CHAPTER 7. CONSTRUCTION PLAN AND COST ESTIMATION

7.1 SUMMARY OF CONSTRUCTION WORKS

The plan for construction works are prepared for all structures proposed as the components of the optimum structural flood mitigation plan and the flood forecasting and warning system proposed as the eligible non-structural flood mitigation plan.

7.1.1 Community Pond

The community pond is scheduled to complete through the urgent project (2004-2005) as described in the following chapter. The major works are broadly divided into the following three (3) portions: (1) Diversion works, (2) Construction of the flood mitigation facilities and (3) Construction of the amenity facilities. The works items and work volumes for these portions are as listed below:

Table R 7.1.1 Major Construction Works of Community Pond

Work Item		Specification	Unit	Quantity
1. Diversion Facilities	1.1 Intake			
	Fixed Weir	H=2.5m	set	1
	Diversion Weir	H=5.2m	set	1
	Wet Stone Pitching		m^2	2,500
	Wet Stone Masonry		m^2	2,800
	1.2 Diversion Channel	L=1,340m, W=8m	set	1
	1.3 Box Culvert, etc.		L.S.	1
2. Flood Control Facilities	2.1 Detention Dam	Mixed type		
	Foundation Excavation		m^3	90,000
	Earth Fill	Homogeneous	m^3	160,000
	Concrete		m^3	31,000
	2.2 Pond Excavation		m^3	2,000,000
3. Amenity Facility	3.1 General Facilities			
	Entrance Gate		set	4
	Car Park		set	4
	Main Road	Asphalted	m	4,700
	3.2 Sports & Recreation			
	Multipurpose Ground		set	2
	Tennis Court		set	6
	Basket Court		set	4
	Other Facilities		set	1
	3.3 Landscape			
	Water-front Open Area		m^2	15,000
	Entrance Open Area		m^2	4,000
	Flower Bed		m^2	75,000
	Forest Park		m^2	417,000

7.1.2 Flood Diversion Channel

Construction of the flood diversion channel would be made through two (2) phases, namely: the short-term project (2005-2007) and the long-term project (2008-2012) as described in the following chapter. The major works for the construction are also divided into the following four (4) portions: (1) Diversion channel from Bedarawali Kas to Tenawali Kas, (2) Diversion Channel from Tenawali Kas to Saidpur Kas, (3) Diversion channel from Saidpur Kas to Kurang

River and (4) Improvement Kurang River. The works items and work volumes for these portions are as listed below:

Table R 7.1.2 Major Construction Works of Diversion Channel

Work Item		Unit	Quantity (Short term)	Quantity (Long term)
1. Diversion Channel (Bedarawali Kas - Tenawali Kas)	1.1 Fixed Weir	place	0	1
	1.2 Diversion Weir	place	0	1
	1.3 Diversion Channel			
	Common Excavation	m^3	0	1,148,000
	Revetment (wet stone masonry, wet stone pitching)	m^2	0	76,200
	Concrete (reinforced concrete & floor concrete)	m^3	0	33,840
	1.4 Bridge	place	0	4
2. Diversion Channel (Tenawali Kas - Saidpur Kas)	2.1 Hydraulic Drop (Tenawali Kas & Kanitawali Kas)	place	2	2
	2.2 Intake Weir (Tenawali Kas)	place	1	1
	2.3 Diversion Weir (Saidpur Kas)	place	1	1
	2.4 Diversion Channel (L=2,150m)			
	Common Excavation	m^3	184,000	443,000
	Dike Embankment	m^3	26,000	47,000
	Revetment	m^2	0	30,400
	Concrete (Floor Concrete)	m^3	0	21,390
	Drainage Outlet	place	40	50
	2.5 Bridge	place	8	8
3. Diversion Channel (Saidpur Kas - Kurang River)	3.1 Hydraulic Drop (Ojhri Kas)	place	2	2
	3.2 Diversion Channel (L=5,126m)			
	Common Excavation	m^3	1,542,000	2,430,000
	Dike Embankment	m^3	49,000	84,000
	Revetment (wet stone masonry, wet stone pitching)	m^2	0	107,300
	Concrete (Floor Concrete)	m^3	0	18,400
	3.3 Hydraulic Drop (Diversion Channel)	place	1	1
	Common Excavation	m^3	9,000	9,000
	Concrete (Mass Concrete)	m^3	11,000	11,000
	Gabion Mattress W 1.0m x B 1.5m x T 0.5m	m^3	11,300	11,300
	3.4 Bridge	place	8	8
4. Improvement of Kurang River	4.1 Excavation and Embankment Works			
	Common Excavation	m^3	82,000	164,000
	Dike Embankment	m^3	82,000	164,000
	4.2 Slope Protection (sodding)	m^2	37,000	74,000
	4.3. Drainage Outlet	place	30	70
5. Compensation	5.1 House Evacuation (for diversion channel)			
	For diversion channel	house	15	20
	For Improvement of Kurang River	house	110	220
	5.2 Land Acquisition (for Improvement of Kurang River	m^2	211,500	348,000

7.1.3 Supplementary Works for On-going Channel Improvement by RDA

The supplementary works are broadly divided in to the following two (2) portions, namely: (1) river improvement of Lai Nullah below Chaklala Bridge ((RD5+277-RD6+215) and (2) side slope protection works for the on-going channel river section of Lai Nullah from Chaklala Bridge to Kattarian Bridge (RD6+251-RD17+210). The river improvement of Lai Nullah below Chaklala Bridge of the above item (1) is scheduled to complete through the urgent project (2004-2005), while the side slope protection works of the item (2) is through the short-term project (2005-2007), as described in the following chapter. The works items and work volumes for these portions are as listed below:

Table R 7.1.3 Major Construction Works of Supplementary Works for On-going River Channel Improvement of Lai Nullah

Work Item		Unit	Quantity
1. Downstream River Improvement	1.1 Earth Work (Common Excavation)	m^3	31,000
	1.2 Slope Protection (Wet stone pitching)	m^2	41,000
	1.3. Compensation		
	Land Acquisition	m^2	8,000
	House Evacuation	house	0
2 Slope Protection	2.1 Revetment (Wet Stone Pitching)	m^2	302,000
	2.2 Compensation		
	Land Acquisition	m^2	0
	House Evacuation	House	0

7.1.4 Flood Forecasting and Warning System (FFWS)

The flood forecasting and warning system is to be completed through the urgent project (2004-2005) same as the aforesaid community pond. The principal equipment to be installed for the system are as listed below:

Table R 7.1.4 Major Equipment to be Installed for FFWS

Station	Principal Equipment	Quantity (unit)
1. PMD Master Control Station	Telemetry Supervisory Equipment	1
	Radio Equipment for 5.2 GHz and 400MHz	2
	Antenna System	1
	Display System & PC type Operation Console	1
	Printer & Processing System (FFWS Server)	1
	Emergency Power Supply System	1
2. Monitoring Station (FFC, WASA, Jinnah Park)	Radio Equipment for 5.2 GHz Wireless LAN	3
	Antenna System	3
	Display System	3
	Emergency Power Supply System	3
3. Rawalpindi Warning Control Station	Warning Supervisory/Control System	1
	Radio Equipment for 5.2 GHz ad 400MHz	1
	Antenna System	1
	Printer	1
	PC type Operation Console	1
	Display System	1
	Emergency Power Supply System	1
4. Rainfall Gauging Station	Remote Terminal Unit (RTU)	5
	Radio Equipment for 400MHz	5
	Antenna System	5
	Sensor Rainfall Gauge with Data Memory Pack	5
	Emergency Power Supply System	5
5. Water Level Gauging Station	Remote Terminal Unit (RTU)	5
	Radio Equipment for 400MHz	5
	Antenna System	5
	Sensor Water Level Gauge with Data Memory Pack	5
	Emergency Power Supply System	5
6. Warning Post	Warning Equipment	10
	Siren Equipment	10
	Audio Amplifier	10
	Laud Speaker and Sound Collector	10
	Radio Equipment for 400MHz	10
	Antenna System	10
	Emergency Power Supply System	10
7. Repeater Station (Telemetry System)	Repeater Equipment	1
	Radio Equipment for 400MHz	2
	Antenna System	1
	Power Supply	1
8. Repeater Station (Wireless LAN)	Radio Equipment for 5.2 GHz Wireless LAN	4
	Antenna System	2
	Emergency Power Supply System	2

7.2 BASIC CONDITIONS OF CONSTRUCTION PLAN

7.2.1 Earth Work

The performance of the construction machines is assumed as listed in Table R 7.2.1 taking the most suitable machine combination and the reuse of the excavation soil. Based on the performance of the construction machine, the construction period of earthwork was estimated.

Table R 7.2.1 Performance of Construction Machines

Earthwork	Machine	Performance Capacity	Remarks
Excavation	Bulldozer (32 ton)	146.21 m^3/hr.	
Loading	Backhoe (1.0m^3)	104.00 m^3/hr.	
Carrying	Dump truck (10 ton)	30.86 m^3/hr.	Materials handling distance : 0.5km
	Dump truck (10 ton)	8.00 m^3/hr.	Materials handling distance : 8km
	Dump truck (10 ton)	6.70 m^3/hr.	Materials handling distance : 12km
Grading & compaction	Bulldozer (21 ton)	100.00 m^3/hr.	Disposal Area
Spreading material for fill work	Bulldozer (21 ton)	119.60 m^3/hr.	Dam Work
Spreading material for fill work	Backhoe (0.7m^3)	53.50 m^3/hr.	Dam Work
Compaction of material for fill work	Tamping Roller (20. 7 to 34.5 ton)	55.00 m^3/hr.	Dam Work

7.2.2 Mass Concrete Placing Work

The construction period of mass concrete of the dam body is estimated on the basis of the following assumptions:

(1) The daily concrete placing capacity is 225 m^3 (15m in width x 10m in depth x 1.5m in height).

(2) The maximum casting height of 1.5m.

(3) One cycle of the daily concrete placing works will take 8 days, which include 2 days of form fabrication, 5 days for concreting and curing, and 1 day for dismantling.

7.2.3 Available Working Days

Construction works are much influenced by rainfall. The works related to soil materials in particular could be performed in the non-rainy days. Taking these conditions into account, the number of the available construction-days in a month is assumed at 25 days. It is also assumed that each of the preparation, the temporary work and the clearing works would take 0.5 months.

7.2.4 Dumping Sites

The dumping sites for the excavated materials are provisionally assumed at Block H-12 and F-13 in Islamabad (refer to Fig. 7.2.1).

7.3 CONSTRUCTION SCHEDULE

In accordance with the phased program, the entire construction/installation period for the major work components of the proposed structural plan as well as the flood forecasting and warning

system proposed as the non-structural plan was assumed as shown in Table R 7.3.1. The detailed construction schedule for the structural plan was further prepared based on the aforesaid work volumes and basic conditions for construction as shown in Table 7.3.1.

Table R 7.3.1 Entire Construction Period of Major Works

Classification	Work Item		Construction and/or Installation Period
Structural	Community Pond		Urgent (2004-2005)
	Diversion Channel	Channel (Tenawali Kas-Kurang River, Qmax= 470 m^3/s)	Short-term (2005-2007)
		Channel (Bedarawali Kas-Kurang River, Qmax=1,790m^3/s)	Long-term (2008-2012)
		Improvement of Kurang River	Short/Long-term (2005-2012)
	Supplementary Works for River Improvement of Lai Nullah	River improvement below Chaklala Bridge	Short-term (2004-2005)
		Side slope protection of the on-going improvement section	Short-term (2005-2007)
Non-structural	Flood Forecasting and Warning System		Urgent (2004-2005)

7.4 COST ESTIMATION

7.4.1 Project Cost

The project cost, which consists of the direct construction cost, indirect construction cost and compensation cost, is estimated base on the following assumptions.

(1) All costs expressed in the Study are based on the average prevailing market prices in 2002, and the exchange rate of currency of US$ 1.0 =120.06 yen (Japanese currency) = Rs. 58.0.

(2) Direct construction cost consists of material cost, labor cost and plant cost.

(3) Indirect construction cost consists of the following common temporary work cost, management cost and overhead cost:

  (a) Common temporary work cost: 5% of the direct cost,

  (b) Management cost: 10% of the total of the direct cost and the common temporary cost, and

  (c) Overhead cost: 10% of the total of the direct cost, the common temporary cost and the management cost.

(4) The physical contingency and price contingency are included in the construction cost. The physical contingency is assumed at 5% of direct cost and indirect cost. Estimation of the price contingency is based on the inflation rate of 4% per year inflicted to the local currency portion of the direct cost and indirect cost.

(5) Compensation cost is given to the land acquisition and house evacuation, and it is based on the following unit prices:

Item	States	Unit Price
Land Acquisition	Urban Area	Rs. 5,500 to 11, 000/m^2
	Rural Area	Rs. 1,600 to 2, 000/m^2
	Forest	Rs.500/m^2
House Evacuation	Urban Area	Rs.8,000,000/house
	Rural Area	Rs.50,000 to 100,000/house

(6) Cost for engineering service estimated at 10% of the construction cost.

(7) Administration service is estimated at 1% of the construction and compensation cost.

(8) Duty and tax are estimated as the with-holding tax (6.4%) on the construction cost and the cost for engineering service.

Based on the above assumptions, the project cost estimated for the optimum structural flood mitigation plan is estimated at Rs. 7,615 million in total, which is divided into (1) Rs. 1,137 million for the community pond, (2) Rs. 5,605 million for the flood diversion and (3) Rs. 873 million for the supplementary works for the on-going channel improvement of Lai Nullah. The project cost is also divided into (1) Rs. 1,267 million for the urgent project, (2) Rs. 2,857 million for the short-term project and (3) Rs. 3,492 million for the long-term project. As for the flood forecasting and warning system proposed as the non-structural flood mitigation plan, the project cost is estimated at Rs. 302 million, which would be invested during the term of the urgent project cost. The breakdown of these project costs is as tabulated in Table R 7.4.1.

Table R 7.4.1 Project Cost for the Proposed Structural and Non-structural Flood Mitigation Plan

(Unit: Rs. million)

Work Item			Urgent Project	Short-term Project	Long-term Project	Total
Structural	Community Pond		1,137	-	-	1,137
	Diversion Channel	Channel (Tenawali Kas-Kurang River)	-	2,059	-	2,059
		Channel (Bedarawali Kas-Kurang River)	-	-	3,433	3,433
		Improvement of Kurang River	-	55	59	114
		Sub-total	-	2,113	3,492	5,605
	Supplementary Works for Lai Nullah	River improvement below Chaklala Br.	130	-	-	130
		Side slope protection of the river channel	-	743	-	743
		Sub-total	130	743	-	873
	Grand Total of Structural Plan		**1,267**	**2,857**	**3,492**	**7,615**
Non-structural	Flood Forecasting and Warning System	(1) Equipment Cost	248	-	-	248
		(2) Installation Cost	28	-	-	28
		(3) Cost for Civil Works	10	-	-	10
		(3) Materials/ other miscellaneous	16	-	-	16
	Grand-total of Non-structural Plan		**302**	-	-	**302**

7.4.2 Operation and Maintenance Cost

The operation and maintenance cost for the components of the proposed structural plan is assumed to consist of (1) the machine operation cost, (2) the machine maintenance cost, (3) the cost for the administrative and logistic support, (4) cost for repair of the structures and office running cost, and (5) the miscellaneous expenses. Based on these items assumed, the annual

operation and maintenance cost is estimated at Rs. 3,256 thousand upon completion of the urgent project, Rs. 4,784 thousand upon completion of the short-term project and Rs. 5,373 thousand upon completion of the long-term project as listed in Table R 7.4.2.

Table R 7.4.2 Annual Operation and Maintenance Cost for the Components of the Structural Plan

(Unit: Rs. Thousand)

Item	Upon Completion of Urgent Project	Upon Completion of Short-term Project	Upon Completion of Long-term Project
(1) Machine operation cost	696	1,006	1,006
(2) Machine maintenance cost*	1,404	1,404	1,404
(3) Cost for administrative and logistic support	542	1,160	1,160
(4) Cost for repair of the structures and office running cost	460	986	1,547
(5) Miscellaneous expenses**	155	228	256
Total	3,256	4,784	5,373

*: Includes cost for regular maintenance, repair of the machineries, supply of spare parts
**: Assuming 5% of the items (1) to (4)

As for the flood forecasting and warning system, the necessary annual operation and maintenance cost is estimated at about Rs. 3 million, which is composed of Rs. 2.3 million for maintenance of equipment and Rs. 0.7 million for administrative/logistic support as listed in Table R 7.4.3. This operation and maintenance cost would accrue immediately after completion of the urgent project in 2005.

Table R 7.4.3 Annual Operation and Maintenance Cost for the Flood Forecasting and Warning System in the Proposed Non-structural Plan

(Unit: Rs. Thousand)

Item	Cost
Maintenance cost for equipment, office running cost, etc.	2,258*
Cost for administrative and logistic support	700
Total	2,958

*: 1% of procurement & installation cost of the equipment, civil works and other miscellanies direct cost.

CHAPTER 8. ENVIRONMENTAL IMPROVEMENT PLAN RELATED TO FLOOD MITIGATION

8.1 IMPROVEMENT OF DRAINAGE AND SEWERAGE SYSTEM

8.1.1 General

The Lai Nullah is currently used as the principal outlet for drainage of storm water and sewerage in Islamabad and Rawalpindi. Islamabad is located on the gradual slope toward Lai Nullah. Due to the favorable geophysical condition as well as the rather adequate existing drainage network in the built-up area, most of the jurisdiction area of Islamabad is likely to not have any significant drainage problem. On the other hand, the drainage conditions in Rawalpindi are deteriorated due to low-lying ground and the backwater effects of the high water level of Lai Nullah. Moreover, due to poor capacity of the existing sewage treatment plants both in Islamabad and Rawalpindi, the river water of Lai Nullah is seriously polluted giving off a stench during a period of low flow discharge

In order to retrieve Lai Nullah from the current sewage problems, improvement of the existing sewage treatment plant for Islamabad has been launched out in 2003 through a financial assistance from the French Government. The sewerage and drainage master plan for the city center of Rawalpindi has been also formulated in 2002 and, in accordance with the master plan, the improvement works are now being implemented through a financial assistance from ADB funding.

The sewerage master plan and the drainage master plan for Rawalpindi are, however, projected to be completed in 2020, and 2014, respectively. Thus, it would still take some time more to be free from drainage and sewerage problems. Moreover, the drainage and sewage improvement work in Rawalpindi is limited to the jurisdiction area of WASA, RDA, and the Cantonment Area in Rawalpindi (i.e., the jurisdiction area of RCB) is left behind from any drainage and sewerage improvement. Taking these conditions into account, the following items would be given as the principal issues on the drainage and sewage.

8.1.2 Clarification of Phased Improvement Programs for On-going of Drainage and Sewage Improvement

The phased improvement programs are likely to have been already formulated in the on-going plan.

1) Improvement of Islamabad Sewage Treatment Project (STP)

Joint project by CDA and French government, consisting of newly completion of STP Phase IV, besides improvement and repair of the other STP Phase I, II and III, will start abound first of

2004 and construction period is about 30 months. After the completion, it is expected river water quality at downstream of the STP located at I-9 will be improved. It would be, however necessary to retrieve leakage of sewage from the trunk sewer and to complete the house connection system with sewers. A system for regular monitoring on the water quality of the river as well as the inflow/outflow at the STP would be also required.

2) Improvement of TMA-R Sewerage and Drainage System

After the "Urban Water Supply & Sanitation Project, Phase 1", "Rawalpindi Environmental Improvement Project" is now under preparation as a phase 2. The components are (a) water supply, (b) sewerage, (c) drainage, (d) solid waste management, and (e) institutional strengthening. A feasibility study will start in September 2003 and the detailed components of the project (Phase II) will be decided five (5) months after commencement of the feasibility study. The project will be subject to the financial assistance with a loan amount of US$ 50 million from ADB.

The components of the sewerage system are roughly classified into (a) construction of lateral sewers, (b) construction of trunk and outfall sewers, (c) construction of sewerage treatment plant, (d) purchase of equipment and machinery for operation and maintenance of the system. The components of the drainage are also classified into (a) Lai Nullah improvement works – phase 2, which includes channel lining, deepening and construction of maintenance roads on both banks and (b) rehabilitation of Kassi East, Kassi West and other main drains.

8.1.3 Implementation of Drainage and Sewerage Improvement for Jurisdiction Area of RCB

The master plan for improvement of sewerage system in the jurisdiction area of RCB has been formulated by Engineers 10 Corps, Rawalpindi, while the drainage system in the area is left behind without any definitive improvement plan. The master plan for the sewage plan should be updated, as required. Effluent quality at STP is proposed as 40 mg/L in BOD and less than 1000 organisms/100 ml in fecal coli-form, and the figure is relatively high, especially in fecal coli-form. Effluent quality with activated sludge sewage treatment process is regulated in Japan as BOD is less than 20mg/l, fecal coli-form is less than 3000 organisms/ml and SS is less than 70 mg/l. And the necessary budgetary arrangements as well as other relevant necessary works for implementation should be taken immediately. At the same time, the drainage master plan should be formulated in the earliest opportunity taking the on-going river improvement of Lai Nullah, the on-going drainage improvement works for the jurisdiction area of TMA and other relevant flood mitigation works into consideration.

8.2 SOLID WASTE MANAGEMENT

It is common that most of the residents living close to Lai Nullah and its tributaries are apt to dump solid wastes into the river. The residents are taking an easy way to dump their solid wastes, instead of bringing them to the nearest containers. This kind of activities would deteriorate the water quality and sanitary conditions of the rivers. However, the residents usually complain about lack of containers in their vicinity, or that the containers are always full of solid waste. What the residents want is simply to get rid of their solid wastes from their premises without considering any environmental impacts.

In order to relieve these unfavorable conditions, CDA, TMA and RCB shall take necessary actions to remove these habits, attitudes and kind of social customs. A realistic SWM policy shall be formulated and the following measures be urgently proposed:

8.2.1 Collection of Accurate Solid Waste Data in a Scientific Way

The authorities in charge of the solid waste management are not aware of how much solid wastes are generated what kinds of components they are consisted of, and how the characteristics are changing, etc. Due to lack of the collection capacity, they just collect some of the generated solid wastes and transport them to dumping site. It is Obvious that the remaining wastes are dumped into empty lands or rivers.

The volume of the solid waste is presently estimated by visual judgment without measurement of the actual weight, whereof it is virtually difficult to get accurate reliable data. The method is unreliable and shall be converted to a scientific one. The authority shall accumulate the basic data on the weights and components of the collected, disposed solid waste and generated solid waste. To formulate a scientific and efficient long-term plan of SWM, the measurement by the truck scale (measuring equipment for the truck weight) shall be conducted soon. Moreover to formulate a future plan concerning the SWM, the data collection is essential to calculate the capacity and lifetime of the landfill site, or to estimate the required numbers of collection vehicles and so on.

8.2.2 Legislation of Act of Solid Waste Management

There currently exits no definite and independent regulation for solid waste management in Pakistan. No treatment of solid wastes is given before transporting them to the dumping sites, and open dumping is made with inadequate landfills, which causes serious environmental problems in and around the dumping site. The strategic plan needs to be prepared comprising both long term strategy, vision of how municipal solid waste management service in the city will be developed in the future, and action plan, how the city is going to get there.

Therefore to improve the situations related to solid wastes in Islamabad and Rawalpindi, "the Solid Waste Management Act" shall be legislated. "The Solid Waste Management Act" shall be designed to protect the living environment and promote public health. The residents (citizens), enterprises and the municipalities (government) play their respective rolls in promoting appropriate waste management.

The act shall clarify what kind of roles the residents (citizens), enterprises and the municipalities (government) are to play in the daily activities. Important considerations for improving the SWM in the study area are summarized in the following Table R 8.2.1.

Solid Waste Management Act (assumed name, hereafter referred to as "the Act") shall promote the creation of "source reduction of waste and recycling system". People, enterprises and government shall cooperate together to reduce, reuse and recycling the waste. The Act shall provide their respective roles in promoting appropriate waste management.

Municipalities are responsible for management of domestic waste, such as garbage from households. Municipalities shall set solid waste management plan in respective administrative area. And the plan includes the following matters:

(1) Estimation of the volume of domestic waste to be generated and to be treated

(2) Estimation of fundamentals of proper domestic waste management and fundamentals relating to authorities carrying out such management

(3) Evaluation on the matters pertaining to improvement of expansion of domestic waste treatment facilities and landfill site.

Enterprises are in charge of their own industrial waste such as construction waste, cinders, sludge and waste oil etc. generated from their own business activities. And each enterprise shall treat and dispose their waste by themselves consulting with the municipalities. Regardless of industrial waste, business must recycle waste produced from their activities and make effort for waste reduction. The following measures relating to products and by-products are the way of source reduction of waste.

(1) Measures for reducing waste by designing long-life products

(2) Measure for reusing parts

(3) Measures for manufacturers to recover and recycle end-of life products

(4) Measures for reduction and recycling of by-products.

The owners of large office buildings and market directors may carry out the reduction of solid waste and recycling. First of all they shall set the reduction numerical target (goal) in the offices or markets for solid. The volume of garbage may be measured or counted by numbers of bags

baled in waste. And owners or the directors shall direct to reduce the garbage, which is generated by each tenant of the buildings or every small market owner in the market.

People should separate waste according to their types. Moreover, in order to promote effective reduction, reuse and recycling waste. For example community residents gather and separate the garbage to dispose and resource to use from the waste and have the resources collected by recycling company.

Table R 8.2.1 Items to be considered for Preparation of the SWM Act

Items to be considered	Explanation
To organize recycle system and to reduce the solid waste generation.	• To formulate source reduction, reuse and recycling system for solid wastes.
To define the solid waste	• To clarify the definition of domestic waste, hazardous wastes, infectious hospital waste and industrial wastes.
To clarify the duty and roll of central government, municipality, citizen and enterprise.	• Central Governments; To provide guidance and financial assistance from central government to municipalities • Municipalities; to collect, transport and dispose domestic waste. • Citizen and community; To separate and reduce their wastes To use the recycled products. • Enterprise and factories; to be in charge of their own industrial wastes (such as construction waste, factory waste) i.e. each enterprise shall treat and dispose industrial waste by themselves consulting with municipalities.
To make solid waste management planning	• To make solid waste management planning, consisting prediction of solid waste generation, future plan for landfill site and other solid waste treatment facilities.
To dispose hospital waste	• To collect, transport and dispose the infectious hospital waste by hospitals by themselves consulting with municipalities.

8.2.3 Reduction of Waste Generation by Community-based Organization or Private Enterprise Partnership

By the discussion and interview with the staff of TMA and CDA, after the SWEEP project had been completed, it was found that this kind of activity could not be sustained without large efforts required to maintain it. However JICA Study Team have come to a conclusion that this project would be useful to give substantial impacts, such as introducing the concept of Community-based Organization (CBO) or Private Enterprise Partnership (PEP) to participate in solid waste management, to reduce the public cost and enlighten the importance of the social awareness.

Both the municipality and the citizen shall be responsible for solid waste management with the cooperation in order to effectively solve the solid waste management problem.

At the garbage generation point, citizens (or community) can segregate and reduce the garbage. Community cooperation needs to be carried out the source reduction measures.

To formulate solid waste reduction programs, the municipality shall formulate a feasible strategy: 1) to promote the waste reduction program with community and enterprise participation, because of the high effectiveness of source reduction by the citizen, and 2) to introduce waste separation to make an easy waste recycling.

8.2.4 Gradual Prohibition of Scavenging Activity

The scavenging activity might contribute to the reduction and recycling of solid wastes to be collected to some degree. However negative impacts would not be negligible such as scattering the wastes or aesthetic disturbances. On the other hand there are a certain number of people, who are living on scavenging. A sudden prohibition would cause social problems related to the scavenging activity. In light of avoiding sudden major change, JICA Study Team would propose to prohibit the scavenging gradually or only limited places. To this end a social survey will be required on the method and timing toward the prohibition of the scavenging activity.

8.3 CONTROL AND REMOVAL OF ENCROACHMENT

8.3.1 Overview

In the study area, there remain several communities developed within the existing right-of-way (ROW) of various tributaries of Lai Nullah River as well as those of Kurang River. The communities are in situations where no proper solid or sanitary waste collection or disposal programs exist. Therefore many of the residents are forced to dispose of their waste directly to watercourse, resulting eventually in degradation of their living environment and nearby watercourse environment.

In this context, a possible resettlement of the community was initially considered in the urban settings for improving living environment of the community. The residents in rural setting such as those in Kurang River was subsequently incorporated into potential target population for resettlement program when potential needs of relocation was recognized in the course of project designing. In parallel with the formation of the project concept, Capital Development Authority (CDA) should initiate the debate on relocation of Kachi Abadi dwellers in Islamabad whose abodes were destroyed in the flood.

The intervention through the resettlement program will involve two-dimensional consequences such as significant beneficial impacts to the living environment of the people and adverse socio-economical impacts such as disruption of community, loss of employment opportunity as a result of distant relocation sites from the current community unless appropriate measures are designed for restoring and improving their livelihood.

In this study, legislative aspects of relocation was briefly examined, which led to development of proposal for modification of resettlement program of the government to minimize adverse impacts and to maximize project benefit by incorporating mitigation measures. Total lack of the legal framework for rehabilitation and those for informal squatters will necessitate development of a set of the project-specific guidelines for resettlement assistance incorporating principal elements stipulated in the guidelines of potential funding sources.

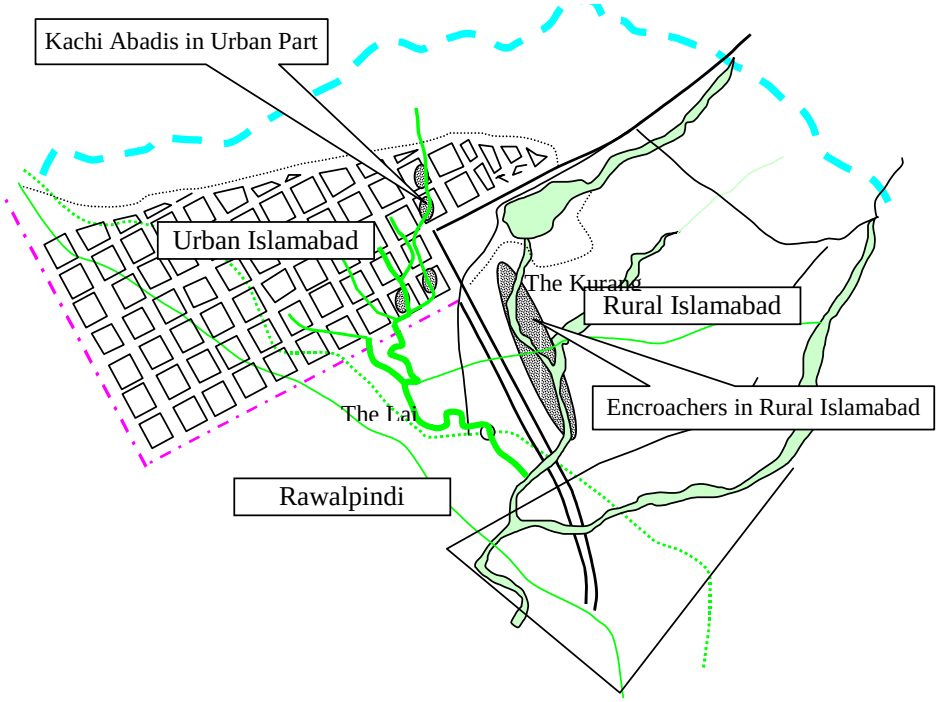

Fig. R 8.3.1 Location of Encroachments

8.3.2 Issues to be addressed in the Program

The principal issues are addressed to the existing encroachments in the right-of-way for the river as described hereinafter

1) History and Current Encroachers

The government has emerged at the time of Islamabad development as "provider" of housing assistance, sometimes in ad-hoc built "satellite towns" sited nearby that is generally referred to as Kachi Abadi in the area. In this context, most housing within Kachi Abadi was property of the government with decent level of infrastructure in its early period. However, it has sprawled across the low-lying area as a result of increased migration of people seeking for increased opportunity in the urban area.

Residents currently live in overcrowded dwelling environment where no proper solid and sanitary waste collection, and disposal programs exist, which therefore render them to dispose directly to watercourse resulting eventually in degradation of their living

environment and nearby watercourse environment. The incidence of flood in the year 2001 indicated that direct disposal of solid waste has disturbed water flow and hence lowered flow velocity of the watercourse, which is deemed to be the underlying cause of the substantial damage incurred to the whole community within the Study Area.

Kachi Abadis are located on marginal and prone to natural and man-made disasters as have seen in the year 2001. The lack of basic environmental infrastructure and locations on marginal land often translate the residents into higher rates of disease and lower life spans. In addition, they are most affected group of people by increased flooding due to changes in land use by others upstream yet they generally have the least power to enact change or to compel government to intervene on their behalf due to their fragile legal position.

2) Governmental Proposal for Relocation of Kachi Abadi

Due to unclear tenure system of Kachi Abadi, there is the fear of imminent eviction among the residents. This has been debated in a recent meeting of All-Pakistan Alliance of Kachi Abadis. The agenda debated in the meeting includes eviction notices issued to the residents of Railway Colony in Peshawar. The eviction operation was called off due to pressure from the residents, however, there is an indication that the Pakistan Railways has restarted its eviction drives all over again. In the Study Area, it is being debated in the context of rehabilitation of Kachi Abadi dwellers in Islamabad whose abodes were destroyed in the flood. The flood victims of Kachi Abadi in G sectors such as G-7/1, G-7/2 and G-8/1 have been granted permission to rebuild their houses at the same place where they were originally constructed. However, there is still not much clarity on how the residents of I-sector Kachi Abadi will be rehabilitated. Capital Development Authority has proposed recently to relocate the Kachi Abadis to a site in Alipur Farash.

3) Adverse Impact of Resettlement

An interview with several informants within Kachi Abadis in Islamabad indicated that forced displacement for those affected means not only the loss of their homes, but also the loss of their prior jobs. The distance of the relocation site from the original place and jobs will become an obstacle to maintaining prior employment and thus result in possible escalation of wages in Islamabad for low-paying job. Furthermore, those who lacked legal title to their shelters and house plots are regarded as ineligible for compensation. Tenants are also ineligible for compensation, even though they may be unable to find elsewhere equally affordable tenancy arrangements. The social and cultural disruptions in neighborhood ties and kinship networks will also have deep effects, which are additional to the tangible economic losses. Such non-quantifiable but real social and economic costs are

the loss of access to site-related mutual help networks, to exchange and borrowing opportunities and to services such as schools, churches, etc.

4) Legislative Aspects of Encroachment Removal and Recommendations

The current government relocates encroachment on the ground of the Land Acquisition Act, LAA that was enacted originally in 1894, more than 100 years ago, when the role of the public sector in promoting economic development was negligible and was based on the doctrine of laissez-faire. The Act allows the Government to acquire privately owned land for public purpose such as river improvement, highway and building construction. Compensation is in cash for the loss of land, other productive assets such as standing crop, house plots and residence.

There seems to be deficiencies in the LAA in view of the internationally accepted procedure for land acquisition such as the latest environmental guidelines of JBIC, the Guidelines for Environmental Social Consideration, as well as OP 4.12 and BP 4.12 "Involuntary Resettlement" of the World Bank. A major gap is the absence of any law, regulation or policy guidelines governing "resettlement" and "rehabilitation". Restoration of community and household productive assets, or standard or quality of life, is not covered by the LAA. In addition, no legal framework is available to pay compensation to informal settlers, encroachers or illegal occupants.

The Bank policy states that 'where displacement is unavoidable, resettlement programs should be conceived and executed as development programs, providing sufficient investment resources to give the persons displaced by the project the opportunity to share in project benefits'. It also mandates that the affected people should be 'offered opportunities to participate in planning and implementing resettlement programs'; and that 'displaced persons should be assisted in their efforts to improve their former production levels, income earning capacity and living standards, or at least to restore the production levels, income earning capacity and living standards they would have achieved in the without-project case' (World Bank 1998:1).

In order to reduce the economic losses, social trauma and psychological pain inflicted on displaced people, the country must develop guidelines that will explicitly regulate displacement and relocation with due consideration on the fact that the deprivation suffered by displaced people raises vital issues of constitutional norms and human rights, including the right to survival, and the basic right to live with dignity.

8.3.3 Resettlement Program of Encroachers

The details of the resettlement programs of encroachments are as described hereinafter:

1) Objectives of Resettlement Program

The major objectives of the resettlement program are the following:

(a) To improve living environment;

(b) To reduce environmental degradation of the watercourse;

(c) To increase flow velocity by reducing direct disposal of solid waste to the watercourse; and

(d) To empower poor people by participatory program planning.

2) Target Population of Resettlement Program

The target population of the program includes those living in communities developed within the existing right-of-way of various tributaries of Lai Nullah River as well as Kurang River in Islamabad. They are generally poorer than other segment of the society, which is the common dimension of the target population, though; they are diverse in environmental settings as they encompass those living in urban as well as rural settings. The target population in urban environment includes residents of Kachi Abadis in Islamabad developed inside the riverbank of the Lai Nullah, while that in rural environment is the settlement extending along the Kurang River. Resettlement in urban or pre-urban settings, usually referred to as urban resettlement, is differentiated from rural resettlement since the types of problems involved and the strategies proposed to address them are substantially different from those in rural resettlement. Due to limited range of information on socio-economy of the community along the Kurang River available as of the time of report prepared, this part of the report temporally address the issues of Kachi Abadi community resettlement in urban settings.

3) Proposal for Modification of Resettlement Program

Efforts must be made to examine all possible ways to avoid involuntary resettlement and loss of means of livelihood. When involuntary resettlement is unavoidable even after such examination, effective measures to minimize impacts and compensate losses shall be agreed upon with the parties concerned.

Residents who are forced to relocate involuntarily or forfeit their means of livelihood shall be sufficiently compensated and supported by the project proponent for an appropriate duration of time. Sufficient compensation and support should not stop at preventing the

deterioration of the quality of life, but may mean improving it as well. Measures to achieve this purpose may include providing monetary and land compensation (to cover monetary and land losses), as well as support the means for an alternative sustainable livelihood, the expenses necessary for relocations, and the re-establishment of a community at relocation sites.

Meaningful participation of relevant stakeholders, such as affected people and communities, shall be promoted in planning, implementation, and monitoring of resettlement and rehabilitation plans.

In the development of resettlement plan, principal elements that should be included are (a) a census survey of displaced persons and valuation of assets; (b) description of compensation and other resettlement assistance to be provided; (c) consultations with displaced people about acceptable alternatives; (d) institutional responsibility for implementation and procedures for grievance redress; (e) arrangements for monitoring and implementation; and (f) a timetable and budget.

8.4 LAND USE CONTROL IN THE HABITUAL FLOOD INUNDATION AREA

The land use control, which is adopted as the non-structural flood mitigation measure, would generally require less cost than the structural flood mitigation measures and essentially bring about environmentally beneficial in that it does not attempt to regulate the natural flooding pattern of a river.

With installation of proposed structural measures, on the other hand, local pre-project adaptations to flood would be relaxed or abandoned or increased development on the flood-prone area would occur in the post-project period, which might increase risk to life and property when structural failure could occur and floodwaters would exceed the capacity of control structures/measures.

The target flood protection area in the Twin City of Islamabad/Rawalpindi is a developed urban part of the country where use of non-structural flood control is imperative in conjunction with structural facilities to minimize investment cost and to ensure realization of project objectives in an environmentally sound and socially acceptable manner.

In this context, zoning as an effective means of controlling floodplain development will provide basis to enable sustainable development of flood prone urban area. Zoning the land for such things as residential areas, parks and conservation areas is compatible with floodplain protection, and prevention of land uses which are vulnerable to flood damage.

The objectives and tools of land use control are: (1) to prohibit or to regulate development on the floodplain or watershed areas or flood-proof existing structures; and (2) to reduce the

potential for loss from flooding. In order to achieve these objectives, the following acts for the land use control would be required:

1) Zoning Act

Regulations in zoning acts can prohibit or specify the types and function of structures that can be built on the floodway and flood plain to minimize the flood risk. For example, the disposal of sewage, toxic and other harmful materials can be prohibited, and flood protection of structures shall be required. The construction of buildings and private roads, that may exacerbate the effects of floods, shall not be allowed.

2) Sanitary Act

Sanitary acts and building acts can make further specifications on floodplain management. Sanitary acts reduce the risk of health problems which could arise from contamination of water supplies when sewage disposal systems are disrupted by flooding, or when contaminated groundwater is infiltrated into the pipes. The acts can prohibit the installation of soil absorption systems (e.g., septic tanks, absorption fields, etc.) or require that a permit be obtained prior to installation with appropriate specification by the government.

3) Building Act

Building acts can specify structural requirements of new buildings to reduce their vulnerability to flooding, reduce health and safety hazards to occupants (e.g., regulations on electrical wiring and floor elevations), and minimize the extent that the building could impede the flow of floodwaters.

Relevant land use plans are included in the Master Plan of Islamabad and that of Rawalpindi. Future land use of Rawalpindi, where a significant economic damage incurred in 2001, with objectives of (1) achieving sustainable and systematic growth of the city, (2) achieving convenience, aesthetic and healthy environmental for the residents, and (3) creating a compact city within the existing built up area.

As represented in the objectives, the future plan aims at bolstering economic development by streamlining transportation and improving convenience of the people rather than creating flood-proof community. The problem in the city's land use plan may underlie in (1) lack of flood hazard information among urban planner, (2) lack of tools for land use control reflecting flood hazard and (3) inadequate information about plans to citizens. Flood hazard information will become available upon the completion of this study. Therefore, development of concrete zoning, sanitary and building acts will be necessary and a sort of awareness program may be required.

8.5 WATERSHED MANAGEMENT IN LAI NULLAH BASIN

In Lai Nullah basin, the land development associated with exploitation of water sources has been promoted for a long term covering the whole basin. As the results of such activity, the following issues are pointed out, though the specific data to identify such conditions are very limited:

(1) Deterioration of water quality;

(2) Reduction of water conservation capacity of forest;

(3) Increase of sediment runoff from the river basin;

(4) Increase of the peak flood runoff discharges as well as flood damage;

(5) Decrease of the low flow discharge; and

(6) Lowering of grand water level.

As noted from the above conditions, it is necessary to practice the watershed management in Lai Nullah basin, which would contribute to reduction of the water problems. To successfully practice the watershed management, coordination among agencies concerned and also public participation are essential. The necessity of the watershed management might have been discussed among the agencies concerned and it has been practiced so far by several agencies. The following activities are enumerated as the typical examples of the watershed management in Lai Nullah basin and its adjacent river basin:

Table R 8.5.1 Activities of Watershed Management

Project	Implementation Agency	Location	Major contents of the Project
Watershed Management of Rawal Dam*	Small Dams Organization	Catchment area of Rawal dam (Out of Lai Nullah)	355 check structures and 25 Nos. bed bars (The works were completed at the end of 2002 October.)
Watershed Management of Lai Nullah	CDA	CDA Territory in Lai Nullah basin	Construction of check dam, landscaping, and afforestation**, land use control in the upstream and along the river course
Watershed Management of Silly dam***	CDA	Catchment area of Silly dam (Out of Lai Nullah)	Construction of check dam, terracing, retaining wall, silt detention dam afforestation,

*: Source: PC1 for watershed management of Rawal Dam

**: Afforestation has been practiced since 1960's. Recent work volume is plantation of about 200,000 trees (the area of about200 ha/year). (Source: Environment, CDA)

***: As the effectiveness of the watershed management, annual sedimentation volume remarkably reduced as follows: from 0.37 million m^3/year ('83 – '94) to 0.19 million m^3/year. (Source: Simly Dam Project, CDA)

In case of Lai Nullah Basin, CDA has undertaken several works in the territory as shown in the above table. On the other hand, TMA, RDA and Cantonment area have not undertaken any concrete action for the watershed management within their jurisdiction area of Rawalpindi. Furthermore, at present, there may not exist a responsible agency, which handles basin-wide

watershed management. Thus, judging from the present water issues as above-mentioned, it seems to be necessary to strengthen watershed management currently being practiced. As the major reasons not to be undertaken such activities, the following are considered:

(1) Necessity of basin-wide watershed management may not be well recognized among agencies concerned as well as inhabitants in the basin.

(2) It may not be clear which agency should have responsibility of basin-wide watershed management together with the coordination among agencies concerned.

(3) There is no law to specify the responsibility of agencies concerned on the matter.

1) Watershed Management for Flood Problems

The following flood problems relating to watershed management are pointed out: (i) increase of flood discharge, (ii) decrease of river channel flow capacity and (iii) increase of flood damage. In order to relive these problems, the watershed management for alleviation of flood problems is considered as described hereinafter:

a) Alleviation of Increase of Flood Discharge

As one of the main causes of increase of flood peak discharge, the land development in a manner of deforestation in the upper reaches and urbanization in the middle and lower reaches are pointed out. In principle, the followings measures and activities are considered to cope with the situation:

(i) Restriction of deforestation and implementation of afforestation in the upper reaches.

(ii) Land use control and introduction of detention facilities to compensate the increase of flood discharge due to land development in the middle and lower reaches.

b) Alleviation of Decrease of River Channel Flow Capacity

As the main causes of alleviation of decrease of river channel flow capacity, the followings are pointed out; encroachment to the river channel in a manner of construction of houses, buildings, etc., and dumping of garbage. It may be understood that these issues are related to rather river management than watershed management. As for the measures to cope with the situation, control and removal of encroachment and control of garbage dumping into the river are conceived.

c) Alleviation of Flood Damage

In combination with the increase of flood peak discharge and decrease of river channel capacity, the flood damage naturally increases. Furthermore, land development in flood prone area and encroachment to the river channel also cause the increase of flood damage. To alleviate the situations, land use control and control and removal of encroachment are pointed out.

2) Watershed Management for the Other Water Issues

As the remaining major water issues, water resources development and utilization and environment are pointed out. Needless to say, to identify the detailed issues and measures to cope with the issues, further studies including arrangement of the necessary data are required. Nevertheless such works are too wide to be covered in this study, and instead of them, only basic process for the further study on watershed management are clarified as below:

(a) The necessity of basin-wide watershed management on water resources development and utilization and environment should be highly recognized among the agencies concerned as well as inhabitants considering the current conditions relating to water utilization.

(b) Agencies responsible for the watershed management should be confirmed.

(c) The major water issues on water resources development and utilization and environment in Lai Nullah basin should be identified through arrangement and monitoring of necessary data to indicate the issues.

(d) Necessary measures to cope with the major water issues should be analyzed and examined.

(e) The watershed management plan should be formulated to implement the necessary measures. As the typical urgent issues, lowering of ground water level and deterioration of water quality in Lai Nullah should be examined and take an action to settle down the issues in a manner of watershed management.

8.6 DEVELOPMENT OF WATER RESOURCES BY THE PROPOSED FLOOD MITIGATION FACILITIES

As described in subsection 4.3, the study area is now suffering from the chronic water shortage, and the competent agencies (i.e., CDA, WASA and RCB) have an attempt to increase the water supply capacity. However, the service area of WASA in particular could not meet the full water demand in 2001 even after completion of the on-going water supply project under UWSSP-I.

Moreover, the current practices for water supply are oriented more to expansion of the treatment capacity and/or the abstraction capacity of tube-wells, but less to development of the new water resources. Such unbalanced way of water resources development brings out a big gap between the treatment capacity and the actual water supply capacity. Difficulties in abstracting the groundwater also occur due to the serious drawdown of the groundwater level.

Under the above conditions, a particular attention is given to the subsidiary effects of flood mitigation facilities on water resources development. That is, among the potential flood mitigation facilities as identified in the foregoing subsection 6.2, the reservoir of the flood control dam proposed at Block E-11 in Islamabad could be used as the water supply sources, and the community pond at the Fatima Jinnah Part in Islamabad may have a potential function for recharging to the groundwater. The on-site flood detention facilities would have also the function of rainwater harvesting and/or recharging to the groundwater. From these viewpoints, the potentials of water resources development by the flood mitigation facilities and the major issues for development are preliminarily clarified at this study stage.

8.6.1 Flood Control Dam proposed at Block E-11 in Islamabad

The present water quality of the dam inflow discharge is kept to be non-polluted, and the water stored in the dam reservoir could be the water source particularly for domestic use in Islamabad and Rawalpindi. The following major issues and/or difficulties are, however, identified in developing the dam reservoir as the water supply source:

(1) The dam site is located adjacent to the urban center of Islamabad, and the upper catchment of the dam site is likely to have the significant land value for urban development. In fact, the land development around the dam site is in progress, although it is not legally approved by CDA. In order to maintain the present suitable water quality of the dam inflow, however, it is indispensable to reserve the upper catchment (19.7km^2) of the dam site as the "Controlled Area" to prohibit any type of land development.

(2) The maximum live storage capacity and the catchment area of the proposed dam reservoir are about 1.5 million m^3 and 19.7km^2, respectively which are far smaller than those of the existing three (3) dam used as the present water supply source for the study area as listed below. Accordingly, the proposed dam reservoir could not be the fundamental solution for the current serious water shortage of the study area.

Table R 8.6.1 Comparison of Existing and the Proposed Dam Reservoir

Name of Dam	Catchment Area (km^2)	Live Storage (MCM)
Khanpur	778	113
Simply	153	25
Rawal	275	53
The proposed dam at Golra	**19.7**	**1.5**

8.6.2 Community Pond at Fatima Jinnah Park

The proposed community pond receives the flow discharge of Tenawali Kas, and the diverted discharge from the adjacent eastern tributary of Bedarawali Kas. The water quality of the discharge from Tenawali Kas is seriously polluted getting off an offensive odor due to effluent of the non-treated wastewater from the upper built-up area. On the other hand, the substantial part of the catchment area of Bedarawali Kas is remained as the non-built up area, and the water quality of the tributary is not aggravated.

In due consideration of the water quality of the inflow discharges, the proposed community pond is designed to impound the inflow only from Bedarawali Kas but not from Tenawali Kas during a dry season. The water impounded in the pond could be used as the source for recharge to groundwater. In order to sustain the present water quality from the eastern tributary of Bedarawali Kas, however, it is required to reserve the catchment area of the tributary (9.9km^2) as the non-built-up area just like the aforesaid case of the dam catchment area of Golra.

8.6.3 Channel Deepening of Lai Nullah

The channel deepening of Lai Nullah is considered as one of possible flood mitigation measures. The channel deepening drops the riverbed level by 2m, which would cause lowering of the river water stage during low flow discharge.

Lowering of river water stage during low flow discharge may cause, in general, the adverse effect on the groundwater level. Nevertheless, the present groundwater level in the study area is 40m below the ground level, while the depth of the river channel upon completion of the channel deepening is 9.5m, which is far higher the present groundwater level. Accordingly, the adverse effect on the groundwater level by channel deepening could be evaluated to be minimal.

8.6.4 Flood Diversion Channel

The proposed flood diversion aims at diverting the flood runoff discharge from Lai Nullah basin to the external Kurang river basin. Should the whole of the basin runoff discharge be diverted to the external basin during the non-flooding period, the present natural recharging capacity to the groundwater in the basin may be dropped. In order to avoid such adverse effect, the flood diversion structure is designed to divert only the flood discharge over the channel flow capacity of the downstream channel but to remain the non-flood discharge within Lai Nullah basin.

8.6.5 On-site Flood Detention Facility

Among the various types of the on-site flood detention facility, the storage tank installed at an individual house lot and the infiltration facility would be useful to the water resources development as the supplementary effect of flood mitigation.

1) Storage Tank Installed at Individual House Lot

The storage tank could effect the reduction of runoff discharge from each of house lots. At the same time, the rainwater stored in the tank could be used for washing, watering to garden and other various secondary water uses other than use for drinking.

According to the rainfall records at Chaklala gauging station, the Lai Nullah basin could receive about 49 mm per month in average even during a dry season from October to June. Assuming a roof top of $50m^2$ as the space to collect the rainfall, the daily average rainwater volume to be stored in the tank is estimated at about 80 litters/day/house (=49 mm x $50m^2 \div 30$ days). The standard type of the storage tank has a capacity of 2,000 litters, which would be enough for storage and use of the whole rainwater during a dry season.

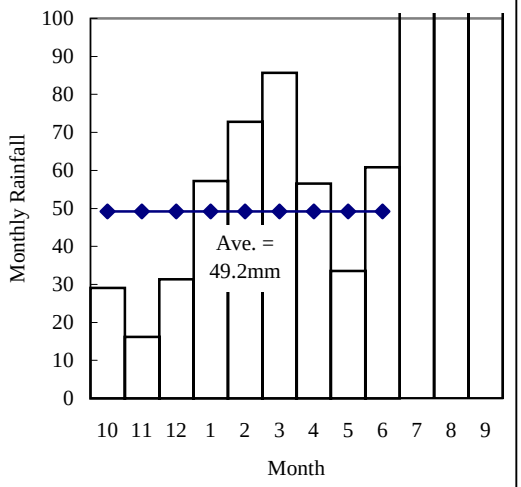

Fig. R 8.6.1 Monthly Average Rainfall at Chaklala

If the number of residents per one unit of house is assumed at 5 personnel, the daily average rainwater volume of 80 litters/day/house could cover the water consumption of about 16 litters/person/day (=80 litters/day/house ÷ 5 personnel/house). This consumption fed by the rainwater harvesting corresponds to 22% of the present per capita water consumption in the service area of WASA (=74 litters/day/person). Thus, the significant rate of the water consumption could be fed by the rainwater harvesting, and therefore, the storage tank installed at individual house lot would be useful as the subsidiary water supply source.

2) Infiltration Facility

There are various infiltration facilities to retain the flood runoff discharge such as soak pit, infiltration gutter and trench as proposed in the foregoing subsection 6.2.5. These infiltration facilities are also expected to effect on recharging to the groundwater. Nevertheless, the difficulties are foreseeable in estimating the definitive infiltration capacity of the facilities. The infiltration capacity of the facilities also easily drops down due to clogging of the filter. In order to clarify the definitive infiltration capacity and maintain the infiltration effect of the facilities, the field infiltration test together with the soil mechanical test as well as the sustainable maintenance works for the facilities are indispensable.

CHAPTER 9. IMPLEMENTATION PROGRAM

9.1 IMPLEMENTATION PROGRAM FOR FLOOD MITIGATION PROJECT

The proposed flood mitigation projects involve the structural and non-structural measures. The structural measures are proposed to progressively complete through three (3) phased programs of the urgent project, the short-term project and the long-term project with the ultimate target completion year of 2012. Hence, the implementation program is prepared to divide each of the structural measures into the three (3) phased programs taking the period physically required to completion of the components and significance of flood mitigation effects.

The implementation program is also prepared for the proposed non-structural flood mitigation measures such as the flood forecasting and warning system and the dissemination of the flood risk maps. These non-structural flood mitigation measures could effect to mitigate the flood damage together with the structural measures, particularly for those caused by the extra-ordinary floods over the design scale of the structural measures. The non-structural flood mitigation measures are provisionally assumed to progressively complete by the target year of 2012 in parallel with implementation of the structural measures so as to fulfill the maximum flood mitigation effect.

The overall implementation program for the flood mitigation projects is as summarized in Table R 9.1.1, and the details of the program are as described in the following subsection 9.1.1 to 9.1.3.

Table R 9.1.1 Implementation Program for Flood Mitigation Project

Sector	Scheme	Phased Program		
		Urgent (2004-05)	Short-term (2005-07)	Long-Term (2008-12)
1. Structural Flood Mitigation Project	1.1 Community Pond at the Fatima Jinnah Park	○		
	1.2 Flood Diversion			
	(1) Flood diversion from Bedarawali Kas to Tenawali Kas			○
	(2) Flood diversion from Tenawali Kas to Kurang River		○	○
	(3) Improvement of Kurang River		○	○
	1.3 Supplementary works for on-going river channel improvement			
	(1) River improvement below Chaklala Bridge	○		
	(2) Side slope protection works of the on-going improvement section		○	
2. Non-structural Flood Mitigation Project	2.1 Establishment of flood forecasting and warning system	○		
	2.2 Establishment of flood risk map		○	○

9.1.1 Flood Mitigation Measures for Urgent Project

Among the proposed flood mitigation measures, the following two structural measures {items (1) and (2)} and one non-structural measure (item (3)) are selected as the components of the Urgent Project considering the immediate mitigation of flood damage and the possible completion within the target implementation period by the year of 2005.

1) Improvement of the section of Lai Nullah (RD5+277-RD6+216) below Chaklala Bridge

The river improvement of the section of Lai Nullah between Chaklala Bridge and Kattarian Bridge (RD6+216-17+210) is now in progress and scheduled to complete by September 2003. The realignment/enlargement of the meandering section around Murree Brewery Area (RD4+077-RD5+277) has also been completed as the supplementary work of the river improvement.

However, the section (RD5+277-RD6+216) sandwiched between the above river improvement sections is left behind without any channel improvement. It is verified that the section forms bottleneck causing the adverse backwater effect to the on-going river improvement section above Chaklala Bridge. Accordingly, the river improvement of the section is urgently required to offset the adverse backwater effect and to preserve the design flow capacity of the on-going channel improvement.

2) Construction of Community Pond

The substantial part of the park Fatima Jinnah Park as the construction site of the community pond still remains as the vacant land without any major permanent structure. CDA, the administrator of the park has given the provisional consent to use the park as the flood detention facility, in view of the function of community pond to improve the amenity of the park. Due to these conditions, construction of the community pond would not require any house evacuation and land acquisition, which avail the early commencement of construction. Moreover, the required construction period is provisionally estimated at about 2 years, whereof the community pond could be completed by the target year of 2005 for the Urgent Project. Moreover, The community pond could have cut almost all the probable peak runoff discharge of 25-year return period, and reduce about 35% of the park flood discharge even in case of 100-year return period. These functions could increase the flood safety level of the downstream of Lai Nullah. Thus, the proposed community pond would contribute the significant flood mitigation effect to the downstream of Lai Nullah.

3) Reinforcement and Expansion of the Existing Flood Forecasting and Warning System

In the event of July 2001 flood, Pakistan Metrological Department (PMD) observed an extra-ordinary scale of rainfall intensity in Lai Nullah through its weather surveillance radar and rainfall gauging. Judging from the results of the observation, PMD predicted a possibility of serious flood overflow along Lai Nullah a few hours before its actual occurrence. In spite of the advanced awareness of the flood, the flood caused the death of 75 people.

Should the existing flood gauging, communicating and warning system be strengthened, the more accurate and immediate flood information could be systematically collected, and the death calamity as experienced in 2001 flood would be relieved. From these viewpoints, the improvement of the existing flood forecasting and warning system is proposed as an eligible measure to immediate effect mitigation of the flood damage, the calamity of death in particular.

9.1.2 Flood Mitigation Measures for Short-term Project

The Short-term Project with its target completion year of 2007 would include the flood diversion channel for the design scale of 25-year return period as the structural measure and the establishment of the flood risk maps as the non-structural measures.

1) Flood Diversion Channel for Short-term Project

The flood diversion channel for the design scale of 25-year return period would be completed by the year 2007 as the provisional flood mitigation measure for the under-mentioned flood diversion channel with the design scale of 100-year return period. The diversion channel will divert the flood runoff discharge from Tenawali Kas and Saidpur Kas into Kurang River. In addition, the flood runoff discharge from the tributary of Bedarawali Kas would be indirectly diverted, through Community Pond, Tenawali Kas, and the diversion channel. The design discharges of the diversion channel are as listed below (refer to Fig. R 9.1.1):

Table R 9.1.2 Design Discharge of Diversion Channel in Short-term Project

Section	Design Flow Capacity (m^3/s)
Tributary of Bedarawali Kas to Tenawali Kas (Community Pond)	70
Tenawali Kas to Saidpur Kas	70-140
Saidpur Kas to Ojhri Kas	320
Ojhri Kas to Kurang River	470

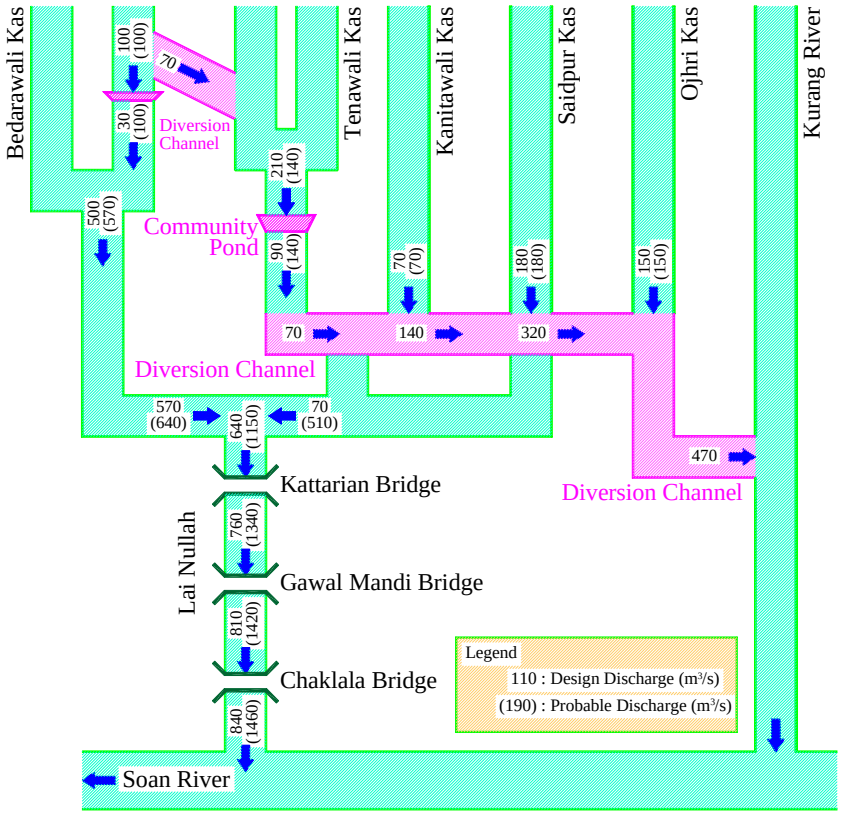

Fig. R 9.1.1 Design Discharge for Short-term Project (25-year Return Period)

2) Establishment of Flood Risk Map

As described in the foregoing subsection 6.4.2, the base maps for the extent and depth of the probable flood inundation was delineated in this Study. The flood risk map thus prepared should be disseminated to the public through a bulletin, an information board and other available information tools. However, the available evacuation centers as well as evacuation routes for each unit of the local communities need to be selected by the relevant local government agencies based on the base maps, and the flood risk map should be finalized. Accordingly, establishment of the flood risk map would require a substantial period. Moreover, the evacuation centers and the evacuation routes would need to be progressively modified in accordance with expansion of the built-up area. From these viewpoints, establishment of the flood risk map is assumed to complete in the period of short-term period and need to be revised through the period of the long-term project.

9.1.3 Flood Mitigation Measures for Long-term Project

The Long-term Project with its target completion year of 2012 would include the flood diversion channel for the design scale of 100-year return period as the structural measure and the establishment of the flood risk maps as the non-structural measures continued from the above short-term Project. Through the Long-term Project, a new diversion channel will connect a channel with a flow capacity of 600 m^3/s from Bedarawali Kas to Tenawali Kas. Moreover,

the diversion channel from Tenawali Kas to Kurang River completed in the Short-term Project will be also expanded as listed below (refer to Fig. R 9.1.2):

Table R 9.1.3 Comparison of Design Discharges of Diversion Channel for Short-term and Long-term Project

Section	Design Flow Capacity (m^3/s)	
	Short-term Project	Long-term Project
Tributary of Bedarawali Kas to Tenawali Kas (Community Pond)	70	80
Bedarawali Kas to Tenawali Kas	-	600
Tenawali Kas to Saidpur Kas	70-140	980-1,120
Saidpur Kas to Ojhri Kas	320	1,480
Ojhri Kas to Kurang River	470	1,790

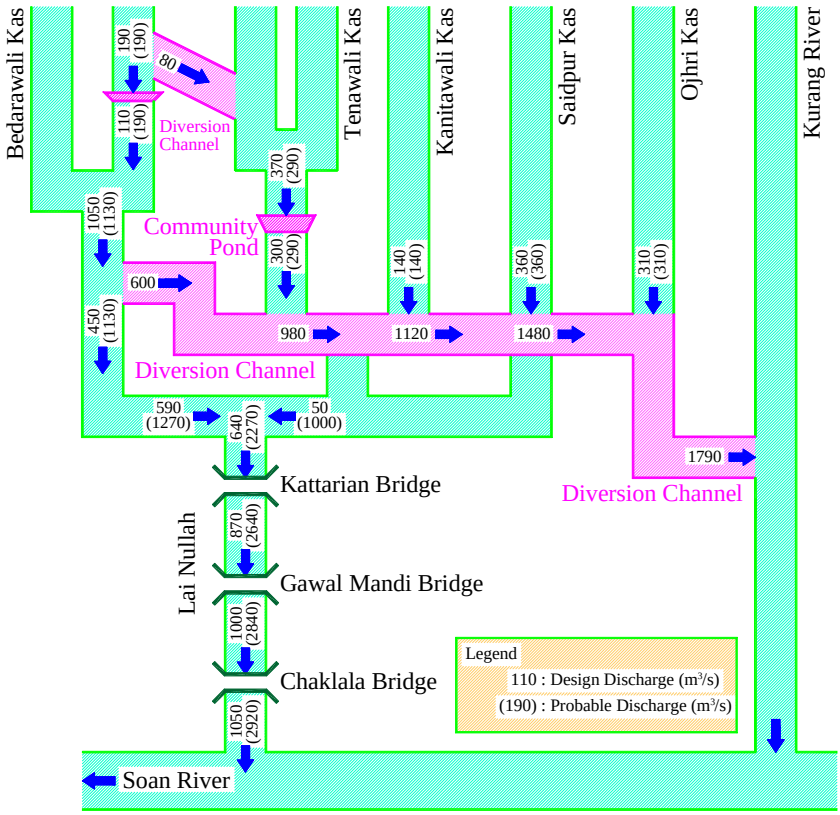

Fig. R 9.1.2 Design Discharge for Long-term Project (100-year Return Period)

9.2 IMPLEMENTATION PROGRAM FOR RELEVANT ENVIRONMENTAL IMPROVEMENT AND STRENGTHENING OF ORGANIZATION SETUP

The implementation program covers the phased action programs for the relevant environmental improvement measures such as the removal of encroachment along the river course, the control of garbage dumped into the river and the drainage and sewerage improvement. These environmental improvement measures would effect to sustain the design capacity of the structural measures and create the appropriate environmental conditions of Lai Nullah. There are several on-going and projected environmental implement plans such as improvement of

sewerage treatment plant in Islamabad City and the Urban Water Supply & Sanitation Project, Phase –1 and 2 (UWSSP-1 & 2), Rawalpindi City. Therefore, the implementation programs for the environmental improvement measures are prepared taking the implementation schedules committed and/or proposed for these on-going and projected projects into consideration.

The strengthening of the institutional setup would be also raised as an important issue to facilitate the overall river administration and management. Among the proposed components for strengthening of the institutional setup, establishment of Management Committee and Task Force for the integrated administration of Lai Nullah is urgently required to enhance execution of the project. Demarcation of roles and authorities of the relevant land administrators is also urgently required likewise. On the other hand, long-term efforts would be required to strengthening of the legal setup and capacity building. From the viewpoints, the implementation program is prepared for the strengthening of institutional setup aspect.

Table R 9.2.1 Implementation Program for Environmental Improvement and Strengthening of Organization Setup

Sector	Scheme	Phased Program		
		Urgent	Short-term	Long-Term
1. Related Environmental Improvement Project	1.1 Land use control			
	(1) Formulation of a step-wise resettlement plan	○		
	(2) Execution of the resettlement plan and demolishing of the site		○	○
	1.2 Control of solid wastes dumped into the river			
	(1) Apprehension of the volume of solid wastes	○		
	(2) Legislation of the acts for the solid waste management		○	○
	(3) Formulation and execution for reduction and recycle and solid waste			○
	1.3 Improvement of drainage and sewerage			
	(1) Improvement of sewerage treatment plant in Islamabad	○		
	(2) UWSSP-I	○		
	(3) UWSS-2		○	
	(4) Drainage and sewerage improvement for area of RCB		○	○
2. Strengthening of Institutional Setup	2.1 Establishment of Management Committee for the integrated administration of Lai Nullah	○		
	2.2 Establishment of Task Force for implementation of flood mitigation project of Lai Nullah	○		
	2.3 Demarcation of roles and authorities of the relevant land administrators	○		
	2.4 Strengthening of Legal-setup			○
	2.5 Capacity building	○	○	○

CHAPTER 10. PROJECT EVALUATION

10.1 ECONOMIC EVALUATION

10.1.1 Project Economic Benefit

The project economic benefit accrues from the amount of flood damage progressively reduced by the phased structural flood mitigation plans, namely, the urgent project, the short-term project, and the long-term project. The economic benefit would also accrue from the non-structural flood mitigation plans such as the flood forecasting and warning system and the dissemination of the flood risk maps. However, the principal benefit of the non-structural flood mitigation plans is oriented to securing of human life, but its monetary term is not generally accepted. Due to these backgrounds, the economic benefit by the non-structural flood mitigation plans was not incorporated into this evaluation.

In order to assess the project economic benefit, the economic damages by the Flood 2001 were initially assessed based on the interview survey conducted in the first field survey. The table below indicates that the Flood 2001 resulted in enormous amounts of economic damages corresponding to Rs. 28 billion, which is shared by the residential damage of 46% an the damage in business of 54%.

Table R 10.1.1 Estimated Economic Damages in the Flood 2001

(Unit: Rs. Million)

Sector			Damage Item	Damage/Expense		
Private	Residential	Direct Damage	Structure	7,681	12,852 (45.6%)	28,193 (100%)
			Household effects	4,976		
		Indirect Damage	Loss of Income	124		
			Emergency Measures	17		
			Other*	54		
	Business	Direct Damage	Structure	4,485	15,153 (53.7%)	
			Loss of merchandise stock	7,823		
		Indirect Damage	Business suspension	2,681		
			Emergency Measures	5		
			Flood Proofing Activity	159		
Public	Infrastructure			153	187 0.7%)	
	Emergency Assistance**			34		

Source: JICA Study Team 2002
* The expenses on the flood fighting/evacuations, the medical expenses, ets.
**Expenses as emergency assistance includes that from a NGO.

As listed above, the flood damage is classified into (1) the residential damage which covers the damage of the private house structures and household effects and other indirect damage, (2) the damage in business, which accrues from the damages of the structures and stocks as well as loss of business suspension, and (3) the damage in the public sector, which includes the damage of the public infrastructures such as road and bridges, and the expenses for public rescue operation.

The probable and annual average flood damage was further estimated based on (1) the probable flood inundation area/depth as estimated in the hydrological simulation, (2) the assets within the

probable flood inundation area as estimated in the Study and (3) the flood damage rates as estimated in the aforesaid field survey on the damage of the Flood 2001.

As the results, the annual average flood damage is estimated at about Rs. 597 million when any proposed flood mitigation structure is implemented (i.e., without-project). On the other hand, the annual average flood damage could be reduced to Rs. 397 million upon completion of the urgent project and further reduced to Rs. 167 million upon completion of the short-term project as listed in Table R10.1.2. Moreover, the long-term project could make free from any damage by the probable flood of less than 100-year return period. The annual average economic benefit is expressed as the difference between the annual average damages of the without-project and the with-project, and therefore estimated at Rs. 218 million with-the urgent project, Rs. 430 million with-the short-term project and Rs. 597 million with the long-term project as listed below:

Table R 10.1.2 Estimation of Annual Average Flood Damage and Annual Average Benefit

States	Frequency Return Period (year)	Probable Damage (Rs billion)	Annual Average Damage (Rs million)	Annual Average Benefit (Rs million)
Without Project*	Less than 10	0	597	-
	25	7.09		
	50	13.46		
	100	22.44		
Upon Completion of Urgent Project	Less tan 13	0	379	218
	25	4.35		
	50	10.55		
	100	19.37		
Upon Completion Short-term Project	Less than 25	0	167	430
	50	6.21		
	100	14.70		
Upon Completion of Long-term Project	Less than 100	0	0	597

* The completion of the on-going channel improvement work by RDA is assumed as the Without Project Case.

10.1.2 Project Economic Cost

The economic costs of projects were derived by subtracting price contingencies and taxes from the financial costs of the projects, then, adjusting it by the opportunity cost of labor and land for the construction cost as described bellow. Estimation of the economic cost is further subject to subtracting of the cost for the amenity facilities for the community pond, since the amenity facilities contribute to enhancement of aesthetic and recreational value of the land but not mitigation of the flood damage. The economic costs of local materials were based on the prevailing market prices assumed to remain unchanged in real terms at constant 2002 price.

(1) Opportunity cost of labor: The opportunity cost of unskilled labor was derived by adjusting the prevailing market wage rate by a factor of 0.75 in line with estimated level

of seasonal unemployment and underemployment in the subproject areas[1].

(2) Cost of land acquisition: The lands acquired for the project include those owned by the government as well as personally owned lands. As for the land owned by the government, it is currently used as a central reservation of the road network in Islamabad City, and therefore, the cost of land is not included in the economic analysis considering the opportunity cost of the land. On the other hand, the land owned by private individuals is assessed at its market price with consideration on the urban and/or pre-urban settings where land market is rather competitive.

As the results of the above assumptions, the project economic cost was estimated as listed below:

Table R 10.1.3 Project Cost and Disbursement Period of Project Cost

Description	Urgent Project		Urgent Project + Short-term Project		Urgent Project + Short-term Project + Long Term Project	
	Initial Investment	Annual O & M	Initial Investment	Annual O & M	Initial Investment	Annual O & M
Financial Cost (Rs. Million)	895.5	3.3	3,337.2	4.8	5,900.7	5.4
Economic Cost (Rs. Million)	835.8	3.1	3,129.8	4.6	5,535.6	5.1
Disbursement Period	2003-2005	2006-2052	2003-2007	2008-2052	2003-2012	2013-2052

Note: The financial cost and the economic cost exclude the cost of the amenity facilities for the Community Pond. The financial cost further excludes the price contingency.

10.1.3 Economic Internal Rate of Return

The economic internal rate of return (EIRR) was estimated assuming the aforesaid project economic benefit and economic cost. The sensitivity analysis was further made assuming 10% reduction of the economic benefit or the economic cost. The results of the estimation are as listed below:

Table R 10.1.4 EIRR and B/C Ratio of the Proposed Structural Measures

Progress of the Project	EIRR			B/C Ratio*
	Base Case	10% Reduction in Benefit	10% Reduction in Cost	**Base Case**
1 Urgent Project	**22.4 %**	20.4 %	20.5 %	**2.3**
2 Urgent + Short-term Project	**12.8 %**	11.6 %	11.7 %	**1.3**
3 Whole (Urgent + Short-term + Long-term Project)	**10.4 %**	9.3 %	9.4 %	**1.0**

*: Assuming the discount ratio of 10%

As estimated above, the proposed structural flood mitigation plans could be evaluated to be economically viable indicating the EIRR over the capital opportunity cost of 10%. Moreover, the population of about 183,000 could be relieved by the structural flood mitigation measures as a whole. However, as the EIRR of the Long-term Project is marginally beyond the opportunity

[1] Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Islamic Republic of Pakistan for the Second Flood Protection Sector Project, October 1997 (PRP:PAK28165)

cost 10 %, and the reduction in benefit or 10 % overrun in project cost pushes EIRR below the threshold. The flood mitigation effect begins in nature to accrue as soon as the measures are installed. Therefore, a delay in benefit realization may take place when completion of construction is overdue. The preparation and construction of the structures of the project would, therefore, need to be closely monitored during the supervision with particular reference to timely resource mobilization of the Pakistan side by facilitated interagency coordination.

10.2 FINANCIAL EVALUATION

The cost for flood mitigation is subsidized in most case, and not recovered directly from beneficiaries. From these viewpoints, the financial analysis was made to clarify the fiscal capacity of the government to afford the project with referring to the results of the recent public expenditures.

10.2.1 Review on the Public Expenditure Reviews

Table below summarizes the consolidated national revenue and expenditure in 2001. The total revenue amounts to Rs 625.4 billion against Rs 837.6 billion in total expenditure. An overall fiscal deficit of Rs.212.2 billion is financed through external and domestic sources.

Table R 10.2.1 Consolidated National Revenue and Expenditure in 2001

Item		Amount (Rs. Billion)
1. Revenue	1.1 Tax Revenue	486.0 (78%)
	1.2 Non-Tax Revenue	139.4 (22%)
	Total Revenue	625.4 (100%)
2. Expenditure	2.1 Current Expenditure	705.5 (84%)
	(1) Federal	535.4 (64%)
	(2) Provincial	170.1 (20%)
	2.2 Development Expenditure	132.1 (16%)
	(1) Public Sector Development Program (PSDP)	127.0 (15%)
	(2) Others	4.1 (1%)
	Total Expenditure	837.6 (100%)
3. Overall Fiscal Deficit	3.1 External	148 (70%)
	3.2 Domestic	64.2 (30%)
	Total Deficit	212.2 (100%)

Source: Economic Survey 2001-2002 (Modified Budget Estimated)

Among the above items, the budget for expenditure of the Public Sector Development Programme (PSDP) is expected as the eligible financial source for implementation of the proposed flood mitigation plans. The budget of PSDP for 2001 is Rs 127 billion, which accounts for 15% of the total expenditures. Out of Rs. 127 million for the budget of PSDP in 2001-02, about Rs 9 billion or 7% has been allocated to water sector.

According to the “Ten Year Perspective Development Plan 2001-2011”, the whole budget of PSDP is projected to increase from to Rs. 127 billion in 2001 to Rs. 418 billion in 2010 with an

annual growth rate at 14%. In parallel with increment of the whole budged of PSDP, the budget for the water sector is also raised to Rs. 60 million in 2010 (refer to Table R 10.2.2).

Table R 10.2.2 Projected Whole and Water Sector Budget of PSDP
(Ten Year Perspective Development Plan 2001-2011)

(Unit: Rs. Billion)

Year / Sector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Water Sector	9	29	47	41	42	44	46	51	58	60	426
Whole Budget of PSDP	130	150	180	202	227	255	287	324	367	418	2,540

Source: Ten Year Perspective Development Plan 2001-11 and Three Year Development Programme 2001-04, Planning Commission, September, 2001

10.2.2 Fiscal Impact of the Proposed Flood Mitigation Project

The initial investment cost of the proposed flood mitigation project is Rs. 7,615 million in total, while the annual O & M cost for the proposed project will gradually increase to Rs. 3.3 million upon completion of the Urgent Project in 2004 to Rs 5.4 million upon completion of the Long-term Project in 2012, which would imposes a fiscal burden during the entire project life as listed below:

Table R 10.2.3 The Project Initial Investment Cost and Annual O & M Cost

Project	Initial Investment Cost (Rs. million)	O & M cost (Rs. million/ year)
Urgent Project	1,267	3.3
Urgent + Short-term Project	4,124	4.8
Urgent + Short-term + Long-term Project	7,615	5.4

In order to firstly clarify the fiscal burden of the initial investment cost to the government budget, the annual disbursement schedule of the project investment cost is compared with the whole budget of PSDP and its budget in the water sector as listed below.

Table R 10.2.4 Project Investment and Ten Year Perspective Development Plan 2001-2011

Item	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(1) Whole Budget of PSDP (Rs. million)	130,000	150,000	180,000	202,000	227,000	255,000	287,000	324,000	367,000	418,000	-	-
(2) Budget of Water Sect. in PSDP (Rs. million)	9,000	28,500	47,100	41,100	41,500	44,300	46,000	50,700	57,600	59,800	-	-
(3) Project Cost (Rs. million)	-	-	69	813	1,194	1,066	1,084	658	677	680	707	666
(4) (3)/(1)	-	-	0.04%	0.40%	0.53%	0.42%	0.38%	0.20%	0.18%	0.16%	-	-
(5) (3)/(2)	-	-	0.15%	1.98%	2.88%	2.41%	2.36%	1.30%	1.17%	1.14%	-	-

Source: Ten Year Perspective Development Plan 2001-11 and Three Year Development Programme 2001-04

As compared above, the project will have the maximum increment of only 2.88% of the budget for water sector programs. The corresponding figure for the PSDP up to 2012 in total is merely

0.53%. As far as the current size of the expenditure is concerned, there will be a negligible incremental fiscal burden on the federal governments. Additional annual expense with implementation of the project is, therefore, generally deemed to fall within the capacity of the government. In addition, recent development in tax reform including broadened tax base has increased tax revenue of the central government by 13% from 2001-02 to the 2002-03, which is expected to contribute to balanced budget in the future.

In addition to the above clarification the fiscal burden of the initial investment cost, the fiscal burden of the annual O & M cost to the government budget was also clarified. The eligible budgetary source for the annual O & M cost would accrue from the budget for the Normal Annual Development Program (NADP) in the National Flood Protection Plan (NFPP), which is allocated as a part of the budget of the aforesaid water sector in PSDP. According to the draft National Flood Protection Plan-III issued on May 2001, it is planned to invest Rs 2,400 million in total for the NADP for a period from 1998 to 2012. The annul average budget for NADP is estimated at about Rs. 185 million, while the project would require the annual O & M cost of Rs. 5.4 million, which will results in 3% increase on the annual base budget of NADP and deemed to be affordable within the limit of the budget.

10.3 INITIAL ENVIRONMENTAL EVALUATION

The proposed flood mitigation plan consists of the two principal structural measures, that is: (1) the Community Pond constructed in the Fatima Jinnah Park and (2) the Flood Diversion Channel, which runs across the upper reaches of Lai Nullah Basin. The initial environmental evaluation (IEE) for these structural measures was carried out based on information collected during this Master Plan Study, and consultation with concerned government, the NGOs and other project stakeholders. The major assessment given below is a cross impact matrix, with the major environmental resources as rows, and the activities for implementation of the proposed plan as the columns.

Table R 10.3.1 Activities for Each Project Phase.

Phase	Project Activity
Planning and Design Stage	Land Acquisition
Construction Phase	Construction camp establishment
	Equipment servicing and fuelling
	Site preparation and clearing
	Earthworks
	Quarries and borrow sites
Operation Phase	Operation

In the matrix, assessment of impacts was made in terms of magnitude, duration or time framework, causal relationship and probability. The result of the assessment was presented following the categories.

Table R 10.3.2 Assessment Category

Magnitude of Impact	A	Major impact is anticipated. Mitigation measure is judged required.
	B	Potential major impact is anticipated. Detailed study required in EIA.
	C	Some impact is anticipated.
		Blank represents no anticipated impact.
Duration of Impact	L	Long-term impact
	S	Short-term impact
Causal relationship	D	Direct Impact
	I	Indirect impact
Probability	H	Highly probable,
	M	Moderately probable,
	U	Unpredictable

The checklists for each of the project phase as well as the above assessment categories were clarified as shown in Tables R 10.3.3 and 10.3.4. As the results of the checklists, it is evaluated that the flood mitigation plan proposed in the Master Plan will induce relatively insignificant adverse impacts as compared with the flood mitigation projects in alluvial area in rural setting where flooding recharges soil moisture, replenishes soil nutrients and thus enhances productivity of natural resources such as wildlife, livestock and fisheries. Several potential adverse impacts were, nevertheless, identified in the evaluation, and it is concluded that the Environmental Impact Assessment (EIA) is required in the succeeding study period. The particular evaluations for each of the Community Pond and the Flood Diversion Channel are as described below:

1) Community Pond

The community pond poses far less adverse environmental impact as compared with the flood diversion in the initial screening level, in addition, it will have a significant beneficial impact on improvement of the living environment by increased aesthetic, recreational and partly educational value of the park. However, one of the adverse environmental impacts would be addressed to ***waste*** of construction during the construction phase, whereby a special attention should be given to selection of disposal site of excavated soil during the construction phase. The adverse impacts on ***fauna and flora*** in the existing park are also expected during the construction phase, whereby it is necessary to confirm that there exist no threatened or rare species of fauna and flora in the park. The adverse impact during the operation phase would be further brought about through ***water pollution*** of the pond, resulting in increase of ***offensive odor*** and emergence of water-borne disease. Increased waste disposal from visitors of the park needs to be properly collected to maintain cleanliness of the park. These adverse impacts should be the principal items for the

succeeding EIA. Nevertheless, it is preliminarily evaluated that these adverse impacts would be minimized by construction of: (1) the oxidation pond, (2) the check dam to stop the inflow of garbage, (3) diversion channel to bring the clean discharge from the adjacent Bedarawali Kas and (4) alternative sewerage channel of the polluted low flow from Tenawali Kas.

Table R 10.3.3 Checklist for Community Pond

Category of Environmental Impact	Overall Assess.	Planning and Design Phase				Construction Phase				Operation Phase				Beneficial		
		Magnitude	Duration	Causal	Probability	Magnitude	Duration	Causal	Probability	Magnitude	Duration	Causal	Probability	Magnitude	Duration	Causal
Social Environment																
Involuntary Resettlement																
Economic Activity																
Traffic and Public facilities																
Split of Communities																
Cultural Properties																
Water and Common Rights																
Public Health Conditions																
Waste	B					B	S	D	H	B	L	I	M			
Hazards (risk)																
Other social impacts														A	L	D
Natural Environment																
Topography and Geology																
Soil Erosion																
Groundwater																
Changes in Hydrology																
Fauna and Flora	B					B	S	D	H							
Metrology																
Landscape																
Other natural impacts																
Pollution																
Air pollution	C					C	S	D	M							
Water Pollution	B					B	S	D	M	B	L	I	M			
Soil contamination	C					C	S	D	M							
Noise and vibration	C					C	S	D	M							
Land subsistence																
Offensive odor	B					C	S	D	M	B	L	I	M			
Other impact in pollution control																

2) Flood Diversion Channel

The flood diversion channel will require ***involuntary resettlement*** along Kurang River as the outlet of the diversion channel during the planning and design phase, which would be enumerated as one of the principal objectives of the succeeding EIA. The resettlement would be, however, indispensable regardless to construction of the diversion channel, because the objective houses for resettlement are located within the present habitual flood inundation area and the great impediments to the flow of flood discharge. The number of house to be resettled is about 220, which is far less than 2,000 houses evacuated by RDA for the on-going river channel implement. Accordingly, the objective resettlement associated with construction of the diversion channel would be realizable provided that the stepwise resettlement plan and the support by micro financing are formulated and executed

as described in the foregoing subsection 6.3. Interaction with *traffic and public facilities* will be also a potential impact in construction phase. Due to linear alignment of the diversion channel, it will result in *split of community* as well as damage on *cultural properties*. In order to cope with these adverse affects, it would be necessary to construct temporary bypasses and several permanent bridges. Adverse impacts in *waste disposal* will occur in two distinct occasions in construction and operation phases, and control of the garbage dumped into the channel should be carefully made based on legislation of the Act for Solid Waste Management and formulation/execution of the program for reduction and recycle of solid waste (refer to subsection 8.2).

Table R 10.3.4 Checklist for Flood Diversion Channel

Category of Environmental Impact	Overall Assess.	Planning and Design Phase				Construction Phase				Operation Phase				Beneficial		
		Magnitude	Duration	Causal	Probability	Magnitude	Duration	Causal	Probability	Magnitude	Duration	Causal	Probability	Magnitude	Duration	Causal
Social Environment																
Involuntary Resettlement	A	A	L	D	M											
Economic Activity	B	B	L	D	M											
Traffic and Public facilities	B					B	S	D	H	B	L	D	H			
Split of Communities	A					B	S	D	H	A	L	D	H			
Cultural Properties	A					A	S	D	M							
Water and Common Rights																
Public Health Conditions																
Waste	A					B	S	D	H	A	L	I	H			
Hazards (risk)																
Other social impacts																
Natural Environment																
Toporaphy and Geology																
Soil Erosion																
Groundwater																
Changes in Hydrology	A									A	L	I	M			
Fauna and Flora	C					C	S	D	H	C	L	D	M			
Meteology																
Landscape	C									C	L	D	M			
Other natural impacts																
Pollution																
Air pollution	B					C	S	D	M							
Water Pollution	B					B	S	D	M							
Soil contamination	B					C	S	D	M							
Noise and vibration	B					C	S	D	M							
Land sussistence																
Offensive odor	B					C	S	D	M							
Other impact in pollution control																

CHAPTER 11. CONCLUSION AND RECOMMENDATION

The low-lying area along Lai Nullah has suffered the chronic flood inundation, and occasionally encountered the disastrous flood damage potential including death of human life as experienced in 2001 Flood. Thus, the flood of Lai Nullah calls the serious social malaise and at the same time, hinders the regional economy as well as the urban environment. In order to get rid of these significant flood problems, it is indispensable to implement the proposed flood mitigation and relevant river environmental improvement plan.

Among the proposed plan components, the proposed structural flood mitigation plan is confirmed to be economically and financially viable. The environmental adverse impacts caused by implementation of the plan could be also minimized by the several practical countermeasures attached to the proposed structural plan. Accordingly, implementation of the proposed structural plan is recommended in accordance with the proposed phased programs, where the year of 2012 is set as the target completion year.

The overall proposed plan further includes the non-structural flood mitigation plan, the environmental improvement plan and the plan for strengthening of the institutional setup for project implementation and management. These are essential to ensure and/or supplement the functions of the proposed structural measures and need to be implemented in parallel with the phased programs for the structural flood mitigation plan. The principal recommendations in implementation of these proposed overall plans are as summarized hereinafter:

1) Implementation of the Proposed Urgent Project

Lai Nullah would cause the serious flood overflow by the comparatively small probable flood, even upon completion of the on-going river channel improvement above Chaklala Bridge by RDA, due to the limited right-of-way availed to the on-going improvement and the bottlenecks left behind below Chaklala Bridge. Thus, Lai Nullah still has the high flood damage potential, and it is strongly recommended to take the early implementation of the proposed urgent project and produce the immediate flood mitigation effect.

2) Implementation of the Phased Short-term and Long-term Project

Lai Nullah Basin has experienced the disastrous damage by 2001 Flood including death of 74 people and destruction of about 3,000 houses. The 2001 Flood is the recorded maximum flood, and the design scale of the above urgent project is still far less than the scale of 2001 Flood. The flood damage potential would further increase with the expansion of population in the basin as projected from 1.0 million in 1998 to 2.3 million in 2030.

Under the above conditions, it is inevitable to implement the drastic flood mitigation plan, which could cope with even the scale of 2001 Flood. Nevertheless, the plan would take a long implementation period of about 10 years due to its huge work volume. Accordingly, the plan would be progressively implemented through the phased short-term and long-term project. In order to complete these phased programs within due time, the close monitoring on implementation would be indispensable.

3) Feasibility Study on Flood Diversion Plan

The flood diversion channel is proposed as the principal structural measure for the long-term project. A feasibility study would be, however, required to clarify the further details of the proposed diversion structures with a particular attention to a comment given from CDA on the allowable width of the diversion channel (refer to item 2 in the Minutes of Steering committee Meeting on the Draft Final Report as attached to this Main Report). The objectives of the feasibility study should further include clarification on the detailed river improvement works required to Kurang River, which is proposed as the outlet of the diversion.

4) Involvement of the Federal Government in Implementation and Management of the Project

The principal beneficiary of the proposed flood mitigation plan is biased to the lower reaches of Lai Nullah in Rawalpindi City, while the major flood mitigation structures such as the community pond and the diversion structure are placed in the upper reaches in Islamabad City. This contradiction may lead to conflicts between the regional administrators for the two cities in implementation and management of the proposed flood mitigation. In order to minimize the conflicts, the federal government as represented by the Ministry of Water and Power and/or the Federal Flood Commission would be required to coordinate the overall project implementation and management works, and/or further directly undertake a part of them.

5) Implementation of Environmental Improvement Works of Lai Nullah

The environmental improvement particularly in the aspect of control of the garbage dumped into the river and the encroachment in the right-of-way of the river would be the important issues to sustain the flood mitigation capacity and the appropriate river environment of Lai Nullah. From these viewpoints, it is necessary to urge the relevant on-going environmental improvement projects such as enlargement of the capacity of the existing sewerage treatment capacity for Islamabad and the UWSSP-I and II for Rawalpindi

City. At the same time, legislation of the new act and enforcement for control of garbage dumping and encroachment in the waterway of the river would be required.

6) Budgetary Arrangement

According to the recent national policy in Pakistan, the public development investment is deemed to tend toward the regions other than the capital territory of Islamabad. This national policy may lead to difficulties in securing the necessary budget for the proposed flood mitigation plan. The budgetary arrangement would need, therefore, to be deliberated thoroughly by the federal agency as represented by the Ministry of Water and Power and the relevant local government agencies such as CDA and the provincial government of Punjabi, TMA, RDA and RCB.

7) Strengthening of Hydrological Data

The existing hydrological gauging data including the rainfall and water level data in Lai Nullah Basin is quite inadequate and less orderly prepared, which is a great hindrance for formulation of the flood mitigation plan as well as other various water resources development plan. In order to retrieve such unfavorable conditions, it is recommended to increase the hydrological gauging stations and at the same time, an attempt should be given to orderly arrange the gauged data.

8) Coordination with CDA on Layout of Amenities as Attached to Community Pond

The community pond proposed as a component of the urgent project would have the multiple functions as flood mitigation facility during a flood and as the amenity of the existing Fatima Jinnah Park during a non-flood time. CDA is quite concerned with the layout of the amenity facilities attached to the community pond, and therefore, a close coordination with CDA on this matter would be required during the succeeding detailed design stage.

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