LIABILITIES	577.07	222.55	227.75	244.41	251.26	268.19	278.66	288.03	298.02	308.10
NET CURRENT ASSETS	235.08	411.45	315.41	318.35	317.77	325.45	332.84	370.49	394.44	474.17
TOTAL NET ASSETS	1095.8	1382.8	1361.6	1464.4	1583.7	1718.8	1873.0	2001.2	2115.2	2306.2
EQUITY & LIABILITIES:										
EQUITY \1	392.77	393.67	1298.9	1428.9	1528.9	1528.9	1528.9	1528.9	1528.9	1528.9
SURPLUS	0.00	-131.2	-298.8	-452.6	-580.4	-599.3	-587.2	-564.9	-513.9	-421.8
TOTAL	392.77	262.44	1000.0	976.21	948.48	929.54	941.62	963.90	1015.0	1107.1
LONG TERM DEBT	703.00	1120.4	361.53	488.21	635.23	789.25	931.40	1037.3	1100.2	1199.1
TOTAL EQUITY & DEBT	1095.8	1382.8	1361.6	1464.4	1583.7	1718.8	1873.0	2001.2	2115.2	2306.2
Debt %	64.16	81.02	26.55	33.34	40.11	45.92	49.73	51.83	52.01	52.00
/Equity Ratio %	35.84	18.98	73.45	66.66	59.89	54.08	50.27	48.17	47.99	48.00

Note: \1 Equity includes Debentures in FY 83 and after and also grants from KMC.
\2 Fixed Assets include capitalised interest during construction

PAKISTAN

KARACHI WATER SUPPLY PROJECT

Present Retail Tariff Structure - KWSB

		Rs Per Month
I.	Unmetered	
A.	Residential - Covered Area Tariff	
	1. Property With Water Connection	
	Ground Floor Square Yards:	
	Up to 60	6.00
	61 to 120	8.25
	121 to 200	12.00
	201 to 300	18.00
	301 to 400	25.00
	401 to 600	35.00
	601 to 1000	50.00
	1001 to 1500	100.00
	1501 to 2000	125.00
	2001 to above	150.00
	Each Additional Floor	50% of ground floor 4.00
	2. Property Without Water Connection	
	3. Flats - with water connection	
	Up to 500 square feet	8.25
	501 to 800	12.00
	801 to 1000	15.00
	1001 to 1200	20.00
	1201 to 1500	30.00
	1500 to 1800	50.00
	1801 and above	60.00
B.	Commercial and Industrial	
	1. Property Without Water Connection	6 1/2% ARV
	2. Property With Water Connection	9% ARV
II.	Metered	
A.	Industrial, commercial and agricultural per 1,000 gallons	6.00
B.	Domestic, per 1,000 gallons	4.50

PAKISTAN

LRMCOW
N30

KARACHI WATER SUPPLY PROJECT
AVERAGE INCREMENTAL COST OF WATER

YEAR	CAPITAL COST RS.MN.	OPCOST RS.1.75 PER 000 GALLONS	REHAB &DISTR RS.MN.	TOTAL RS.MN.	NEW WATER MGD	WATER AVAILABLE %	WATER AVAILABLE MGD	OLD WATER(295) LOSS %	OLD WATER(295) REDUCTION MGD	TOTAL ADDTL MGD	TOTAL ADDTL MGY	ADDTNL REVENUE RS.MN.	NETCASH FLOW RS.MN.
									295				
1983						72							
1984	125		25	150		73		1	2.95	2.95	1076.8	3.9301	-146.1
1985	125	8	50	183	12	74	8.88	2	5.9	14.78	5394.7	19.691	-163.3
1986	28	31	25	84	49	75	36.75	3	8.85	45.6	16644	60.751	-23.25
1987		38	5	43	60	76	45.6	4	11.8	57.4	20951	76.471	33.471
1988		38	5	43		76	45.6	4	11.8	57.4	20951	76.471	33.471
1989		38	5	43		77	46.2	5	14.75	60.95	22247	81.201	38.201
1990		38	5	43		78	46.8	6	17.7	64.5	23543	85.930	42.930
1991		38	5	43		78	46.8	6	17.7	64.5	23543	85.930	42.930
1992		38	5	43		78	46.8	6	17.7	64.5	23543	85.930	42.930
1993		38	5	43		79	47.4	7	20.65	68.05	24838	90.660	47.660
1994		38	5	43		80	48	8	23.6	71.6	26134	95.389	52.389
1995		38	5	43		80	48	8	23.6	71.6	26134	95.389	52.389
1996		38	5	43		80.4	48.24	8.4	24.78	73.02	26652	97.281	54.281
1997		38	5	43		81	48.6	9	26.55	75.15	27430	100.12	57.119
1998		38	5	43		81.2	48.72	9.2	27.14	75.86	27689	101.06	58.064
1999		38	5	43		81.6	48.96	9.6	28.32	77.28	28207	102.96	59.956
2000		38	5	43		82	49.2	10	29.5	78.7	28726	104.85	61.848
												0	
DISCOUNT RATE				.1							.1	.1	.1
NET PRESENT VALUE				647.58							166456	607.56	-40.01
AVERAGE INCREMENTAL COSTOOOG				3.8904									
ECONOMIC RATE OF RETURN %													8.2049

IBRD 16904R
MAY 1983

PAKISTAN
KARACHI WATER SUPPLY PROJECT
PROPOSED EXPANSION OF WATER SUPPLY FACILITIES