THE ISLAMIC REPUBLIC OF PAKISTAN
CAPITAL DEVELOPMENT AUTHORITY

THE REGIONAL STUDY
FOR
WATER RESOURCES DEVELOPMENT POTENTIAL
FOR
THE METROPOLITAN AREA
OF
ISLAMABAD-RAWALPINDI

APPENDIX E
(IMPLEMENTATION AND COST ESTIMATES)

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(MINUTES OF MEETINGS AND COUNTERPART PERSONNEL)

FEBRUARY 1988

JAPAN INTERNATIONAL COOPERATION AGENCY

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APPENDIX E.

IMPLEMENTATION AND COST ESTIMATES

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E.1. Implementation Programmes

The Project will be implemented under a staged development plan. The staged development plan of the water resources in the Metropolitan area should be established taking into account the water demand of respective sectors, economic standpoint of facility construction and other social infrastructures related. The project would be implemented over a 43-year period, starting in 1988 with implementation of the first phase being followed by the second phase in 2001 and the third phase in 2011 to end in 2030. The phase-wise, facility-wise plans of water resources development are tabulated in Table E-1-1.

Around 100 MCM of the developed volume from tubewell sources as of 1987 includes 40 MCM of groundwater for both Wah and Taxila industrial complexes. Total volumes of 83.6 MCM from diversion dam in the year of 2000 consist of 77.2 MCM of irrigation water and 6.4 MCM for urban water supply.

As can be judged from Table E-1-1, most of the water resources to be developed are storage water from the main river and its tributaries. The shares of new storage water to those of total are about 81.4 percent. Technology of the dam planning and designing aspect as well as construction supervision in Pakistan is at a quite high level with many experiences, especially in Water and Power Development Authority. The schemes recommended in the report are rather on a preliminary study basis. The detailed investigations, survey, analysis and designing, therefore, should be carried out before the commencement of dam construction. The said comprehensive high technology shall be transferred from WAPDA to the implementing agencies concerned gradually based on the development time schedule.

Another important aspect to be considered is effective utilization of limited water resources. The allocation of river discharge in the Haro river basin, especially, is comparatively more

complicated than in other river basins. The negotiation among beneficiaries concerned for the development scheme shall be done smoothly in accordance with the laws and regulations of the country and comprehensive plan on the water resources development availability.

Table E-1-1. Water Sources-Wise Development Plan

(unit : MCM)

Water Resources	Developed As of 1987	2000	2010	2030	Total
A. Storage Dam					
Simly Dam	34.7	18.1	-	-	52.8
Rawal Dam	35.0	2.2	-	-	37.2
Khanpur Dam	66.8	93.2	-	-	160.0
D-1 Dam	-	-	-	107.0	107.0
H-4 Dam	-		-	80.0	80.0
Shahpur Dam	-	-	17.3	-	17.3
S-1 Dam	-	60.0	-	-	60.0
L-1 Dam	-	-	-	70.0	70.0
KL-1 Dam	-	-	34.0	-	34.0
SL-1 Dam	-	-	40.0	-	40.0
Sub-total	136.5	173.5	91.3	257.0	658.3
B. Diversion Dam					
Head Works (Islam.)	15.1	6.4	-	-	21.5
JW-1 D.D.	-	70.8	-	-	70.8
SW-3 D.D.	-	6.4	-	-	6.4
Sub-total	15.1	83.6	-	-	98.7
C. Tubewell/Spring					
Tubewells(Wah.Tax.)	40.2	7.1	-	-	47.3
Ditto (Islam.)	23.5	11.3	4.5	-	39.3
Ditto (R'pindi)	35.6	10.2	-	-	45.8
Ditto (Airport)	-	0.8	0.9	0.8	2.5
Sub-total	99.3	29.4	5.4	0.8	134.9
Total (A + B + C)	250.9	286.5	96.7	257.8	891.9

E.2. Investment Cost Estimates

The total investment costs which consist of construction cost, land acquisition, office facility, administration/engineering, physical contingencies and the cost of terminal facility are estimated at Rs.16,500 million, of which Rs.5,340 million is for the first phase, Rs.2,200 million for the second phase, Rs.8,960 million for the third phase. The phase-wise, facility-wise investment costs to be required are tabulated in Table E-2-1.

The construction costs for the development of water resources are estimated at Rs.9,652.6 million. Out of it, Rs.4,218.7 million or 43.7 percent will be catered for by foreign exchange component, and the remaining Rs.5,433.9 million or 56.3 percent will be met by local currency. The source-wise, facility-wise construction costs for water resources development facilities are shown in Table E-2-2.

Table E-2-1. Phase-Wise Investment Cost

(unit: Rs. million)

Facility Code	First Phase (1988-2000)	Second Phase (2001-2010)	Third Phase (2011-2030)
A. Construction Cost			
A.1. Storage Dam			
D - 1	-	-	1,166.6
H - 4	-	-	1,645.3
SL- 1	-	415.0	-
S - 1	381.5	-	-
L - 1	-	-	1,575.9
KL- 1	-	303.4	-
Shahpur	-	60.0	-
Sub-total	381.5	778.4	4,387.8
A.2. Head Work			
Dw - 1	-	-	74.1
Jw - 1	27.2	-	-
Sw - 3	1.0	-	-
Ki - 2 (Intake)	-	-	56.8
Sub-total	28.2	-	130.9
A.3. Lifting Pump			
Jp - 1	116.1	-	-
Np - 1	-	73.3	-
Kcp - 1	193.5	-	-
Kcp - 2	186.0	-	-
SLp - 1	-	70.5	-
LP - 1	-	-	111.5
KLp - 1	-	50.5	-
Sip - 1	33.0	-	-
Sub-total	528.6	194.3	111.5
A.4. Conduction			
Dc - 1	-	-	225.8
Kc - 2	13.6	-	-
Kc - 4	119.6	-	-
Kc - 6	256.0	-	-
Kc - 8	-	-	4.8
Kp - 1	-	-	476.7
Jc - 1	460.7	-	-
Nc - 1	-	22.0	-
Kc - 5	406.9	-	-
SLc- 1	-	77.0	-
Sc - 1	71.3	-	-
Rc - 2	161.0	-	-
Lc - 1	-	-	280.0
KLc- 1	-	34.8	-
Sub-total	1,489.1	133.8	987.3

Facility Code	First Phase (1988-2000)	Second Phase (2001-2010)	Third Phase (2011-2030)
A.5. Expansion Works			
Existing Head Work	62.5	-	-
Simply Dam	354.7	-	-
Rawal Filtration P.	48.0	-	-
Tubewell (Islamabad)	17.9	-	-
Tubewell (Rawalpindi)	14.5	-	-
Sub-total	497.6	-	-
A.6. Airport Water (T.W)	1.2	1.3	1.1
Total (1 to 6)	2,926.2	1,107.8	5,618.6
B. Land Acquisition			
B.1. Storage Dam	33.1	17.1	56.1
B.2. Conduction	30.2	2.2	19.7
Total (1 to 2)	63.3	19.3	75.8
C. Office Facility	15.0	4.7	28.3
D. Engineering/Admin.	295.2	91.2	538.2
E. Physical Contingencies	329.3	122.0	625.1
Total (A to E)	3,629.0	1,345.0	6,886.0
F. Terminal Facility			
F.1. Urban Water Supply	1,378.2	726.9	2,009.6
F.2. Irrigation	328.7	123.6	60.3
F.3. Airport Water	4.1	4.5	4.1
Sub-total	1,711.0	855.0	2,074.0
Grand-Total (A to F)	5,340.0	2,200.0	8,960.0

Table E-2-2. Source-Wise Construction Costs for Water Resources Development Facilities

(unit: Rs.milion)

Code	Name of Facility	Construction Cost		
		Foreign C	Local C	Total
A.	Dor River Basin			
D-1	storage dam	359.0	807.6	1,166.6
Dw-1	head work	39.3	34.8	74.1
Dc-1	conduction	85.8	140.0	225.8
	Total	484.1	982.4	1,466.5
B.	Haro River Basin			
H-4	storage dam	502.0	1,143.3	1,645.3
	Shahpur dam heightening	34.0	26.0	60.0
	Sub-total	536.0	1,169.3	1,705.3
Ki-2	intake tower	30.1	26.7	56.8
Jw-1	head work	14.4	12.8	27.2
	Sub-total	44.5	39.5	84.0
Jp-1	lifting pump	60.7	55.4	116.1
Np-1	"	38.3	35.0	73.3
Kcp-1	"	101.2	92.3	193.5
	Sub-total	200.2	182.7	382.9
Kc-4	conduction	45.5	74.2	119.6
Kc-8	"	1.8	3.0	4.8
Kp-1	"	175.4	301.3	476.7
Jc-1	" (incl. reg. pond)	198.7	262.0	460.7
Nc-1	"	9.8	12.2	22.0
Kc-6	"	94.2	161.8	256.0
Kc-2	"	6.8	6.8	13.6
	Sub-total	532.1	821.3	1,353.4
	Total	1,312.8	2,212.8	3,525.6
C.	Soan River Basin			
SL-1	storage dam	234.0	181.0	415.0
S-1	"	160.0	221.5	381.5
L-1	"	885.0	690.9	1,575.9
KL-1	"	176.0	127.4	303.4
	Sub-total	1,455.0	1,220.8	2,675.8
Sw-3	head work	-	1.0	1.0
	Sub-total	-	1.0	1.0
Kcp-2	lifting pump	97.2	88.8	186.0
SLp-1	"	36.9	33.6	70.5
Lp-1	"	58.3	53.2	111.5
KLp-1	"	26.4	24.1	50.5
Sip-1	"	17.3	15.7	33.0
	Sub-total	236.1	215.4	451.5

Code	Name of Facility	Construction Cost		
		Foreign C	Local C	Total
Kc-5	conduction	158.5	248.4	406.9
SLc-1	"	28.3	48.7	77.0
Sc-1	"	31.7	39.6	71.3
Rc-2	"	71.6	89.4	161.0
Lc-1	"	103.0	177.0	280.0
KLc-1	"	12.8	22.0	34.8
	Sub-total	405.9	625.1	1,031.0
	Improvement of existing H.W.	34.4	28.1	62.5
	Expansion of Simly dam	248.3	106.4	345.7
	Expansion of Rawal F.P	24.0	24.0	48.0
	Sub-total	306.7	158.5	465.2
	Tubewell for Islamabad	9.0	8.9	17.9
	Tubewell for Rawalpindi	7.3	7.2	14.5
	Tubewell for Airport	1.8	1.8	3.6
	Sub-total	18.1	17.9	36.0
	Total	2,421.8	2,238.7	4,660.5
	Grand Total	4,218.7	5,433.9	9,652.6

E.3. Project Organization

E.3.1. Basic Concept on the Organizational Setup of the Project

Implementation programmes of water resources development in the Metropolitan area are based upon a super long-term concept with intermediate and ultimate target years set at 2010 and 2030, respectively. The development of the Metropolitan areas is expected to be increasingly stepped up in line with such a concept. At the same time, the administrative functions of Islamabad will necessarily be broadened and enhanced in parallel with such a development, including utilization and management of developed facilities.

In this connection, it will not be long before the need arises to consider the adjoining city of Rawalpindi functionally a part of the Metropolis or the Metropolis itself.

The water resources development for urban beneficiaries of the twin cities will center on the construction of dam for the storage of surface water. Such a development is, at the same time, inseparably interconnected with other kinds and purposes of water utilization and it is thus considered to be imperative that an integrated implementation organ for the coordination and adjustment of various conflicting factors will be established.

In this light the expected urban functions of Islamabad and Rawalpindi in the said target years will be studied on the premise that the twin cities will be merged into a single capital city in accordance with the request of the Pakistan Government.

E.3.2. Organization for Project Implementation

At present bulk water supply projects in Islamabad and Rawalpindi are executed by CDA and PHED, respectively. However, if the development of such large storage dams, as described in 8.1. of this chapter, is to be implemented, appropriate reorganization of related administrative organs and sufficient acquisition of competent engineers are indispensable as primary conditions.

WAPDA, which is one of the governmental authority under the Ministry of Water and Power, partook partially or wholly in the planning, designing and supervision of the construction of the three existing dams (Simly, Rawal and Khanpur), because domestic law and regulations dictated it and also they required advanced technology.

Urban water supply facilities include conduction facilities leading to filtration plants, and distribution systems besides water resources facilities. It is essential at the initial stage to draw up a construction plan that will enable those facilities to organically function as a single entity. With this in view, it would be necessary to examine an organization in the shape of a comprehensive organ encompassing operation and maintenance of constructed facilities or, further, a reorganization of urban water departments based on a "Greater Islamabad" concept.

The said reorganization will be executed stage by stage (up to 1990, 2000, 2010) taking into consideration the federal policies and urban development plan and its development progress for the Metropolitan area.

1) First Phase (up to 1990)

As described in the previous chapter, the Khanpur bulk water supply project is a joint construction programme of twin cities of Islamabad and Rawalpindi. Existing execution

agencies of bulk water supply are CDA for Islamabad and PHED for Rawalpindi and they have their own expansion programmes of the Simly and Rawal filtration plants, respectively.

In parallel with the implementation of these expansion programmes, the Khanpur Bulk Water Supply Project Office will be newly established under Member Engineering of Capital Development Authority. It will perform planning, designing and construction supervision of the Khanpur Bulk Water Supply Project.

2) Second Phase (up to 2000)

Metropolitan Bulk Water Development Office directly under the control of CDA Chairman will be newly established (reorganized from Khanpur Bulk Water Supply Office) to perform planning, designing and construction supervision of the proposed dams (S-1, KL-1, SL-1 and heightening of the Shahpur dam) to be developed in and around the Metropolitan areas. It will be an organization independent and different from the existing one (first phase organization), and also it will absorb and incorporate development projects of other sources (tubewells and head works).

3) Third Phase (up to 2010)

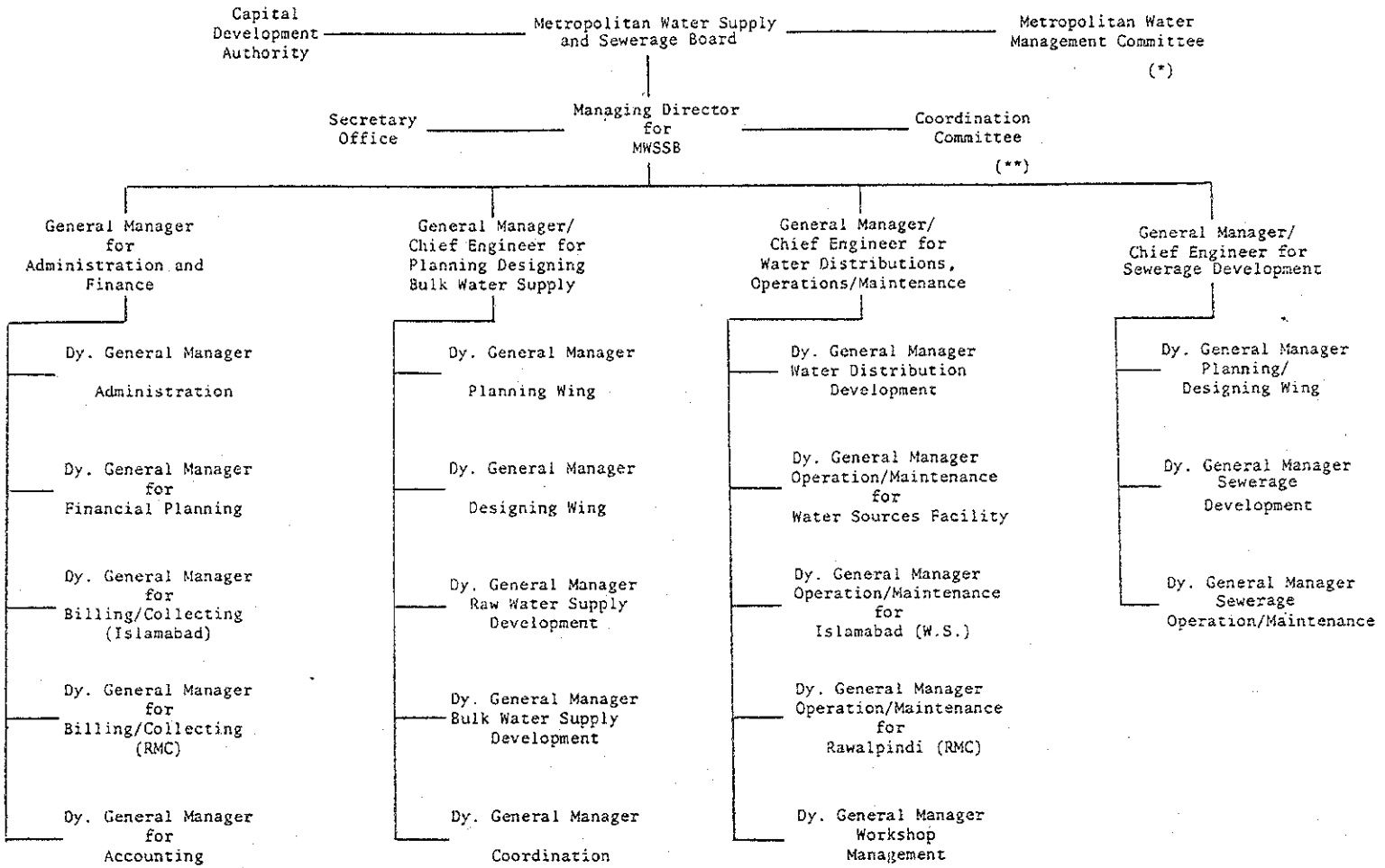
An independent organization technologically, financially and administratively capable of executing all projects related to water supply and sewerage will be established as a consummation of reorganizations in the preceding phases. It may be named Metropolitan Water Supply and Sewerage Board (MESSB). As shown in Figure E-3-1, Managing Director tops this organization, who appoints four General Managers under him. They manage the respective fields of administration/finance, planning/designing and bulk water supply, water distribution and operation/maintenance (Islamabad and RMC in Rawalpindi only) and sewerage facility development.

The existing organizational set-ups for water supply and sewerage in both Karachi and Lahore, which have revolved over many years resemble the proposed organizational set-up. (Refer to Figure E-3-2, E-3-3 and E-3-4.) It is proposed that the envisaged organizational set-up under the Project be expanded/elevated through gradual processes and that particular emphasis be placed on the development/acquisition of sufficient number of competent personnel and the elevation of technology in every related field.

MWSSB will be organizationally placed directly under the Chairman of CDA, but at the same time it will be independent from CDA in respect of finance, personnel, technology and project implementation. If such a situation is to be realized, consolidation of financial basis will be a prerequisite along with organizational expansion. Such a consolidation shall be accomplished by the end of the second phase.

In developing water resources for the Metropolitan areas the needs will arise for adjustments/coordinations among various interested parties, divisions and ministries. To facilitate the execution and management of projects Metropolitan Water Management Committee will be established as the supreme advisory and decision-making organ. This committee, besides performing the said functions, will make deliberations and decision-making on such important matters as budgetary plan, financial/investment/borrowing plans, various development plans and execution of water supply and sewerage projects. Furthermore, Coordination Committee will be established under the Managing Director of MWSSB as an organ in charge of multi-purpose dams, coordination with administrative organs in Rawalpindi Cantonment, adjustments of interest among various related beneficiaries and consultations on project execution.

Figure E-3-1. Proposed Organization of MWSSB (Third Phase)



(*) Member of MWMC:
- Ministry (Division) of Planning/Development
- Ministry of Water/Power
- Ministry of Health
- Ministry of Finance
- Ministry of Agriculture/Food
- Ministry of Defence
- Ministry of Industry
- CDA and WAPDA
- Government of Punjab
- Government of NWFP

(**) Member of CC:
- Ministry of P&D
- Ministry of Water and Power
- Ministry of Health
- Ministry of Defence
- Ministry of Industry
- CDA
- Government of Punjab
- Government of NWFP

Figure E-3-2 Organization Chart of Lahore Development Authority

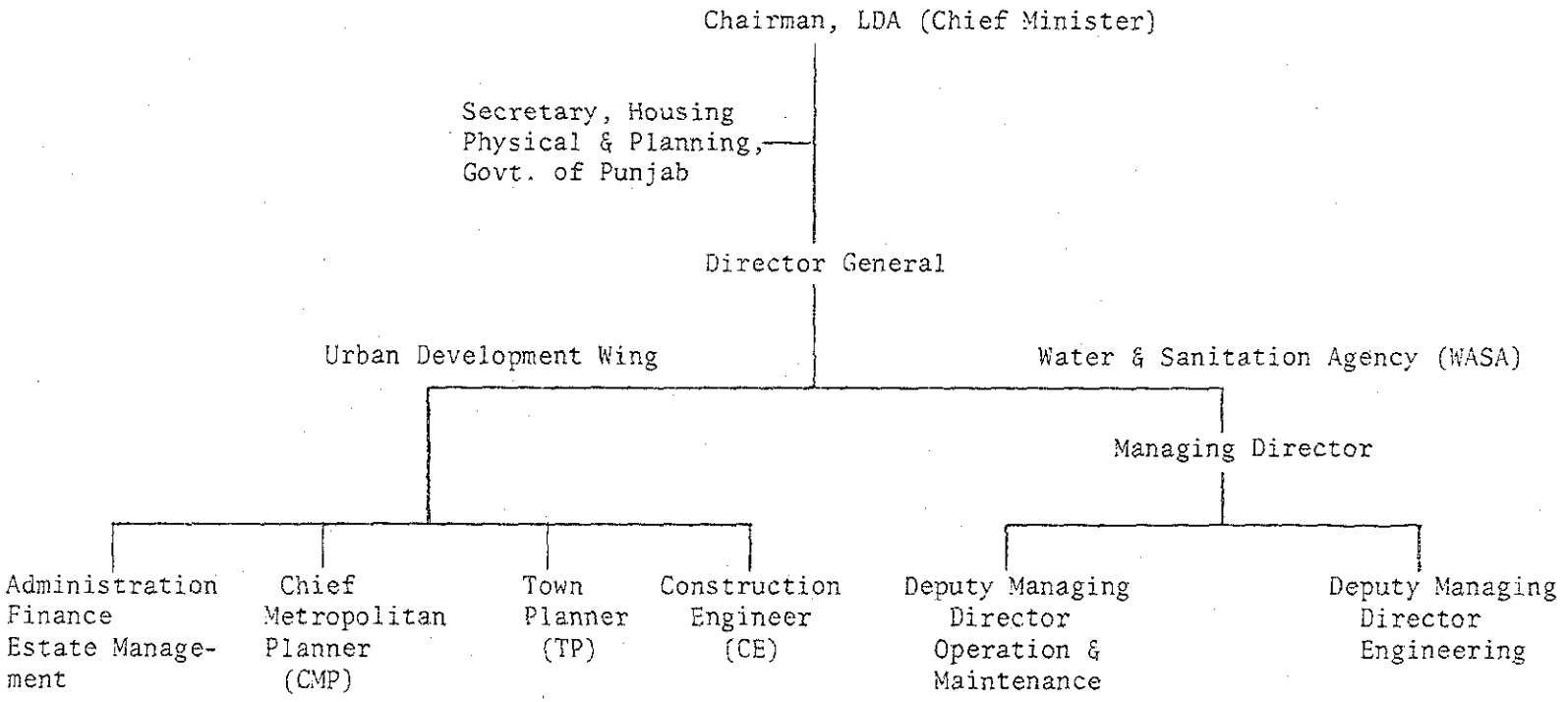


Figure E-3-3 Organization Chart of Water & Sanitation Agency, Lahore

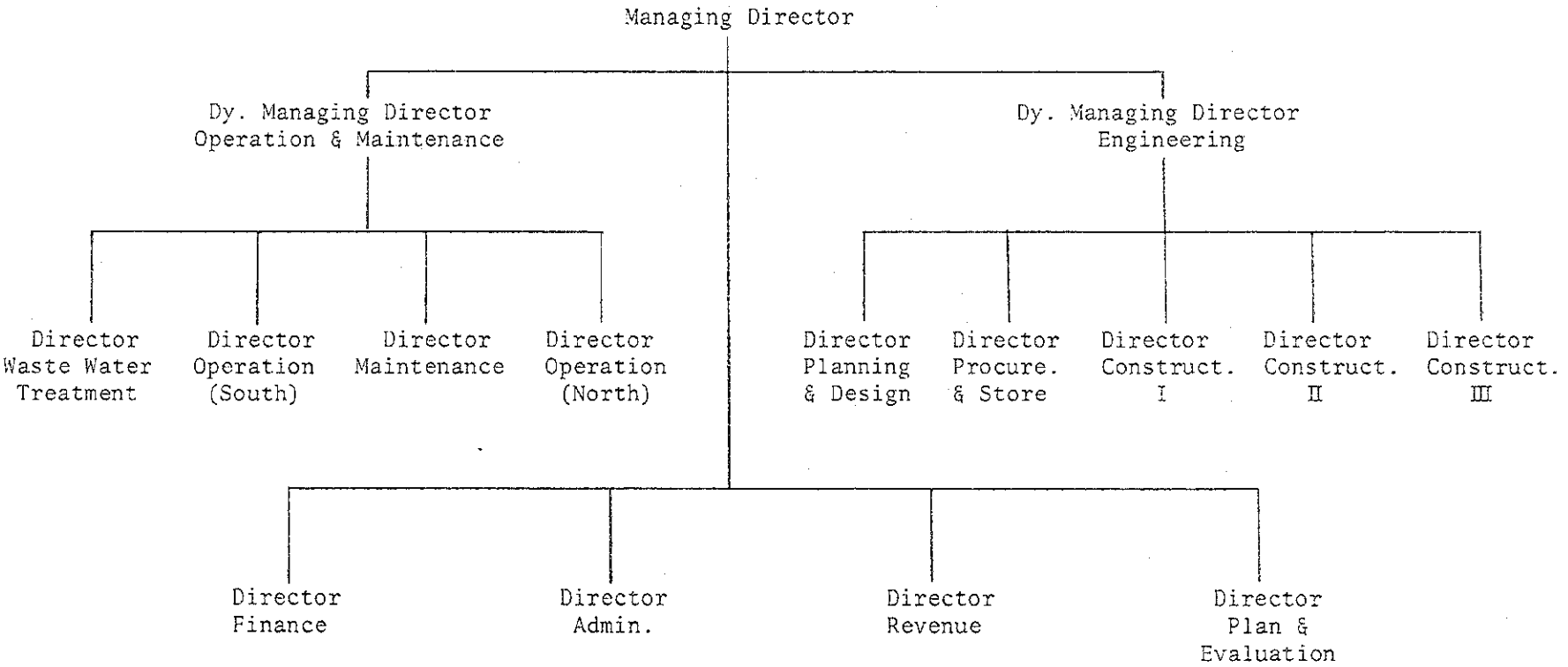
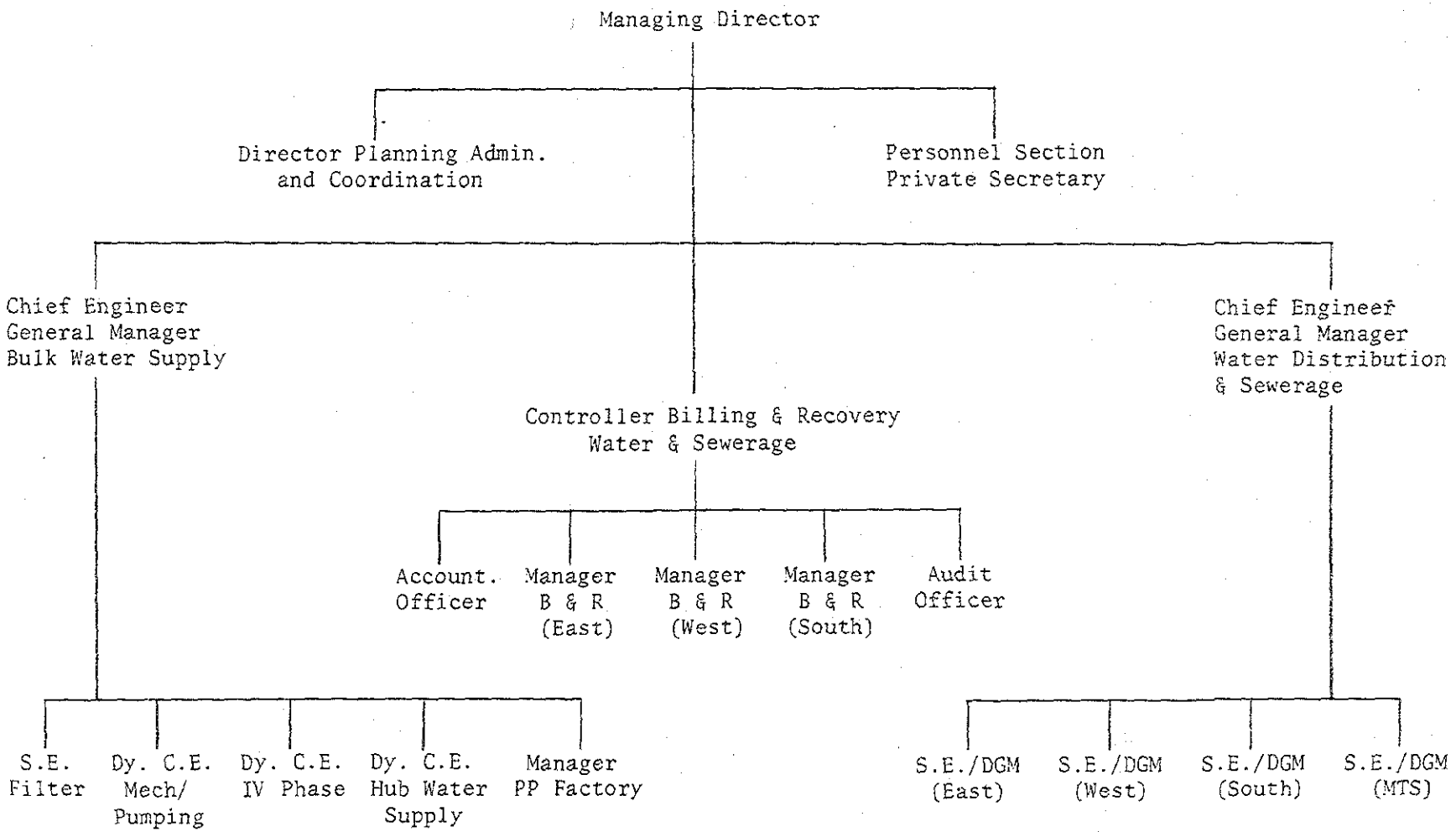


Figure E-3-4 Karachi Water Supply & Sewerage Board



APPENDIX F.

ECONOMY

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F.1. Socio-Economy

The Project Region incorporates administratively two distinctly different units, i.e. Islamabad District which is under direct jurisdiction of the Federal government and Rawalpindi Division which is under jurisdiction of the Provincial Government of the Punjab. Rawalpindi Division consists of four Districts, of which Rawalpindi District and Attock District belong to the Project Region. Seventy one percent of Islamabad urban sector and the entire urban sector along with a fraction of rural sector in Rawalpindi District fall under the urban water service area of the Project. The irrigation water service areas lie in both Attock and Rawalpindi Districts.

F.1.1. Population

According to Population Census 1981 population of the Region was 3,605,795 as of March 15, 1981, occupying 7.6 percent and 4.3 percent of Provincial and national population, respectively. District wise, Islamabad, Rawalpindi and Attock had the population of 340,286, 2,121,450 and 1,144,069, accounting for 9.4 percent, 58.9 percent and 31.7 percent of Reginal population, respectively. Urban population counted 1,371,505 or 38.0 percent and the balance of 2,234,290 or 62.0 percent resided in rural sector.

The Region had an average population density of 225.6 per sq.km, which is similar to the Provincial average of 230.3 per sq.km, but more than double the national average of 105.8 per sq.km. District wise, Islamabad, Rawalpindi and Attock had the population densities of 375.5/sq.km, 401.3/sq.km and 116.9/sq.km, respectively.

Sexual distribution of the Regional population was 51.6 percent for males and 48.4 percent for females, while the shares of male population at the Provincial and national levels were 52.6 percent

and 52.5 percent, respectively. Age structure of the population was 28.7 percent for those under 10 years, 64.0 percent for those 10 to 59 years and 7.3 percent for those 60 years and above. The proportions of 10 to 59 years group in Provincial and national population were 62.0 percent and 61.7 percent, respectively. The population in the Region grew at an average annual rate of 2.3 percent during 1972 to 1981 Census period, while Provincial and national population increased on the average at the annual rates of 2.8 percent and 3.1 percent, respectively during the same period. It is estimated based on the above growth rates that the three categories of population have now reached more than 4 million, 55 million and 100 million, respectively in the above order.

The urban population of the Region grew at an average annual rate of 4.3 percent during the inter-census period, which contrasts with the annual growth rate of 1.3 recorded for the rural population of the Region. The urban population of Pakistan grew in the same period at an average annual rate of 4.4 percent, while the rural population of the country rose at a slower pace of 2.6 percent. Nation wide urbanization is now in full swing as is witnessed in the Province-wise growth rates of urban population: 4.2 percent for the Punjab, 4.4 percent for Sind, 4.0 percent for NWFP and 6.5 percent for Baluchistan.

The population of the urban water service area under the Project was 1,010,675 at the time of 1981 population census accounting for 73.7 percent of the urban population of the Region. It grew from 1972 to 1981 at the average annual rate of 2.9 percent and is estimated to have grown from 1981 to 1987 at the annual rate of 4.5 percent to 1,320,000.

The estimated number of households in the Region in 1981 was 636,063, occupying 8.2 percent and 4.9 percent of Provincial and nation figures, respectively. The average number of members per household was 5.7, which is lower than the Provincial and national averages of 6.1 and 6.5 . (Refer to Table F-1-1.)

F.1.2. Social Aspects

According to Housing Census 1980 25.4 percent of the households in the Region were served with piped water, which is considerably higher than the Provincial and national levels of 14.0 percent and 20.3 percent. Diffusion rate of piped water in the urban sector of the Region was 62.1 percent, which sharply contrasts with 5.0 percent in rural sector.

Forty point seven percent of the Regional households were served with electricity, which is by about 10 percent higher than the provincial and national levels of 29.1 percent and 30.6 percent. Electrified urban households reached as high as 77.6 percent in the Region, while the percentage of electrification in rural households stood at 20.2 percent.

Percentage of the households using gas was 16.1 percent, whereas in the Province and Pakistan it was 4.7 percent and 6.5 percent, respectively. In urban sector it came to 42.8 percent, and in rural sector it was confined to 1.2 percent.

It is noticed from the above that fundamental amenity of home life in the Region is at a higher level than in other regions and that particularly in urban sector it is at an advanced stage.

Ratio of enrollment at primary stage was 67.5 percent in 1981, which is by 20 percent to 30 percent ahead of the Provincial and national averages of 47.7 and 40.6 percent. Similarly, ratio of enrollment at secondary stage was 66.6 percent, by 40 percent to 50 percent ahead of the Provincial average of 20.2 percent and the national average of 17.7 percent.

Again, literacy ratio of 39.6 percent in the Region was by more than 10 points higher than 27.4 percent for the Province and 26.2 percent for the nation. Especially in urban sector the ratio stood at 56.0 percent, which is more than double the Provincial and national levels.

The number of beds in the medical institutions was in 1981 85 per 1000,000 people, whereas it was 47 and 57 in the Province and Pakistan, respectively. Likewise, the length of roads maintained by Highway Department was 61 km per 100,000 people, whereas it was 30 km and 50 km in the Province and Pakistan, respectively. Also, the number of motor vehicles on road was 172 per 10,000 people, which is about triple the Provincial and national averages of 58 and 56.

These things would indicate that the Region is on average more advanced and advantaged than elsewhere in the country in educational, medical and transport infrastructure. (Refer to Table F-1-2.)

Specifically there are in Islamabad three universities exemplified by Quaid-i-Azam University, which spread over approximately 607 ha is an advanced institution producing experts and specialists in various fields to meet the demand of academic institutions and research organizations in the country. There were in 1981 38 colleges in the Region with the enrollment of 23,603. In medical fields, there were 23 hospitals, 120 dispensaries, 12 rural health centers and 10 TB clinics. In Rawalpindi city there is a Combined Military Hospital which has all the modern facilities for military personnel and public.

Shahra-e-Pakistan (Grand Trunk Road) passes through the middle of the Region in south-north direction. The main Pakistan Railway Line also passes through the Region, more or less running along Shahra-e-Pakistan.

Also, there is Islamabad Airport with good domestic and international connection. It is directly linked to Middle East, Europe and China. There were in 1981, 288,839 telephone connections, 33 telephone offices and 700 post offices in the Region.

F.1.3. Economic Aspects

(1) Employment Structure

Working population in the Region was 829,300 in 1981, out of which those belonging to the "agriculture, forestry, hunting and fishing" group had the largest share of 36.4 percent, followed by the "social and personal services" group with the share of 30.3 percent. The third and fourth places were occupied by the "wholesale and retail trade" and "manufacturing" groups with their respective shares of 10.5 percent and 8.0 percent. Shares of the foregoing four groups add up to 85.2 percent.

At the national level the four groups had the respective shares of 52.7 percent, 18.6 percent, 9.4 percent and 9.2 percent in the above order. It shows a predominant place primary industry occupies in the country.

Relatively low percentage of the "agriculture, forestry, hunting and fishing" group and at the time same relatively high percentage of the "social and personal services" group in the Region are explained by the peculiar composition of labor force in urban sector, where the former group accounted for only 4.5 percent and the latter group occupied as much as 48.6 percent. This structural characteristic of the Regional urban sector derives from the fact that it is the seat of the national government.

Employment ratio or participation rate in the Region was 23.0 percent, which is substantially lower than the Provincial and national averages of 26.5 and 26.0 percent. (Refer to Table F-1-3.)

Unemployment rate was 3.7 percent, which is significantly higher than the provincial and national figures of 3.2 percent and 3.1 percent. Broken down to the District level, the rates were 10.7 percent, 2.9 percent and 3.5 percent in the respective Districts of

Islamabad, Rawalpindi and Attock. The exceptionally high rate in Islamabad District pushes up the overall unemployment level of the Region.

(2) Industrial Structure and Economy

The gross domestic product of the Region in 1981 is estimated at Rs.11,241 million, which constitutes 7.2 percent of the provincial GDP or 4.5 percent of the national GDP. Out of it, urban sector accounted for 48.3 percent.

Structurally, the "social and personal services" and agriculture, forestry, hunting and fishing" groups occupied the first and second places with the respective shares of 29.4 percent and 16.7 percent followed by the "wholesale and retail trade" group (15.2%) and the "manufacturing" group (12.0%). Shares of these four groups add up to 73.3 percent. Whereas, at the national level the top two groups exchange their mutual places with 29.0 percent for the "agriculture" and 16.4 percent for the "services". This situation is explained by the peculiar composition of GDP in the Regional urban sector, where the "agriculture" accounted for only 1.6 percent and the "services" occupied as much as 36.5 percent. Otherwise, there are no major differences in the industrial structure between the Region and the whole country. (Refer to Table F-1-3.)

Per capita GDP in the Region in 1981 is estimated at Rs.3,117, which is by 6 percent higher than the national average of Rs.2,939. Sector wise, per capital GDP in the Regional urban sector was Rs.3,961, which exceeds the national average by more than Rs.1,000 or 35 percent. In contrast, the living standard in the rural sector was Rs.2,600, falling short of the national level by 11.5 percent.

The industrial structure of the country in 1985-86 was 24.9 percent for primary industry, 24.6 percent for secondary industry and 50.5 percent for tertiary industry. The structure has consistently changed in such a way that secondary industry has gained ground in a parallel degree that primary industry has lost ground.

The national economy has grown over the 10 years 1975-76 to 1985-86 at the average annual rate of 6.8 percent (GNP) or 6.5 percent (GDP). In the meantime population has increased at the annual rate of 3.1 percent. It follows from the above that the annual growth rates of per capita GNP and GDP were 3.6 percent and 3.3 percent, respectively.

Over the same period GDP deflator and consumer prices have grown at the annual rates of 8.0 percent and 8.5 percent.

As of 1985-86 GNP and GDP stand at Rs.570,719 million and Rs.527,792 million, respectively, and with the population estimated at 97.67 million per capita GNP and GDP are calculated at Rs.5,843 (=$365) and Rs.5,404 (=$338).

(3) National Policy

The following major objectives are laid down in the Sixth Five Year Plan 1983-84 to 1987-88:

1. A major increase in agricultural yields through more efficient use of fertilizer, water and farm technology.
2. An expanding foothold in export markets for wheat and rice as well as for fruits, vegetables, flowers, poultry and meat.
3. Increased self-sufficiency in oilseeds.
4. Rapid development of steel-based engineering goods, modernization of textile industry and establishment of agro-industries for processing agricultural surpluses.

5. A balanced development of service industries particularly public services to satisfy basic human needs.

To attain the objectives the total investments amounting to Rs.495,000 million are programmed, out of which public sector is to bear Rs.295,000 million or 59.6 percent. Public investment is aimed at:

1. Provision of adequate infrastructure, particularly energy.
2. Provision of basic social services.
3. Development of less developed areas.
4. Generation of a reasonable level of employment.

As underlined parts in the above show, the Project is incorporated in the context of the present national plan. At the same time the project must be viewed in a much broader perspective because of its very long-term implications and influence.

TABLE F-1-1 Regional Population and Its Structures, 1981

1. Population, Density and Number of Households

No.	Item	Code/ Formula	Total	Islamabad District	Rawalpindi District	Attock District	Urban	Rural
1.	Area(SQ.KM)	A	15,981	906	5,286	9,789	N.A.	N.A.
2.	Percentage of Area	B	100.0%	5.7%	33.1%	61.2%	N.A.	N.A.
3.	Population	C	3,605,795	340,286	2,121,450	1,144,059	1,371,505	2,234,290
4.	Percentage of Population	D	100.0%	9.4%	58.9%	31.7%	38.0%	62.0%
5.	Density of Population	E=C/A	225.6	375.5	401.3	116.9	N.A.	N.A.
6.	Annual Growth Rate of Population	F	2.3%	4.3%	2.3%	1.8%	4.3%	1.3%
7.	No. of Households	G	636,063	62,908	361,166	211,989	232,220	403,843
8.	No. of Members of Households	H=C/G	5.7	5.4	5.9	5.4	5.9	5.5

2. Sex and Age Structures of Population

No.	Item	Code/ Formula	Total	Male	Female	Under 10 Years	10 to 59 Years	60 Years and Above
1.	Population	A	3,605,795	1,860,421	1,745,374	1,034,340	2,307,838	263,617
2.	Percentage of Population	B	100.0%	51.6%	48.4%	28.7%	64.0%	7.3%

3. Comparative Indices

No.	Item	Code/ Formula	Area (SQ.KM.)	Population	Population Density (/SQ.KM.)	Annual Growth of Population	Number of Households	Number of Household Members
1.	The Region	A	15,981	3,605,795	225.6	2.3%	636,063	5.7
2.	Province of Punjab	B	205,344	47,292,441	230.3	2.8%	7,734,322	6.1
3.	Pakistan	C	796,095	84,253,644	105.8	3.1%	12,952,690	6.5
4.	Provincial Share	D=A/B	7.8%	7.6%	-	-	8.2%	-
5.	National Share	E=A/C	2.0%	4.3%	-	-	4.9%	-

Sources: EC-5 and EC-6
Note: N.A. = not available

TABLE F-1-2 Social Infrastructure and Its Diffusion in the Region

No.	Item	Code/ Formula	Total	Urban	Rural	Province of Punjab	Pakistan
1.	No. of Households	A	620,937	222,055	398,882	7,538,000	12,588,000
2.	No. of Households Served with Piped Water	B	157,919	137,838	20,081	1,059,000	2,561,000
3.	Diffusion Ratio of Piped Water	C=B/A	25.4%	62.1%	5.0%	14.0%	20.3%
4.	No. of Households Served with Electricity	D	252,750	172,304	80,446	2,190,000	3,849,000
5.	Diffusion Ratio of Electricity	E=D/A	40.7%	77.6%	20.2%	29.1%	30.6%
6.	No. of Household Using Gas	F	99,736	95,096	4,640	353,000	813,000
7.	Ratio of Households Using Gas	G=F/A	16.1%	42.8%	1.2%	4.7%	6.5%
8.	No. of Enrolled at Primary Stages	H	349,353	N.A.	N.A.	3,468,000	5,474,000
9.	Population Aged 5 to 9 Years	I	517,433	N.A.	N.A.	7,269,782	13,485,054
10.	Ratio of Enrollment at Premary Stages	J=H/I	67.5%	N.A.	N.A.	47.7%	40.6%
11.	No. of Enrolled at Secondary Stages	K	300,033	N.A.	N.A.	1,257,000	1,961,000
12.	Population Aged 10 to 14 Years	L	450,456	N.A.	N.A.	6,220,472	11,083,202
13.	Ratio of Enrollment at Secondary Stages	M=K/L	66.6%	N.A.	N.A.	20.2%	17.7%
14.	Population	N	3,605,795	N.A.	N.A.	47,292,441	84,253,644
15.	No. of Beds in Medical Institutions	O	3,050	N.A.	N.A.	22,355	48,441
16.	No. of Beds per 100,000 Persons	P=O/N	85	N.A.	N.A.	47	57
17.	Road Kilometers Maintained by Highway Dept.	Q	2,209	N.A.	N.A.	14,402	42,535
18.	Road Kilometers per 100,000 Persons	R=Q/N	61	N.A.	N.A.	30	50
19.	No. of Motor Vehicles on Road	S	61,951	N.A.	N.A.	273,910	468,565
20.	No. of Motor Vehicles on Road per 10,000 Persons	T=S/N	172	N.A.	N.A.	58	56
21.	Literacy Ratio	U	39.6%	56.0%	29.4%	27.4%	26.2%

Notes: Figures No. 1 to 7 are for 1980 and based on EC-7. Figures No. 8 to 20 are for 1981 and based on EC-5 and EC-8. Figures No. 21 are for 1981 and based on EC-6.
N.A. = not available

TABLE F-1-3 Industrial and Employment Structures, 1981 in the Region

1. GDP (Rs. Million)

No.	Major Industrial Group	Total	Urban	Rural	Province of Punjab	Pakistan
1.	Total(A)	11,241(100.0%)	5,432(100.0%)	5,809(100.0%)	155,177(100.0%)	247,596(100.0%)
2.	Agriculture, Forestry, Hunting & Fishing	1,873(16.7%)	86(1.6%)	1,787(30.8%)	41,423(26.7%)	71,699(29.0%)
3.	Mining & Quarrying	105(0.9%)	65(1.2%)	40(0.7%)	471(0.3%)	3,149(1.3%)
4.	Manufacturing	1,347(12.0%)	720(13.3%)	627(10.8%)	37,644(24.3%)	40,969(16.5%)
5.	Construction	679(6.0%)	274(5.0%)	405(7.0%)	7,512(4.8%)	11,449(4.6%)
6.	Electricity & Gas Distribution	353(3.1%)	119(3.7%)	154(2.6%)	5,113(3.3%)	5,928(2.4%)
7.	Transport, Storage and Communication	1,022(9.1%)	482(8.9%)	540(9.3%)	11,520(7.4%)	19,370(7.8%)
8.	Wholesale and Retail Trade	1,709(15.2%)	1,001(18.4%)	708(12.2%)	28,635(18.5%)	40,592(16.4%)
9.	Banking, Insurance and Ownership of Dwellings	852(7.6%)	618(11.4%)	234(4.0%)	6,261(4.0%)	13,858(5.6%)
10.	Social and Personal Services	3,301(29.4%)	1,987(36.5%)	1,314(22.6%)	16,598(10.7%)	40,582(16.4%)

2. Employment (Working Population) (Thousand Persons)

No.	Major Industrial Group	Total	Urban	Rural	Province of Punjab	Pakistan
1.	Total (B)	829.3(100.0%)	307.9(100.0%)	521.4(100.0%)	12,554(100.0%)	21,925(100.0%)
2.	Agriculture, Forestry, Hunting & Fishing	302.0(36.4%)	13.8(4.5%)	288.2(55.3%)	6,679(53.2%)	11,560(52.7%)
3.	Mining & Quarrying	2.9(0.3%)	1.8(0.6%)	1.1(0.2%)	13(0.1%)	87(0.4%)
4.	Manufacturing	66.0(8.0%)	35.3(11.5%)	30.7(5.9%)	1,845(14.7%)	2,008(9.2%)
5.	Construction	54.4(6.6%)	22.0(7.2%)	32.4(6.2%)	603(4.8%)	919(4.2%)
6.	Electricity & Gas Distribution	7.7(0.9%)	4.4(1.4%)	3.3(0.7%)	113(0.9%)	131(0.6%)
7.	Transport, Storage and Communication	47.9(5.8%)	22.6(7.3%)	25.3(4.8%)	540(4.3%)	908(4.1%)
8.	Wholesale and Retail Trade	86.9(10.5%)	50.9(16.5%)	36.0(6.9%)	1,456(11.6%)	2,064(9.4%)
9.	Banking, Insurance and Ownership of Dwellings	10.2(1.2%)	7.4(2.4%)	2.8(0.5%)	75(0.6%)	166(0.8%)
10.	Social and Personal Services	251.3(30.3%)	149.7(48.6%)	101.6(19.5%)	1,230(9.8%)	4,082(18.6%)

3. Economic Indices

1.	Population (C)	3,605,795	1,371,505	2,234,290	47,292,441	84,253,644
2.	Per Capita GDP (A/C)	Rs. 3,117	Rs. 3,961	Rs. 2,600	Rs. 3,281	Rs. 2,939
3.	Employment Ratio (B/C)	23.0%	22.4%	23.3%	26.5%	26.0%

Sources: EC-5, EC-6, EC-8 and EC-9

F.2. Evaluation of Socio-Economic Survey

F.2.1. Urban Water Supply Area

House visit sampling investigations were carried out by the Study Team in January, 1987 to know the existing situation of urban water consumption in the Metropolitan areas and by so doing to secure basic data for estimating the future demands for urban water and the future benefits accruing from the supply of urban water in the Project areas.

Also, along with the above investigations frequent visits to administrative organs in the Metropolitan areas were made to collect data and information on financial performance of the existing water supply service and by so doing to secure a foothold for financial proposals for the Project.

(1) Outline of Survey

The Study Team requested the three representative Metropolitan administrative organs, i.e. CDA, RMC and CB to execute house visit sampling investigations. Planning of the whole matter including preparation of questionnaire forms and evaluation of the results were taken care of by the Team.

Separate questionnaires were prepared for the three categories of urban water beneficiaries, i.e. households, public institutions and commercial/industrial establishments. About 2,000 households, corresponding to 1 percent of the total Metropolitan households were selected based on random sampling. The total number of samples including other beneficiaries reached about 3,000.

The questionnaire for households was made up of such items as monthly wages/salaries, number of household members, estimated quantity of daily water consumption by use and willingness to pay

per month, and questionnaires for other beneficiaries were composed of similar items.

The purposes of the investigations were to know unit/total demand for urban water for each category of beneficiaries, economic benefits per unit quantity of consumption for each category and so forth. Investigators directly visited the residences/working places of selected beneficiaries and elicited answers through interviews.

Also, data and information were gathered from water supply departments of related administrative organs on such items as the existing water tariff systems, annual recurrent water supply costs, water resources development costs, annual water charge receipts and financial sources.

(2) Results and Evaluation of Survey

Computer programmes were made to process the answers collected through house visit investigations. Numbers of effective answers from households, public institutions and commercial/industrial establishments were 1,979, 320 and 547, respectively, adding up to 2,846.

The followings are a summary of the results and evaluation of socio-economic survey on urban water.

a. Willingness to Pay

Willingnesses to pay for water supply service by area and by category of beneficiaries are as shown in Table F-2-1.

As it shows, the beneficiaries in the Metropolitan areas are on average willing to pay Rs.1.77 per 1,000 lit. (Rs.8.05 per 1,000 gal). It is by 45 percent higher than the production cost of Rs.1.22 per 1,000 lit. (Rs.5.55 per

1,000 gal). (Refer to Table F-2-2.) It is also about twice as high as the quantity rate now enforced in the Metropolitan areas. This is an encouraging revelation for water supply authorities which are usually very sensitive and conservative on water tariff issues. However, it can mean that beneficiaries' potential demand for urban water is stronger than its actual supply. For instance the fact that domestic users in Rawalpindi are willing to pay much more than those in Islamabad may be explained by the difference in demand-supply situation in the two areas.

The fact that willingness to pay of public users is not too far away from that of domestic users and also that willingness to pay of commercial/industrial users are roughly twice that of domestic users may be construed to be a reflection of the existing quantity tariff which is structured in like manner.

Domestic users are willing to pay Rs.1.44 per 1,000 lit. (Rs.6.55 per 1,000 gal.). It means that they will spend 1.7 percent of their income as water payment.

Willingness to pay is interpreted as an expression of economic values or benefits of urban water supply service and is utilized for economic evaluation of the Project.

b. Cost and Revenue

As shown in Table F-2-2, administrative organs in the Project areas spent Rs.1.22 (Rs.5.55) in 1985-86 to produce 1,000 lit. (1,000 gal.) of urban water. Out of it, Rs.0.96 percent (Rs.4.36) or 79 percent was accounted for by operation/maintenance cost (in the narrow sense) and the rest of Rs.0.26 (Rs.1.18) or 21 percent by capital cost.

On revenue side, they collected Rs.0.21 (Rs.0.93) per 1,000 lit.(1,000 gal.) as water charges receipt. Cost recovery ratio (ratio of revenue to cost) thus works out at 16.8 percent.

Area wise, unit production cost in Islamabad is more than twice as high as that in Rawalpindi. But, unit revenue is not too different in the two areas. It means cost recovery ratio in the latter is higher than in the former.

More specific pictures of financial situation are depicted under. (Refer to Table F-2-3.)

CDA spent Rs.84.10 million as the annual cost in 1985-86 on water supply. Out of it, payment for electricity charges reached 40.8 percent, followed by depreciation accounting for 25.5 percent. Then came pay & allowance for regular establishment with 16.5 percent and store/materials with 13.1 percent. On the other hand, it collected Rs.11.62 million as water charges receipt. Consequently, if water supply department is financially to be treated independently, cost recovery ratio will be 13.8 percent with the loss amounting to Rs.72.48 million.

However, the actual situation is that water supply department in CDA is not supposed to be a self-financing unit and the loss is automatically met by the subsidy of the Federal Government. In terms of the unit production cost of water, the authority spent Rs.1.64 per 1,000 lit. (Rs.7.45 per 1,000 gal.) and recovered Rs.0.23 per 1,000 lit. (Rs.1.03 per 1,000 gal.) in the above year.

RMC spent Rs.13.14 million as the annual cost in 1985-86 on water supply. Out of it, 57.5 percent was expended to pay for electricity charges and other contingencies. 12.5 percent and 9.9 percent were allotted for depreciation and

pay & allowance of regular establishment, respectively. On the other hand, it collected Rs.4.85 million as water charges receipt in the same year. Consequently, cost recovery ratio was 36.9 percent with Rs.8.29 million going into the red. The loss was offset by revenue in other departments. In terms of the unit production cost of water, the corporation spent Rs.0.50 per 1,000 lit. (Rs.2.29 per 1,000 gal.) and recovered Rs.0.19 per 1,000 lit. (Rs.0.85 per 1,000 gal.) in the above year.

Administrative organs in Rawalpindi Cantonment area spent Rs.20.45 million as the annual cost in 1985-86 on water supply. Out of it, 35.9 percent was used for the payment for electricity charges and 26.8 percent for store/materials. 14.5 percent and 10.3 percent went for pay & allowance of regular establishment and depreciation, respectively. On the other hand, they collected Rs.3.28 million as water charges receipt in the same year. Consequently, cost recovery ratio was 16.0 percent with the loss of Rs.17.17 million.

However, actually the loss is mostly met by the subsidy of the Federal Government via Defense Ministry. In terms of the unit production cost of water, the organs spent Rs.1.05 per 1,000 lit.(Rs.3.33 per 1,000 gal.) and recovered Rs.0.17 per 1,000 lit. (Rs.0.76 per 1,000 gal.) in the above year.

If water supply authorities are to financially stand on their own feet, households shall pay Rs.1.01 per 1,000 lit. (Rs.4.58 per 1,000 gal.) on the assumptions that water rate for commercial/industrial users is twice as high as that for domestic users. At present, average income and water demand per month of a Metropolitan household is estimated at Rs.2,713 and 32.54 m^3, respectively.

Consequently, average water payment per month of a household works out at Rs.33 under the above water rate, corresponding to 1.2 percent of its income.

World Bank considers it all right when water payment is kept within 5 percent of household income. It would be preferable if it could be contained within 3 percent.

It is clear from the above that domestic (and, therefore, all) users have enough means to get water supply authorities financially stand on their own feet. The existing situation where the authorities are subsidized extensively is given rise to by the interactions of various factors centering on the existing water tariff systems.

c. Water Tariff Systems

Water tariff systems of CDA include quantity rate system and flat rate system. Coexistence of two mutually different systems is witnessed also in water tariff systems of any other administrative organ in the Metropolitan areas. Under quantity rate system CDA charges Rs.0.79 per 1,000 lit. (Rs.3.60 per 1,000 gal.) for domestic and public users and Rs.1.32 per 1,000 lit. (Rs.6.00 per 1,000 gal.) for commercial and industrial users. Under flat rate system it imposes fixed monthly charges on individual users on the basis of plot size, dimension of dwellings/buildings, diameters of pipelines, etc. At present quantity rate system is applied to 18 percent of the users in Islamabad, and the remaining 82 percent fall under flat rate system.

As already mentioned, CDA now spends Rs.1.64 (Rs.7.45) to produce 1,000 lit. (1,000 gal.) of urban water, and

financial loss is obviously inevitable under the existing quantity rates. However, if present water tariff systems were unified into quantity rate system, CDA would recover more than 50 percent of cost on the assumptions that billing and collection are perfect. But the reality is that recovery ratio is only 13.8 percent as already mentioned. The reason is flat rate system and its overwhelming prevalence. Therefore, the fundamental measure to attain financial independence of water supply authorities is to completely abolish flat rate systems and establish quantity rate systems that will make them solvent. It is impossible, however, to realize it overnight and it is essential to drastically change both hardware and software aspects of water supply service.

That is to say, all the related aspects of technology, products, institution, personnel, psychology and organization must be changed/elevated in a coordinated, parallel manner. Specifically, it is necessary that the circumstances should mature to such a level where all day service, perfect metering and quantity rate systems can be realized completely and simultaneouly.

In RMC area commercial and industrial users pay Rs.1.10 per 1,000 lit. (Rs.5.00 per 1,000 gal.) under quantity rate system. Quantity rate for domestic and public users has been discontinued. Under flat rate system RMC imposes fixed yearly charges on individual users on the basis of diameters of pipelines, plot size, etc.

The users to whom quantity rate system is applied account for only 2 percent.

CB in Rawalpindi Cantonment area has recently discontinued quantity tariff system and now applies flat rate system only.

Under flat rate system it imposes fixed monthly charges on individual users on the basis of diameters of pipelines, plot size, etc. MES in the same area enforces both quantity and flat rate systems. Under quantity rate system it charges Rs.0.85 per 1,000 lit. (Rs.4.00 per 1,000 gal.) for domestic, public and military users and Rs.1.32 per 1,000 lit. (Rs.6.00 per 1,000 gal.) for commercial and industrial users. Under flat rate system it imposes fixed monthly charges on individual users on the basis of diameters of pipelines, plot size, etc. It is said that quantity rate system is applied to 40 percent of the users.

Financial problems of water supply authorities in Rawalpindi are the same with those of CDA. Therefore, solutions are identical too.

As already mentioned, water supply authorities will be able to financially stand on their own feet, if domestic users pay Rs.1.01 per 1,000 lit. (Rs.4.58 per 1,000 gal.) on the assumptions that water rate for commercial/industrial users is twice as high as that for domestic users, under a single and complete quantity rate system. The Study Team would like to emphasize here that as urban water is one of basic human needs establishment of elaborate tariff based on the quantity of consumption is called for especially for domestic users.

At present Metropolitan households on average consume 32.54 m^3 of urban water per month. If minimum requirement of urban water per capita per day is assumed to be 20 to 50 lit., requirement per household per month works out at 4.37 to 10.92 m^3 as average number of household members is 7.28. It is recommended that extremely low rates will be imposed up to this range, but once it is exceeded rates

will be progressively raised. But, the tariff will be so structured that average rate for the total quantity of urban water to be consumed by domestic users will be as mentioned above. To make such a tariff statistics on the number of households by monthly quantity of consumption is required. The Study Team has gotten such information by electronically processing raw data collected through house visit sampling investigations. Based on it the Team has come up with an example of water tariff incorporating the above concept. Please refer to Table F-2-5.

d. Water Demand

Table F-2-6 shows per capita daily demand for urban water by area and by user. The table was made based on Table F-2-7 which is the outcome of electronic processing of house visit investigation data. Total demand by area and by user in Table F-2-6 was calculated by multiplying a per capita daily demand by the corresponding estimated population. Figures in the same table are utilized in Appendix C.

As Table F-2-6 shows, per capita daily demand for domestic use in Islamabad Proper is nearly twice as high as that in Rawalpindi Urban. Per capita daily demand for other uses in the former is also markedly higher than that in the latter. Summing up, per capita daily demand excluding leakage/wastage in Islamabad Proper comes to 495 lit. (108.8 gal.), which is about 2.7 times as high as the corresponding demand of 184 lit. (40.5 gal.) in Rawalpindi Urban. And the weighted average of the same demand works out at 276 lit. (60.7 gal.).

Since the served population in Rawalpindi Urban is estimated to be about 2.4 times as big as that in

Islamabad Proper, on total base daily demand is not too different between the two areas: it is 140.5 MLD (30.9 MGD) in the capital city and 124.8 MLD (27.5 MGD) in the adjoining twin city, adding up to 265.3 MLD (58.4 MGD).

F.2.2. Irrigation Area

(1) Haro River Left Bank Command Area

a. Geographic Features

This area is situated in 10 km north-west of the Islamabad Capital territory covering 31,500 ha in total. The general elevation of the area ranges between 530 m and 400 m, the gradient varies from place to place but is, generally speaking, gradual from the north-east to south-east.

The most striking feature of the area is the souring brought about by surface erosion, which has cut pock marks of deep ravines all over the face of the area rendering about 40 percent of fertile land unculturable. In the cultivated area, wheat, and pulses are major crops in winter (Rabi) season, maize, millet and pulses in summer (Kharif) season.

b. Social Features

The area comprises the north-eastern part of Attock and Fatehjang Tehsils of Attock district, and the north-western part of Rawalpindi Tehsil of Rawalpindi district. Urban area including Wah Cantonment, Texila Cantonment and Wah Industrial area is developed along the grant trunk road occupying about 10 percent of the total area. Rural area, on the other hand, has 37 villages

scattering all over the area. 11 percent of the cultivated area is irrigated. In the rest of area farmers suffer from rainfed (barani) agriculture which is dependent upon physical factors of climate and soil. Farmers in these areas further suffer from not only insufficiency of irrigation water but also poor communication, inadequacy of rural health centers shortage of educational institutions and absence of proper electrification.

c. Present Agriculture Aspects

Socio-economic survey was conducted on 37 villages which scatter all over the area. Eight villages are situated in the north-eastern part of Attock Tehsil, 15 villages in the north-eastern part of Fatehjang Tehsil and 14 villages in the north-western part of Rawalpindi Tehsil. Present agriculture aspects of the whole area can be grasped by this survey.

i) Population

Tehsil	No. of Village	Population by Sex			Household by Occupation		
		Male	Female	Total	Agri.	Non Agri.	Total
Attock	8	17,622	17,447	35,069	2,924	2,808	5,732
Fatehjang	15	11,991	12,668	24,659	3,629	593	4,202
Rawalpindi	14	12,975	12,173	25,148	3,343	902	4,245
Total	37	42,588	42,288	84,876	9,896	4,283	14,179

ii) Agriculture Household by Holding Size

Tehsil	Small 1/		Medium 2/		Large 3/		Total
	No.	% Age	No.	% Age	No.	% Age	
Attock	1,954	66.4	690	23.0	280	9.6	2,924
Fatehjang	2,198	60.6	871	24.0	560	15.4	3,629
Rawalpindi	2,631	78.7	505	15.1	207	6.2	3,343
Total	6,783		2,066		1,047		9,896

Note: 1/ ... 0-2 ha 2/ ... 2-5 ha 3/ ... 5 ha and above

iii) Land Ownership

Tehsil	No. of Farmers	Owner Cultivator	Tenant	Size of Tenancy	% Age of Tenancy
Attock	2,924	2,924	-	-	-
Fatehjang	3,629	3,622	7	17	0.18
Rawalpindi	3,343	3,334	9	29	0.26
Total	9,896	9,880	16	46	0.22

iv) Sown Area and Production of Major Crops

Crop	Annual Production (1985-86) Area (ha)	Production (tonnes)	Yield (t/ha)
Wheat	13,660	20,930	1.53
Coarse Grain	6,550	4,660	0.71
Pulses	1,860	1,160	0.62
Oil Seeds	1,220	830	0.68
Fruits	440	2,490	5.66
Vegetables	2,500	12,140	4.86

v) Livestock Inventory

Livestock	Attock	Fatehjang	Rawalpindi	Total
Buffalo	2,861	5,286	5,212	13,359
Buffalo Calf	1,129	2,473	2,910	6,512
Cow	1,336	3,269	1,699	6,304
Cow Calf	1,127	3,573	761	5,461
Bullock	5,146	8,405	6,680	20,231
Camel	39	160	99	298
Sheep	600	600	650	1,850
Goat	1,317	3,448	5,614	10,379
Donkey	510	911	2,968	4,389
Horse	351	175	313	839
Poultry	33,059	15,941	33,111	81,111

vi) Income and Expenditure

° Crop Growers[1/]

Annual Income and Expenditure (1985-86) (Rs/acre)

Farmer by Size	Gross Expenditure	Gross Income	Net Income
Small Size (under 2 ha)	950-1,100	1,100-1,250	150
Medium Size (2 ha to 5 ha)	1,100-1,250	1,150-1,300	50-150
Large Size (5 ha and above)	1,200-1,300	1,250-1,400	50-100
All (Average)	1,050-1,216	1,166-1,316	100-116

° Vegetables/Orchards Growers[2/]

Annual Income and Expenditure (1985-86) (Rs/acre)

Farmer by Size	Gross Expenditure	Gross Income	Net Income
Small Size (under 2 ha)	2,000-2,500	3,000-3,550	1,000
Medium Size (2 ha to 5 ha)	2,000-2,550	2,700-3,200	700
Large Size (5 ha and above)	1,800-2,300	3,000-4,000	1,200-1,700
All (Average)	1,600-2,433	2,900-3,566	966-1,133

Note: 1/ Farmers who grow mainly grains.
2/ Farmers who grow mainly vegetables/fruits.

vii) Social Infrastructure

Social Infrastructure	Class	Attock	Fatehjang	Rawalpindi
No. of Villages		8	15	14
	Primary	14	7	8
School/Institutions	Middle	4	1	1
	High	3	1	-
	Others	2	-	-
Villages Electrified		5	7	9
	Qualified	7[2/]	-	2
Health	Doctor			
	Quacks[1/]	14	10	12
Communication	Post Office	6[2/]	5	6
Transport	Telephone	2[2/]		
	Transport	Sufficient	Sufficient	Sufficient
Water	Piped	2[2/]	1	-
Supply	Wells/Ponds	6	14	14
Literacy Percentage		18[1/]	10	13

Note: 1/ ... Unqualified doctor
2/ ... Including Hassan Abdul Town

viii) Present Cropping Pattern and Cropping Intensity

- Cropping Pattern

Cropping calendar generally adopted in the area is shown in Figure F-1-1.

- Cropping Intensity

° Cropping Intensity

Cropping intensity in the surveyed area is as follows.

Tehsil	Current Fallow	Net Sown	Total Area Cultivated (3)=(1)+(2)	Area Sown More Than Once (4)	Total Cropped Area (5)=(2)+(4)	Intensity (5)/(3)
Attock	1,794	12,069	13,863	4,331	16,400	118
Fatehjang	1,971	22,074	24,045	3,877	25,951	108
Rawalpindi	1,635	13,543	15,178	2,439	15,982	105
Total	5,400	47,686	53,086	10,647	58,333	110

° Rabi and Kharif Ratio

Rabi		Kharif		Perennial	
Wheat	58.8%	Coarse Grain	26.8%	Orchard	1.0%
Rabi Pulses	3.8%	Pulses	3.8%		
Oil Seeds	3.0%	Oil Seeds	2.0%		
Vegetables	0.5%	Vegetables	0.5%		
Total	66.1%	Total	33.1%	Total	1.0%

d. Constraints

A fairly fertile and alluvial land spreads over the entire command area where is located at 15 km northwest of the metropolitan area. The area has high potentiality in agriculture and advantage in location.

Despite such favorable aspects, almost all the farmers suffer from rainfed agriculture which is dependent upon physical factors of climate and soil. Moreover, they suffer from poor communication, inadequacy of rural health centers, shortage of education institutions and absence of proper transportation and electrification.

Among those constraints, rainfed agriculture leads farmers to low production and low income.

Yield of the major crops is considerably lower than the average in Punjab due to the fact that nearly 90 percent of the command area is not irrigated and cropping intensity is about 100 percent.

Under the present conditions farmers can not afford to pay any public utility charges because of low income even though public facilities are installed by government subsidy.

Top priority development scheme in the area, therefore, is to establish irrigation development plan, so that cropping intensity can be hightened, cash crops like vegetables and orchard can be grown, and also, livestock farming can be introduced by supplying enough irrigation water to the area.

Consequently, farmers income will be increased enough to pay public utility charge like water and electricity. They will afford to improve such social infrastructure as communication, health centers and other public utilities, then these improvement schemes will raise their living conditions.

(2) Soan River Right Bank Suburban Area

a. The area is located in the south of Rawalpindi and bound on the south by the Soan river, on the west and north by rocky hills or gullied ravines. The Rawalpindi-Adiala trunk road runs in the center of the area. Fertile land which is fully cultivated stretches to the river side from the road, while stony hills or gullied ravines render 50 percent of the area uncultivable on the side of the road.

b. Social Features

In spite of the fact that the area is located in the suburb of Rawalpindi and has high potentiality to be developed as suburban agriculture field, the area has not rendered this advantage realized because of inadequacy of irrigation system and water pollution of the Soan. Social infrastructures are well provided in 5 villages in the area. Irrigation canal with capacity large enough to irrigate about 1,000 ha area exists in the center of the cultivated area, but it is not utilized because lift pumps were damaged by flood.

It is recommendable that the canal should be rehabilitated and fully utilized for irrigation.

c. Present Agriculture Aspects

Socio-economic survey was conducted on 5 villages which scatter all over the area. Present agriculture aspects can be grasped by this survey. The findings from the survey are summarized as follows:

i) Population

No. of Village	Population by Sex			Household by Occupation		
	Male	Female	Total	Agri.	Non-Agri	Total
5	5,613	5,557	11,170	780	1,193	1,973

ii) Agriculture Household by Holding Size

Small 1/		Medium 2/		Large 3/		
No.	% Age	No.	% Age	No.	% Age	Total
332	42.6	305	39.1	143	18.3	780

Note: 1/ ... 0-2 ha, 2/ ... 2-5 ha,
3/ ... 5 ha and above

iii) Land Ownership

Classification of land ownership was not obtained from the survey.

iv) Sown Area and Production of Major Crops

Sown area and production are included in (1).(c).(iv).

v) Livestock Inventory

Livestock	Number
Buffalo	2,029
Buffalo Calf	734
Cow	765
Cow Calf	614
Bullock	618
Camel	16
Sheep	1,373
Goat	800
Donkey	348
Horse	14
Poultry	20,855

vi) Income and Expenditure

For income and expenditure refer to (1).(c).(vi).

vii) Social Infrastructure

Social Infrastructure	Class	Numbers
No. of Villages		5
Schools/Institutions	Primary	6
	Middle	2
	High	1
	Others	1 1/
Villages Electrified		4
Health	Qualified Doctors	1
	Quack	7 2/
Communication/ Transport	Post Office	1
	Telephone Office	-
	Transport	Sufficient
Water Supply	Piped	1 2/
	Well/Pond	4
Literacy Percentage		25%

Note: 1/ Barani Training Institute
2/ In Margah

viii) Present Cropping Pattern and Cropping Intensity

° Cropping Pattern

For cropping calendar generally adopted in the area refer to Figure F-2-1.

° Cropping Intensity

Cropping intensity in the area is as follows;

Tehsil	Current Fallow	Not Area Sown	Total Area Cultivated	Area Sown More Than Once	Total Cropped Area	Cropping Intensity
	(1)	(2)	(3)=(1)+(2)	(4)	(5)=(2)+(4)	(5)/(3)
Rawalpindi	959	3,304	4,263	2,113	5,417	127.0

d. Constraints

Very good fertile land spreads along the Soan river in the area which is located neighbor to the Rawalpindi city. Such social infrastructures as electrification, communication/transport, health centers and educational institutes are being well provided as a part of development of suburban villages and farm around Rawalpindi by ABAD.

As for irrigation scheme, the Daghal canal was constructed in the center of the area about ten years ago and extended up to 17,000 ft during 1981-82 and 1982-83 under phase-I of the said project. Irrigation water through this canal, however, has not been supplied to the farmers due to the reason that lift irrigation system was damaged by the flood. Rehabilitation of the lift irrigation system will be the hightest priority and emergency project in the area.

Table F-2-1 Willingness to Pay, 1987

Unit : Rs./1000 l(Rs./1000gal.)

User	Islamabad Proper	Rawalpindi Urban	Average
1. Domestic	0.95(4.32)	1.83(8.32)	1.44(6.55)
2. Public	1.90(8.64)	1.54(7.00)	1.77(8.05)
3. Commercial/Industrial	2.64(12.00)	2.56(11.64)	2.61(11.87)
4. Average	1.66(7.55)	1.90(8.64)	1.77(8.05)

Source : EC-1

Table F-2-2 Unit Cost and Revenue of Metropolitan Water Supply Service, 1985-86

Unit : Rs./1000 1'(Rs./1000 gal.)

Item	Islamabad Proper	Rawalpindi Urban	Average
1. Operation/Maintenance Cost (A)	1.22(5.55)	0.66(2.98)	0.96(4.36)
2. Capital Cost (B)	0.42(1.90)	0.08(0.37)	0.26(1.18)
3. Total (C=A+B)	1.64(7.45)	0.74(3.35)	1.22(5.54)
4. Revenue (D)	0.23(1.04)	0.18(0.81)	0.21(0.93)
5. Difference (E=D-C)	-0.41(-6.41)	-0.56(-2.54)	-1.01(-4.61)

Source : EC-1

Table F-2-3 Financial Analysis of the Existing Water Supply Service

C.D.A.

(Unit : Rs. million)

(year : 1985/86)

1 Costs and Revenues

1) Operation and Maintenance Costs

a.	Pay & Allowance of Regular Establishment (Personnel)	13.86 (16.5%)
b.	Electricity Charges	34.29 (40.8%)
c.	Store/Materials	11.03 (13.1%)
d.	Depreciation	21.48 (25.5%)
e.	Others	3.44 (4.1%)
	Total	84.10 (1000.0%)

2) Revenues

Water Charges Receipt 11.62

2. Unit Cost of Water Supply

1) Cost per 1000 Liters

$$\frac{\text{Rs. 84.10 million} \times 10^3}{\text{200.8MLD(44.2MGD)X0.7x365 days}} = \text{Rs. 1.64/000 l (Rs. 7.45/000 gal.)}$$

2) Recovery of Cost per 1000 Liters

$$\frac{\text{Rs. 11.62 million} \times 10^3}{\text{200.8MLD(44.2MGD)x0.7x365 days}} = \text{Rs. 0.23/000 l (Rs. 1.03/000 gal.)}$$

Sources : based on the data supplied by CDA

R.M.C.

(Unit : Rs. million)
(Year: 1985/86)

1. Costs and Revenues

1) Operation and Maintenance Costs

a.	Pay & Allowance of Regular Establishment (Personnel)	1.30 (9.9%)
b.	Electricity Charges and Other Contigencies	7.55 (57.5%)
c.	Repairs & Maintenace	0.65 (4.9%)
d.	Depreciation & Amortization	1.64 (12.5%)
e.	Others	2.00 (15.2%)
	Total	13.14 (100.0%)

2) Revenue

Water Charges Receipt 4.85

2. Unit Cost of Water Supply

1) Cost per 1000 Liters

$$\frac{\text{Rs. 13.14 million} \times 10^3}{\text{101.9MLD(22.4MGD)} \times 0.7 \times 365 \text{ days}} = \text{Rs. 0.50/000 l (Rs. 2.29/000 gal.)}$$

2) Recovery of Cost per 1000 Liters

$$\frac{\text{Rs. 4.85 million} \times 10^3}{\text{101.9MLD(22.4MGD)} \times 0.7 \times 365 \text{ days}} = \text{Rs. 0.19/000 l (Rs. 0.85/000 gal.)}$$

Sources :based on the data supplied by RMC

MES & CB

(Unit : Rs. million)
(Year : 1985/86)

1. Costs and Revenues

1) Operation and Maintenance Costs

a.	Pay & allowance of Regular Establishment (Personnel)	2.96 (14.5%)
b.	Electricity Charges	7.35 (35.9%)
c.	Store / Materials	5.48 (26.8%)
d.	Depreciation & Amortization	2.11 (10.3%)
e.	Others	2.55 (12.5%)
	Total	20.45 (100.0%)

2) Revenues

Water Charges Receipt	3.28

2. Unit Cost of Water Supply

1) Cost per 1000 Liters

$$\frac{\text{Rs. 20.45 million} \times 10^3}{\text{76.4MLD(16.8MGD)} \times 0.7 \times 365 \text{ days}} = \text{Rs. 1.05 / 000 l (Rs. 3.33 / 000 gal.)}$$

2) Recovery of Cost per 1000 Liters

$$\frac{\text{Rs. 3.28 million} \times 10^3}{\text{76.4MLD(16.8MGD)} \times 0.7 \times 365 \text{ days}} = \text{Rs. 0.17 / 000 l (Rs. 0.76 / 000 gal.)}$$

Note : excluding PAF

Sources :based on the data supplied by CMES & CB

F-2-4 Existing Water Tariff System

C.D.A.

1. Supply of Water Through Metered System

   1) Domestic Rs. 0.79/000 l (Rs.3.60/000 gal.)

   2) Commercial /Industrial Rs. 1.32/000 l (Rs.6.00/000 gal.)

2. Supply of Water Through Unmetered System

   1) Residential

      (1) Government Quarters

Types	Flat Rate (per Month)
A-Type	Rs. 9
B-Type	Rs. 9
C-Type	Rs. 9
D-Type	Rs. 12
E-Type	Rs. 16
F-Type	Rs. 21
G-Type	Rs. 27
H-Type	Rs. 31
I-Type	Rs. 36

      (2) Private Consumers

Plot Sizes	Flat Rate (per Month)
Less than 209 m^2 (Less than 250 yd^2)	Rs. 18
209 to 417 m^2 (250 to 499 yd^2)	Rs. 22
418 to 835 m^2 (500 to 999 yd^2)	Rs. 27
836 to 1002 m^2 (1000 to 1199 yd^2)	Rs. 36
1003 to 1253 m^2 (1200 to 1499 yd^2)	Rs. 48

1254 to 1671 m^2 (1500 to 1999 yd^2)	Rs. 60
1672 and above m^2 (2000 and above yd^2)	Rs. 72

2) Public and Commercial/Industrial:Different according to the categories and sizes of establishments/institutions

Sources : CDA

R.M.C

1. Supply of Water Through Metered System

   1) Domestic Discontinued

   2) Commercial/Industrial Rs. 1.10/000 l(Rs. 5/000 gal.)

2. Supply of Water Through Unmetered System

   1) Domestic

	Sizes of Ferrule	Flat Rate (per Annum)
a.	1/2" Ferrule	Rs. 150
b.	3/4" Ferrule	Rs. 300
c.	1" Ferrule	Rs. 700
d.	11/2"Ferrule	Rs.1600

   2) Commercial/Industrial

   Different according to the categories and sizes of establishments/institutions

Sources : RMC

MES

1. Supply of Water Through Metered System

1)	Army	Rs. 0.88 /000 l (Rs.4.00/000 gal.)
2)	Domestic	Rs. 0.88 /000 l (Rs.4.00/000 gal.)
3)	Commercial/ Industrial	Rs. 1.32 /000 l (Rs.6.00/000 gal.)

2. Supply of Water Through Unmetered System

1) According to the Sizes of Ferrule

Sizes of Ferrule	Flat Rate (per Month)
a. 1/2" Ferrule	Rs. 10
b. 3/4" Ferrule	Rs.12
c. 1" Ferrule	Rs.15
d. 11/2" Ferrule	Rs.22
e. 2" Ferrule	Rs.30

2) According to the Covered Area

Covered Area	Flat Rate (Per Month)
a. up to 836 m^2 (up to 1000 yd^2)	Rs.25
b. above 386, not more than 1672 m^2 (above 1000, not more than 2000 yd^2)	Rs.35
c. above 1672 m^2 (above 2000 yd^2)	Rs.50

3) Different according to the categories and sizes of establishments/institutions

Source: CMES

C.B.

1. Supply of Water Through Metered System

Discontinued

2. Supply of Water Through Unmetered System

1) Domestic

Covered Area	Flat Rate (per Month)
a. up to 826 m^2 (up to 1000 yd^2)	Rs. 20
b. above 836, not more than 1672m^2 (above 1000, not more than 2000yd^2)	Rs. 40
c. above 1672 m^2 (above 2000 yd^2)	Rs. 60

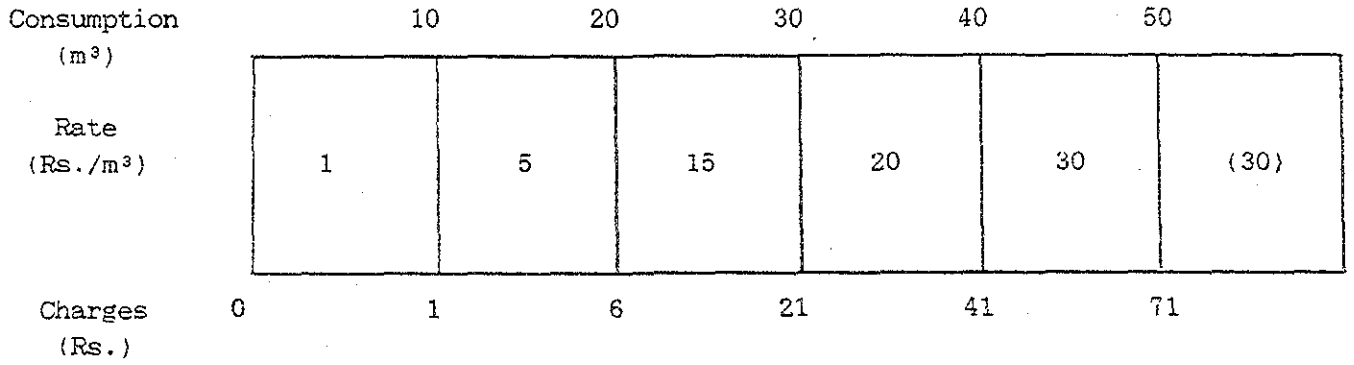
2) Commercial/Industrial

Different according to the categories and sizes of establishment/institutions

Source: CB

Table F-2-5 Example of Proposed Water Tariff Structure (Domestic), 1987

1. Water Tariff Structure



2. Water Charges by Household Income

No.	Income (Rs./M)	Share of Households (%)	Water Cons. (m³/M)	Water Charges (Rs./M)	Water Charges (Rs./m³)
1.	400	2.2	15.28	3.6	0.24
2.	750	13.7	18.42	5.2	0.28
3.	1,500	35.3	22.21	9.3	0.42
4.	2,500	22.5	35.24	31.5	0.89
5.	3,500	12.6	43.25	50.8	1.17
6.	4,000	5.3	53.65	82.0	1.53
7.	6,000	5.0	70.14	131.4	1.87
8.	8,500	1.2	82.08	167.2	2.04
9.	13,000	1.2	94.12	203.4	2.16
Ave.	2,713	(100.0)	32.54	32.9	1.01

Source : EC-1

Table F-2-6 Per Capita Daily Demand and Total Demand for Water in 1987 in Metropolitan Area

1) Per Capita Daily Demand

Unit;l(gal.)

Item	Islamabad Proper	Rawalpindi Urban	Average
1. Domestic Use	222 (48.8)	118(26.0)	149(32.7)
2. Public Use	151 (33.2)	18(4.0)	57(12.6)
3. Commercial/Industrial Use	122 (26.8)	31(6.8)	58(12.7)
4. Military Use	- (-)	17(3.7)	12(2.6)
5. Leakage/Wastage	212 (46.6)	79(17.4)	118(26.0)
Total(Excl.5.)	495(108.8)	184(40.5)	276(60.7)

2) Total Demand

Unit: MLD (MGD)

Item	Islamabad Proper	Rawalpindi Urban	Total
1. Domestic Use	63.0(13.9)	80.0(17.6)	143.0(31.5)
2. Public Use	42.9(9.4)	12.1(2.7)	55.0(12.1)
3. Commercial/Industrial Use	34.6(7.6)	20.9(4.6)	55.5(12.2)
4. Military Use	- (-)	11.8(2.6)	11.8(2.6)
5. Leakage/Wastage	60.3(13.3)	53.5(11.8)	113.8(25.1)
Total(Excl.5.)	140.5(30.9)	124.8(27.5)	265.3(58.4)

Source: EC-1

Table F-2-7 Background of Daily Demand Calculation for 1987

1) Islamabad Proper

(1) Domestic User Served

284,000 (Population) x 222 l (Daily per Capita Demand) = 63.0 MLD

(2) Public User Served

a. Government Offices

53,300 (No. of Govt. Employees) x 554 l (Daily Demand per Govt. Employee) = 29.5 MLD

b. Schools

48,463 (No. of Pupils/Students) x 58 l (Daily Demand per Pupil/Student) = 2.8 MLD

c. Embassies

77 (No. of Embassies) x 13 (No. of Workers per Embassy) x 765 l (Daily Demand per Worker)
= 0.8 MLD

d. Mosques

151*(No. of Mosques) x 702 (No. of Visitors per Mosque) x 69 l (Daily Demand per Visitor)
= 7.3 MLD * Faisal Mosque is counted as 10.

e. Hospitals / Dispensaries

27 (No. of Hospitals / Dispensaries) x 117 (No. of Patients per Hospital)
x 317 l (Daily Demand per Patient)
= 1.0 MLD

f. Parks

49 (No. of Parks) x 457 (No. of Visitors per Park) x 67 l (Daily Demand per Visitor) = 1.5 MLD

g. Total
42.9 MLD

(3) Commercial / Industrial User Served
3,314 (No. of Establishments) x 10.5 (No. of Workers per Establishment)
x 993 l (Daily Demand per Worker) = 34.6 MLD

2) Rawalpindi Urban

(1) Domestic User Served
678,000 (Pupulation) x 118 (Daily per Capita Demand) = 80.0 MLD

(2) Public User Served

a. Government Offices
55,000 (No. of Govt. Employees) x 121 l (Daily Demand per Govt. Employee) = 6.6 MLD

b. Schools
171,305 (No. of Pupils/Students) x 13 l (Daily Demand per Pupil/Student) = 2.2 MLD

c. Hospitals / Dispensaries
107 (No. of Hospitals/Dispensaries) x 113 (No. of Patients per Hospital/Dispensary)
x 106 l (Daily Demand per Patient) = 1.3 MLD

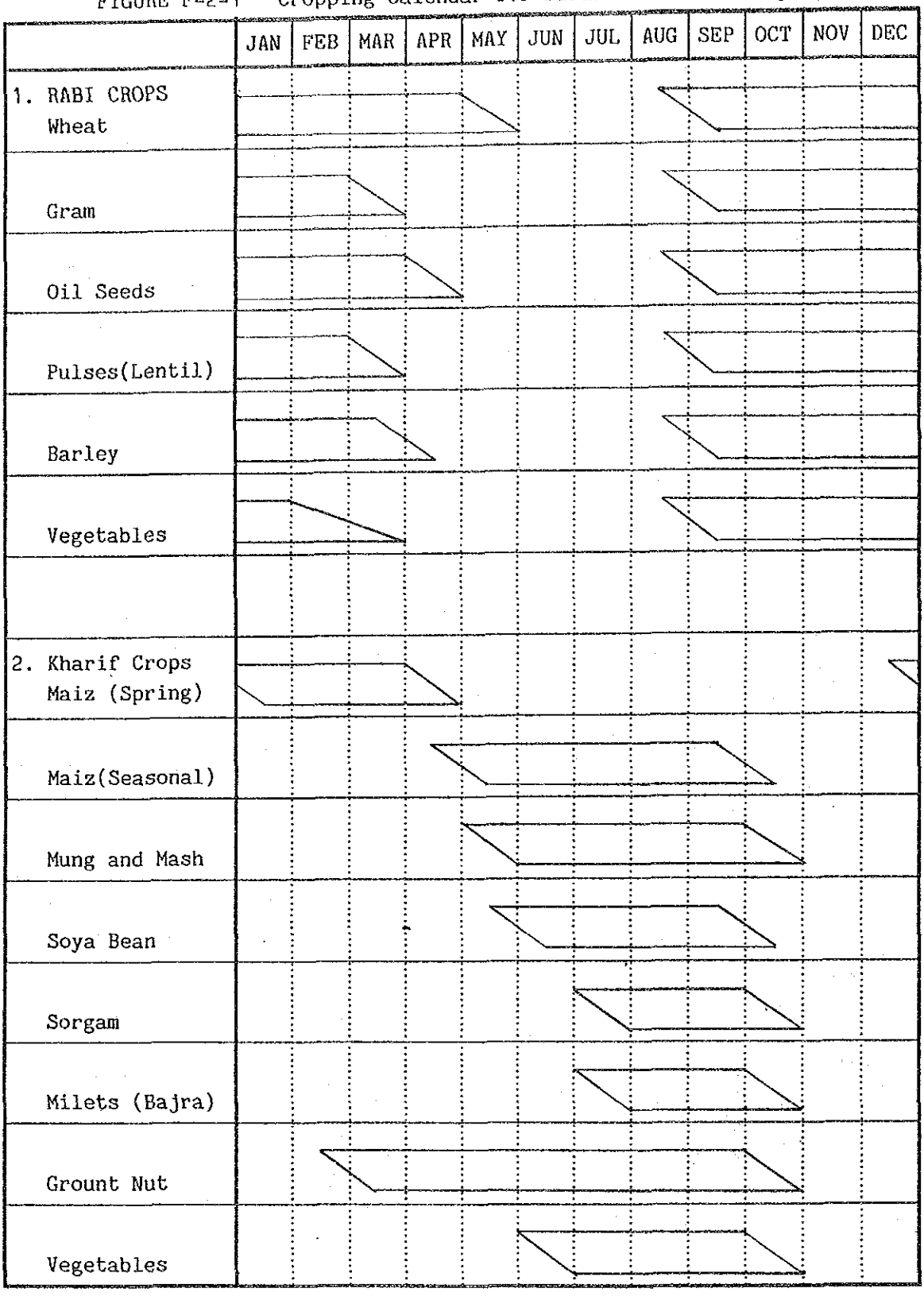
d. Mosques
380 (No. of Mosques) x 247 (No. of Visitors per Mosque) x 14 l (Daily Demand per Visitor) = 1.3 MLD

e. Parks
31 (No. of Parks) x 457 (No. of Visitors per Park) x 49 l (Daily Demand per Visitor) = 0.7 MLD

f. Total
12.1 MLD

(3) Commercial / Industrial User Served
21,176 (No. of Establishments) x 5.4 (No. of Workers per Establishment)
x 183 l (Daily Demand per Worker) = 20.9 MLD

FIGURE F-2-1 Cropping Calendar for Barani Areas of Punjab



F.3. Benefit

F.3.1. General

The benefits to be brought forth by the realization of the Project can be divided into urban water benefits and irrigation benefits in accordance with the ultimate usages of developed water resources. These two kinds of benefits are further divided into financial benefits and economic benefits. Financial benefits of urban water take the form of the income to be received by the organizations in charge of construction and operation/maintenance of the facilities for water resources development and water supply in exchange for the supply service of urban water. Financial benefits of irrigation are an incremental income for the farming beneficiaries, deriving from a greater agricultural/livestock produce. Economic benefits are the benefits to be brought forth by the supply of urban and irrigation water which are assessed in terms of national economy.

The facilities to be constructed under the Project include storage dams, head works, lifts for raw water and conductions, but such water supply facilities as treatment plants, lifts for treated water, distribution mains, service reservoirs and distribution networks as well as channel and other facilities for irrigation are outside the scope of this study. However, benefits of the Project will be realized only when the above facilities are constructed. Therefore, in project evaluation it is necessary to estimate the initial and operation/maintenance costs of those terminal facilities and incorporate them into project costs. Or, in case project costs are confined to the costs to be required under the Project, their ratio to the entire costs including terminal facilities shall be applied to benefits as a coefficient.

F.3.2. Urban Water

(1) Financial Benefits

Financial benefits of urban water depend on the water rates water supply authorities will impose on beneficiaries per unit quantity of consumption. Such water rates must be determined in the most appropriate manner by assessing both beneficiaries' paying ability and financial position of water supply authorities.

As already mentioned, production cost of urban water in the Metropolitan areas is now Rs.1.22 per 1,000 lit. (Rs.5.55 per 1,000 gal.). Domestic users shall pay Rs.1.01 per 1,000 lit. (Rs.4.58 per 1,000 gal.) to cover production cost on the assumptions that commercial/industrial users pay water rates twice as high as domestic/public users per unit quantity of consumption. It is revealed that in such circumstances households will make water payment corresponding to 1.2 percent of their income. It is within the maximum limit of 5 percent recommended by World Bank and also within the realistic and reasonable limit of 3 percent.

If it is assumed that the price of the urban water to be supplied under the Project is Rs.2.53 per 1,000 lit. (Rs.11.50 per 1,000 gal.), then households will pay Rs.2.09 per 1,000 lit. (Rs.9.50 per 1,000 gal.) on the premise that the price for commercial/industrial users is twice as high as that for domestic/public users. In such circumstances households will allot 2.5 percent of their income for water payment. Upon these conditions financial internal rate of return (FIRR) is calculated at 5.2 percent.

The value of 2.5 percent as the ratio of water payment to income in home economy is considered to be one of the most appropriate standard values. According to World Bank, water supply projects seldom have internal rates of return equal to or greater

than 6 to 8 percent. It would not be reasonable, nor realistic to apply long-term interest rate of 14 percent in the country to water supply projects as the acceptable FIRR, as such projects are highly social in nature, involving basic human needs. 5.2 percent is considered to be one of the most appropriate standard values of FIRR for water supply authorities, and it is recommended that when the Government lends capital to water supply authorities the terms will be somewhere along this line.

It is thus decided that financial benefits of urban water to be supplied under the Project will be Rs.2.53 per 1,000 lit. (Rs.11.50 per 1,000 gal.) as of 1987. Then, households will spend 2.5 percent of their income as water payment. Unit benefits will grow in future in parallel with the growth of beneficiaries' income. (Refer to Table F-3-1.)

If the above unit benefits of urban water are rendered into unit benefits of raw water by applying to it the cost ratio of water resources development vis-a-vis the entire undertaking, they work out at Rs.1.00 per 1,000 lit. (Rs.4.55 per 1,000 gal.).

(2) Economic Benefits

Economic benefits of urban water are not calculated on the basis of unit cost of production. They are basically determined by beneficiaries' willingness to pay for unit quantity of consumption. Such a willingness to pay can be regarded as an expression of intrinsic values or benefits beneficiaries attach to the urban water. The greatest and foremost benefit among them is a reduction of diseases to be brought about by the introduction of clean water. The second benefit is a saving of time that is spent every day in fetching water from rivers, ponds, etc. There are other benefits like the benefit to derive from the use of water for fire-fighting. If these individual benefits were expressed in quantitative or money terms, it would provide the most accurate

picture of economic benefits of urban water. But it is difficult in reality and thus beneficiaries' willingness to pay is substituted as an all inclusive expression of those benefits.

F.3.3. Irrigation Water

(1) Financial Benefits

It is expected that agriculture in the beneficiary areas will witness a remarkable growth of income through the elevation of cropping intensity, improvement of cropping pattern, increase of production per unit cropped area, etc. when irrigation water is supplied to those areas under the Project.

It is estimated that when irrigation water of 120.3 MCM is supplied per annum to the service areas of 17,000 ha under the Project, cropping intensity in the areas will go up from the present 111 percent to 140 percent, the present cropping pattern where wheat and other grains are dominant will be transformed into the pattern that gives priority to high income crops such as vegetables, orchards, sugarcane and fodder, and unit production of crops will shoot up two- to four-fold. As a result annual gross income from agriculture in the areas will grow by Rs.474.97 million (646%) and in parallel with it annual net income will grow by Rs.180.27 million (651%). Income in the "with" situation includes that of livestocks that will feed on the fodder to be newly introduced. (Refer to Table F-3-6.)

The number of farming households in the service areas is 10,676. They engage in livestock farming along with agriculture. Annual gross and net income per farming household from livestock farming is said to be about Rs.5,000 and Rs.2,500, respectively. Consequently, it is estimated that by the introduction of irrigation water annual gross income per farming household from both

agriculture and livestock farming will increase from the present Rs.11,886 by Rs.44,489 (374%) to Rs.56,375, and similarly annual net income will increase from the present Rs.5,092 by Rs.16,885 (332%) to Rs.21,977 (excluding payment for irrigation water).

In short, the annual financial benefits of irrigation under the Project will be Rs.180.27 million. It means that annual financial benefits per farming household will be Rs.16,886. Also, financial benefits per 1,000 lit. (1,000 gal.) of irrigation water will be Rs.1.50 (Rs.6.82).

Terminal facilities for irrigation are not considered under the Project. Therefore, if financial benefits are to be grasped in the way that they match the facilities to be constructed and operated/maintained under the Project, they work out at Rs.1.01 per 1,000 lit. (Rs.4.59 per 1,000 gal.) by applying the cost ratio between Project related facilities and entire facilities.

(2) Economic Benefits

In analyzing agricultural benefits resulting from the introduction of irrigation water from the standpoint of national economy, the first thing to do is to convert the prices per unit quantity of related agricultural crops into border prices, i.e. economic prices. Also, the costs of labor, seed, fertilizer, chemicals, machinery, etc. per unit cropped area or unit production for those crops must be converted into economic costs.

Sometimes it happens as a result of such processes that significant difference arises between actual output prices/input costs and economic counterparts depending on the presence/amount of agricultural subsidies, economic environment exemplified by unemployment rate, etc., weight/importance of imports in inputs and so forth. In such cases, ultimate economic benefits from irrigation may significantly differ from financial ones.

However, the factors that will significantly change financial benefits are considered under the present circumstances to be non-existent. Actually, there is no significant difference between the agricultural prices adopted by the Study Team and corresponding world prices. Moreover, there is an inherent limitation on the depth of analysis for this study in that it is a master plan study and not a feasibility study.

Because of the above reasons, so far as irrigation is concerned economic benefits are considered to be equal to financial benefits.

F.3.4. Airport Water

It is estimated that demand for urban water in the New International Airport will reach 2.5 MCM in the ultimate target year of 2030. This estimate is based on the demand forecast for passengers and freight moving to/from the airport. Demand for the year of 2000 and the intermediate target year of 2010 is estimated at 0.8 MCM and 1.7 MCM, respectively.

To meet the airport demand construction of a tubewell is proposed for the special and sole use by the airport. The user of the urban water to be supplied belongs to public institutions and accordingly in accordance with the custom in the country financial benefits of the urban water for the user are assumed to be the same with those for the domestic user, i.e. Rs.2.09 per 1,000 lit. (Rs.9.50 per 1,000 gal.). Unit financial benefits are assumed to grow in future in parallel with the growth of the user's income.

Economic benefits of the airport water are assumed to be equal to the willingness to pay of Metropolitan public beneficiaries, i.e. Rs.1.77 per 1,000 lit. (Rs.8.05 per 1,000 gal.). Unit economic benefits are assumed to grow in future in parallel with the growth of the user's income.

Table F-3-1 Financial Benefit (=Rates) of Domestic Water 1987 to 2030 as Related to Percentage of Water Payment to Income

1. Domestic Water Demand per Household per Month

Item	1987	1990	2000	2010	2020	2030
1) Islamabad Proper						
(1) Population Served	284,000	341,000	621,000	760,000	885,000	1,006,000
(2) Domestic Demand per Capita per Day (l)	222	226	236	245	252	257
2) Rawalpindi Urban						
(1) Pupulation Served	678,000	760,000	1,114,000	1,445,000	1,770,000	2,095,000
(2) Domestic Demand per Capita per Day (l)	118	126	150	177	200	219
3) Rawalpindi Rural						
(1) Population Served	-	-	36,000	65,000	111,000	166,000
(2) Domestic Demand per Capita per Day (l)	-	-	150	177	200	219
4) Total						
(1) Population Served	962,000	1,101,000	1,771,000	2,270,000	2,766,000	3,267,000
(2) Domestic Demand per Capita per Day (l)	149	157	180	200	217	231
5) 1/Domestic Demand per Household per Month (m^3)	32.54	34.29	39.31	43.68	47.39	50.45

1/ No. of Household Members = 7.28

2. Income per Household per Month

Income	1987	1990	2000	2010	2020	2030
1) Economic Growth Rate		7%	6%	5%	4%	3%
2) Growth Rate of Population		3.2%	3.0%	2.0%	1.5%	1.0%
3) Growth Rate of Household Income		3.8%	3.0%	3.0%	2.5%	2.0%
4) Income per Household per Month (Rs.)	2,713	3,034	4,078	5,480	7,015	8,551

3. Financial Benefit (=Rates) of Domestic Water as Related to Percentage of Water Payment to Income (Unit : Rs./m^3)

	Percentage	1987	1990	2000	2010	2020	2030
1)	1%	0.83	0.88	1.04	1.25	1.48	1.69
2)	2%	1.67	1.77	2.07	2.51	2.96	3.39
3)	2.5%	2.09	2.21	2.59	3.14	3.70	4.24
4)	3%	2.50	2.65	3.11	3.76	4.44	5.08

Source : EC-1

Table F-3-2 Water Rate and Water Payment Ratio to Income (Stock Base)

Item	1987	1990	2000	2010	2020	2030
1. Monthly Demand per Household (m^3)	32.54	34.29	39.31	43.68	47.39	50.45
2. Monthly Income per Household (m^3)	2,713	3,034	4,078	5,480	7,015	8,551
3. Demand for Domestic Water (MCM/Year)						
(1) Water to be Developed under the Project	-	10.8	64.1	113.4	166.8	223.2
(2) Water Already Developed	52.3	52.3	52.3	52.3	52.3	52.3
(3) Total	52.3	63.1	116.4	165.7	219.1	275.5
4. Water Rate (Rs./m^3)						
(1) Water to Be Developed under the Project	2.09	2.21	2.59	3.14	3.70	4.24
(2) Water Already Developed	1.01	1.01	1.01	1.01	1.01	1.01
(3) Weighted Average	1.01	1.22	1.88	2.47	3.06	3.63
5. Percentage of Water Payment to Income	1.2%	1.4%	1.8%	2.0%	2.1%	2.1%

Source : EC-1

Table F-3-3 Coefficient of Total Project Cost to Cost of Proposed Project Cost

Unit : Rs. Million

A. Financial Analysis

1. Total Project Cost
   1) Total Project Cost
      (1) Initial Cost : 16,500.0
      (2) O/M Cost : 351.6

   2) Annualization of Total Project Cost

$$16{,}500.0 \times \frac{0.05^{1/} \times (1 + 0.05)^{50\,2/}}{(1 + 0.05)^{50} - 1} + 351.6 = 1{,}225.4$$

2. Proposed Project Cost
   1) Proposed Project Cost
      (1) Initial Cost : 11,860.0
      (2) O/M Cost : 189.0

   2) Annualization of Proposed Project Cost

$$11{,}860.0 \times \frac{0.05 \times (1 + 0.05)^{50}}{(1 + 0.05)^{50} - 1} + 189.0 = 838.7$$

   3) Coefficient

$$\frac{\text{Annualized Proposed Project Cost}}{\text{Annualized Total Project Cost}} = \frac{1{,}225.4}{838.7} = 1.4968$$

B. Economic Analysis

1. Total Project Cost
   1) Total Project Cost
      (1) Initial Cost : 12,725.4
      (2) O/M Cost : 351.6

   2) Annualization of Total Project Cost

$$12{,}725.4 \times \frac{0.05 \times (1 + 0.05)^{50}}{(1 + 0.05)^{50} - 1} + 351.6 = 1{,}048.7$$

2. Proposed Project Cost
   1) Proposed Project Cost
      (1) Initial Cost : 8,865.8
      (2) O/M Cost : 189.0

   2) Annualization of Proposed Project Cost

$$8{,}865.8 \times \frac{0.05 \times (1 + 0.05)^{50}}{(1 + 0.05)^{50}} + 189.0 = 674.6$$

   3) Coefficient

$$\frac{\text{Annualized Proposed Project Cost}}{\text{Annualized Total Project Cost}} = \frac{1{,}048.7}{674.6} = 1.5546$$

Note : 1/ : Annual Rate of Interest
       2/ : Project Life

Table F-3-4

Coefficient of Average Water Price to Domestic Water Rate

Item	1987	1990	2000	2010	2020	2030
1. Islamabad Proper						
1) Population Served	284,000	341,000	621,000	760,000	885,000	1,006,000
2) Daily per Capita Demand (l)						
(1) Domestic/Public/Military	373	377	307	305	314	322
(2) Commercial/Industrial	122	102	117	122	122	126
(3) Leakage/Wastage	212	200	160	143	127	112
2. Rawalpindi Urban						
1) Population Served	678,000	760,000	1,114,000	1,445,000	1,770,000	2,095,000
2) Daily per Capita Demand (l)						
(1) Domestic/Public/Military	153	165	208	241	269	304
(2) Commercial/Industrial	31	33	34	43	47	51
(3) Leakage/Wastage	79	82	91	95	93	86
3. Rawalpindi Rural						
1) Population Served	-	-	36,000	65,000	111,000	166,000
2) Daily per Capita Demand (l)						
(1) Domestic/Public/Military	-	-	169	200	227	250
(2) Commercial/Industrial	-	-	20	30	38	46
(3) Leakage/Wastage	-	-	72	77	77	74
4. Coefficient (%)	84.67	84.10	87.61	90.59	92.84	95.87

Note : Water rate for commercial/industrial user is twice that for domestic user and of course we cannot collect any charges from leakage/wastage.

Source: EC-1

Table F-3-5

Information on Unit Water Price

1. Relation between Unit Price of Raw Water and That of Domestic Water for the Project

1) Revenue from urban water = Total production of urban water x Unit Price of urban water = Total production of urban water x Unit price of domestic water x Ratio of unit price of urban water to that of domestic water = Total production of urban water x Unit price of domestic water x 0.8467

2) Revenue from raw water = Total Production of raw water x Unit price of raw water = Total production of urban water x 1.05 x Unit price of raw water

3) Revenue from urban water = Revenue from raw water x Ratio of project cost for urban water to that for raw water = Revenue from raw water x 1.4968

From 1), 2) and 3) we get 4) and ultimately 5).

4) Total production of urban water x Unit price of domestic water x 0.8467 = Total production of urban water x 1.05 x Unit price of raw water x 1.4968

5) Unit price of raw water = Unit price of domestic water x 0.8467/ (1.05 x 1.4968) = Unit price of domestic water x 0.5387

2. Relation between Revenue Unit Price of Urban Water and Unit Price of Domestic Water

Item	Islamabad Proper	Rawalpindi Urban
Population	284,000	678,000
Per Capita Daily Demand (l)		
Domestic/Public/Military	373	153
Commercial/Industrial	122	31

Note : Estimates for 1987

It is assumed that water rate for commercial & industrial users is twice that for domestic, public & military users. Then, the following equation will hold based on the above table.

$$\frac{\text{Revenue unit price of urban water (RUPUW)}}{\text{Unit price of domestic water (UPDW)}} =$$

$$\frac{284{,}000 \times (373 + 122 \times 2) + 678{,}000 \times (153 + 31 \times 2)}{284{,}000 \times (373 + 122) + 678{,}000 \times (153 + 31)} = 1.2098$$

$$RUPUW = UPDW \times 1.2098$$

3. Unit Price of Domestic Water, Percentage of Water Payment to Income and Unit Price of Raw Water for 1987

1) Unit price of domestic water = Revenue unit price of urban water/ Coefficient of revenue unit price of urban water to unit price of domestic water = Rs. 1.22/m^3 * x 1.2098 = Rs. 1.01/m^3

* Figure for 1987

2) Precentage of water payment to income = Unit price of domestic water/Unit price of domestic water under water payment of one percent to income = (Rs. 1.01/m^3)/ (Rs. 0.83/m^3) * = 1.22%

* Figure for 1987

Table F-3-6 Financial Benefits of Irrigation

Crop	Cropped Area (ha)	Producation (t/ha)	Gate Price (Rs./t)	Unit Revenue (Rs./ha)	Sales Revenue (Rs.million)	Net Income (Rs.million)
Code	A	B	C	D=B x C	$E=AxDx10^{-6}$	F=Ex1/
1)	"Without" Situation					
Wheat	9,828	1.53	2,208	3,378	33.20	9.96
Coarse Grain	4,712	0.71	2,444	1,735	8.18	4.91
Pulses	1,338	0.62	4,254	2,637	3.53	2.12
Oil Seeds	878	0.68	5,610	3,815	3.35	1.84
Fruits	316	5.66	4,295	24,310	7.68	2.69
Vegeta-bles	1,798	4.86	2,011	9,773	17.57	6.15
Total	18,870	-	-	-	73.51	27.67
2)	"With" Situation					
Wheat	6,800	3.06	2,208	6,756	45.94	13.78
Maize	5,100	2.54	2,103	5,342	27.24	14.98
Soy Bean	850	1.69	5,250	8,873	7.54	4.52
Oil Seeds	850	1.36	5,610	7,630	6.49	3.57
Fruits	1,700	22.64	4,295	97,239	165.31	57.86
Vegeta-bles	5,100	19.44	2,011	39,094	199.38	69.78
Sugarcane	1,700	71.14	267	18,994	32.29	11.30
Fodder	1,700	70.43	-	-	64.29 2/	32.15
Total	23,800	-	-	-	548.48	207.94
3)	"With - "Without"					
Total	4,930	-	-	-	474.97	180.27

Sources: EC-1, EC-2, EC-3, EC-4 and EC-5

1/

Crop	Production Cost as Percentage of Gross Income (%) A	Net Income Ratio (%) (= r) B=100-A
Wheat	70	30
Coarse Grain	40	60
Pulses	40	60
Oil Seeds	45	55
Fruits	65	35
Vegetables	65	35
Maize	45	55
Soy Bean	40	60
Sugarcane	65	35
Cattle	50	50

2/ 1,700ha x (70.43 tonnes/ha) / (11.95 tonnes/head)* x (Rs.6,417/head)**

= Rs. 64.29 million

* Average quantity of fodder required to bring up one head of cow, bullock or buffalo

** Average farm gate price per head

Table F-3-7. Water Cost to be Borne by Farmer

No.	Percentage of O/M Cost to be Borne by Farmers	Water Costs to be Borne by Farmer/Yr	Unit Water Cost to be Bone by Farmers	Incremental Net Income/ Farmer/Yr	Percentage of Water Payment to Gross Income
	(%)	(Rs.)	(Rs./m^3)	(Rs.)	(%)
1.	10	421	0.04	16,465	0.7
2.	20	841	0.07	16,045	1.5
3.	30	1,262	0.11	15,625	2.2
4.	40	1,682	0.15	15.204	3.0
5.	50	2,103	0.19	14,783	3.7
6.	60	2,523	0.22	14,363	4.5
7.	70	2,944	0.26	13,942	5.2
8.	80	3,365	0.30	13,521	6.0
9.	90	3,785	0.34	13,101	6.7
10.	100	4,206	0.37	12,680	7.5

Remarks: 1) Annual O/M Cost = Rs.44.9 Million

2) Annual Requirement of Irrigation Water = 120.3 MCM

3) No. of Farming Households = 10,676

4) Water Requirement per Farmer = 120.3 MCM/10,676 = 11,268 m^3

5) Incremental Net Income per Farmer per Year before Water Payment = Rs.180.27 Million/10,676 = Rs.16,886

6) Gross Income per Farmer per Year = Rs.548.48 Million/ 10,676 + Rs.5,000 = Rs.56,375

Source: EC-1

F.4. Financial and Economic Justification

It is estimated that under the Project annual end demand for water amounting to 551.0 MCM will newly arise during the period 1988 to 2030, and to cope with it initial and O/M costs related to water resources development facilities amounting to Rs.11,860.0 million and Rs.189.0 million, respectively will be required.

Furthermore, it is preliminarily estimated that initial and O/M costs related to distribution and other facilities amounting to Rs.4,640.0 million and Rs.162.6 million, respectively will be required. Financial benefits arising from the satisfaction of end demand have already been described in the preceding sections.

Project life is assumed to be 50 years, ranging from 1988 to 2037. Project implementation period is assumed to be 43 years, starting in 1988 and ending in 2030.

Financial evaluation is an analysis from the standpoint of water authorities. Whereas, economic evaluation is an analysis from the viewpoint of national economy.

When initial costs for water resources development facilities and the same costs for distribution and other facilities are converted into economic values by subtracting transfer payment such as customs duty and taxes from them, one gets Rs.8,865.8 million and Rs.3,859.6 million (preliminary estimate), respectively. Their respective conversion factors are 74.75 percent and 83.18 percent. Conversion operations were not performed on O/M cost. As regard economic benefits, they have been already described in the preceding sections.

Evaluations are done by target year and by beneficiary. That is to say, financial and economic evaluations are conducted for a project with the target year

of 2030, an urban water supply project, an irrigation water supply project and an airport water supply project.

According to World Bank it is a rare case that a water supply project has an internal rate of return equal to or more than 6 percent. Long term lending rate is at present 14 percent in Pakistan, which can be regarded as the financial opportunity cost of capital. However, it would be not reasonable, nor realistic to set such a value as the financially acceptable standard for a project strongly social in nature, involving basic human need.

The Study Team thus proposes the value of 5 percent as the standard FIRR for a water supply project. As the economic opportunity cost of capital the Team adopts the value of 12 percent which Planning Commission in the country recommends.

F.4.1. Financial Justification

(1) Evaluations by Target Year

a. Target Year: 2010

Demand for urban, irrigation and airport water in the intermediate target year of 2010 under the Project is estimated to add up to 334.9 MCM. To meet it raw water of 388.7 MCM will be developed. Initial and O/M costs for water resources development facilities in connection with it are calculated at Rs.4,974.0 million and Rs.144.2 million, respectively. Also, initial and O/M costs for distribution and other facilities to meet the above demand are preliminarily calculated at Rs.2,566.0 million and Rs.88.9 million, respectively.

That is to say, to meet the annual demand of 334.9 MCM initial cost of rs.7,540.0 million and O/M cost of Rs.233.1 million will be required.

Financial analysis reveals that the project has the FIRR of 5.0 percent. It is equal to the standard FIRR and shows that this project, incorporating water supply sector as a major component can be said to be feasible upon the above-mentioned premises on benefits.

b. Target Year: 2030

The ultimate target year for the Project is 2030. Therefore, the ultimate financial justification of the Project is done for this case.

The combined demand for urban, irrigation and airport water in 2030 under the Project is estimated at 551.0 MCM. To meet it raw water of 625.9 MCM will be developed. Initial and O/M costs for water resources development facilities in connection with it are calculated at Rs.11,860.0 million and Rs.189.0 million, respectively. Also, initial and O/M costs for distribution and other facilities to meet the above demand are preliminarily estimated at Rs.4,640.0 million and Rs.162.6 million, respectively.

That is to say, to meet the annual demand of 551.0 MCM initial cost of Rs.16,500.0 million and O/M cost of Rs.351.6 million will be required.

Financial analysis reveals that the Project has the FIRR of 5.4 percent. It is higher than the standard FIRR of 5 percent by 0.4 percent and shows that the Project, incorporating water supply sector as a major component has

a sufficient viability upon the above-mentioned premises on benefits.

In case the Project is to be evaluated based on the costs and benefits related to the construction and O/M of the facilities contemplated under the Project, the ratio between the costs of the facilities contemplated under the Project and the costs of the entire related facilities including distribution and other facilities must be applied to the ultimate benefits of urban and irrigation water.

Financial analysis reveals that FIRR in this case is 5.2 percent. It is not much different from the first one. It means that whichever procedure will be all right in making financial evaluation.

(2) Evaluations by Beneficiary

Demand for urban, irrigation and airport water in 2030 under the Project is estimated at 428.2 MCM, 120.3 MCM and 2.5 MCM, respectively. To meet it raw water of the respective quantities of 503.1 MCM, 120.3 MCM and 2.5 MCM will be developed.

User wise initial and O/M costs for water resources development facilities in connection with it are as shown in Table F-4-3. Also, user wise initial and O/M costs for distribution and other facilities to meet the above demand are as shown in the same table.

That is to say, as shown in Table F-4-3, to meet the above-mentioned annual demand for urban, irrigation and airport water, the respective initial costs of Rs.14,989.3 million, Rs.1,493.6 million and Rs.17.1 million, and the respective O/M costs of Rs.305.6 million, Rs.44.9 million and Rs.1.1 million will be required.

Financial analysis reveals that urban, irrigation and airport water supply projects have the respective FIRR's of 5.2 percent, 6.3 percent and 19.0 percent.

The urban water supply project occupies a dominant position in the Project and consequently has an FIRR similar to that of the whole project. It is almost equal to the standard FIRR of 5 percent and shows that the project is feasible if afore-mentioned premises are applied to benefits. The irrigation water supply project has an FIRR by 7.7 percent below the long-term lending rate of 14 percent in the country. However, the project is vital for the ever growing future population in the Metropolitan areas in that it will supply them with ample fresh vegetables and fruits, thereby promoting and ensuring their nutritional balance and health. Consequently, it is ultimately judged to be financially feasible.

This project has an FIRR greater than that of the urban water supply project and therefore it has a higher priority than the latter from the standpoint of financial analysis. The FIRR of airport water supply project is by 5.0 percent higher than long-term lending rate in the country. The beneficiary is to engage in an international business and its profitability is considered to be high and as such the above value can be regarded as reasonable.

F.4.2. Economic Justification

(1) Evaluations by Target Year

a. Target Year: 2010

Demand for urban, irrigation and airport water in the intermediate target year of 2010 under the Project is estimated to add up to 334.9 MCM. To meet it raw water of 388.7 MCM will be developed. Economic initial and O/M

costs for water resources development facilities in connection with it are calculated at Rs.3,862.8 million and Rs.144.2 million, respectively. Also, economic initial and O/M costs for distribution and other facilities to meet the above demand are preliminarily calculated at Rs.2,134.4 million and Rs.88.9 million, respectively.

That is to say, to meet the annual demand of 334.9 MCM initial cost of Rs.5,997.2 million and O/M cost of Rs.233.1 million in economic terms will be required.

Economic analysis reveals that this project has the economic internal rate of return (EIRR) of 3.8 percent. It is lower than the opportunity cost of capital of 12 percent by 8.2 percent. However, because of the reasons enumerated in b. this project is judged to be economically feasible.

b. Target Year: 2030

The ultimate target year for the Project is 2030. Therefore, the ultimate economic justification of the Project is done for this case.

The combined demand for urban, irrigation and airport water in 2030 under the Project is estimated at 551.3 MCM. To meet it raw water of 625.9 MCM will be developed. Economic initial and O/M costs for water resources development facilities in connection with it are calculated at Rs.8,865.8 million and Rs.189.0 million, respectively. Also, economic initial and O/M costs for distribution and other facilities to meet the above demand are preliminarily estimated at Rs.3,859.6 million and Rs.162.6 million, respectively.

That is to say, to meet the annual demand of 551.0 MCM initial cost of Rs.12,725.4 million and O/M cost of Rs.351.6 million in economic terms will be required.

Economic analysis reveals that the Project has the EIRR of 4.2 percent. It is lower than the opportunity cost of capital of 12 percent by 7.8 percent. However, as already described, it is rare that a water supply project has an internal rate of return equal to or more than 6 percent. Also, it is difficult to directly quantify economic benefits and when beneficiaries' willingness to pay is substituted for them, it tends to be lower than the real level. Furthermore, a water supply project involves basic human need and can not be left undone if people are to lead hygienic, healthy and modern lives. For these reasons the Project, incorporating water supply sector as a major component is judged to be economically feasible.

There is another approach, where the Project is evaluated based on the costs and benefits at raw water stage, i.e. those costs and benefits as related to the construction and operation/maintenance of the facilities contemplated under the Project. Economic analysis reveals that EIRR in this case is 4.0 percent. It is not much different from the first one. It means that whichever procedure will be all right in making economic evaluation.

(2) Evaluations by Beneficiary

Demand for urban irrigation and airport water in 2030 under the Project is estimated at 428.2 MCM, 120.3 MCM and 2.5 MCM, respectively. To meet, it raw water of the respective quantities of 503.1 MCM, 120.3 MCM and 2.5 MCM will be required. User wise economic initial and O/M costs for water resources development facilities in connection with it are as shown in Table F-4-4. Also, user wise economic initial and O/M costs for distribution and other facilities to meet the above demand are as shown in the same table.