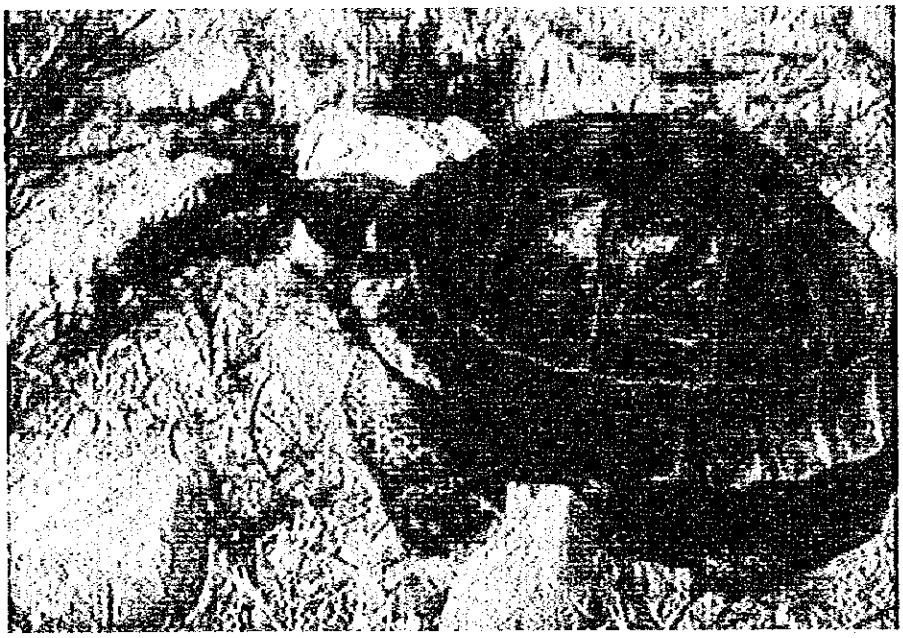
Annex J
Environment



ANNEX J

ENVIRONMENT

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ANNEX J ENVIRONMENT

J.1 TARGET AND PROCESSES OF ENVIRONMENTAL STUDY

Targets of environmental study of the Delay Action Dam Project is to design environmental improvement and mitigating for adverse impacts. The study to attain the target includes the following processes. They are:

1) to review the results of environmental scoping and screening in the preparatory study;

2) to recognize the current environmental situation and trends by means of physical environmental survey and rural socio-economic survey including data collection;

3) to identify and to anticipate the existence, the magnitude, the extent and the frequency of the potential impacts caused by the implementation of the Project by means of Initial Environmental Examination (IEE);

4) to consider the possibility of mitigatory measures to minimize negative impacts;

5) to determine whether detailed Environmental Impact Assessment (EIA) is required for the proposed each dam, if required, to prepare a TOR for EIA and to consider the execution of EIA

6) to establish the environmental conservation plan and measures for DAD project.

The working flow by the procedure is indicated in "Fig. H.1".

J.2 ENVIRONMENTAL STUDY

J.2.1 *Physical Environmental Survey (PES)*

(1) Approaches

Physical environmental survey was carried out by local consultant. The approaches are as followings. They are:

1) to collect the information, data and related study reports regarding the physical environment in the divisions,

2) to prepare a questionnaire for the field interview survey,

3) to execute field survey and interviews to the farmers in the area on current environmental status and trends in the divisions.

(2) Selected Components and Issues

Selected components and issues in the study are biological and ecological issues, mechanical weathering and soil erosion, soil salinity, soil contamination, devastation and desertification, surface water, groundwater, flooding, siltation, water quality and atmosphere issues.

(3) Conclusion

The results of PES were utilized as materials to appraise the current physical environmental status and trends in the divisions for the IEE. In particular, it was useful, the information for afforestation and ecosystem including preservation of national park obtained from Forest Department, the evaluation for trends and parameter of soil erosion, and assumption of the application dosages of pesticides and chemical fertilizer.

Supplemental interview to the village inhabitants regarding the environmental situation was valuable to recognize the historical background of physical changes of land, water and air and also the awareness of inhabitants for the physical environment in the divisions.

J.2.2 Initial Environmental Examination (IEE)

(1) Approaches

The IEE was carried out at each division in the proposed and selected existing delay action dams. Divisions include catchment area, dam and reservoir area, river and riverside, beneficial area, and downstream area.

For existing DADs, the approaches of the IEE are as followings. They are:

1) to observed the environment aspects by means of analyzing the data and information;

2) to identify the environmental impacts caused by the aspects; and

3) to evaluate and the magnitude and the prevalence of the impacts.

For proposed DADs, they are as followings. They are:

1) to observe the actual environment aspects by means of analyzing the data and information;

2) to identify the actual environmental impacts;

3) to assume the potential environment aspects changed by the construction of dams;

4) to anticipate the potential environmental impacts caused by the potential aspects; and

5) to evaluate the magnitude and the prevalence of the potential impacts.

(2) Selected Components and Issues

The environmental components and issues have been determined as extensively as possible through the meeting and discussion with Environmental Section, Planning and Development Department and Balochistan Environmental Protection Agency.

The decision was brought on the following processes which are i) the review of environmental scoping and screening carried out in the preparatory study, ii) the identification of prior issues in the Environmental Impact Assessment Guidelines of Pakistan, and iii) the consideration of components and issues assessed on the developed projects in Balochistan province.

The selected environmental issues are as followings.

1) Physical Environment

Land Use, Soil Erosion, Soil Salinity, Soil Contamination, Surface Water Availability, Groundwater Availability, Groundwater Level, Groundwater Quality, Flooding, Siltation, River Morphology

2) Biotic Environment

Fauna Community/Habits, Vegetation

3) Human Environment

Settlement, Resettlement, Social Equity, Lifestyle, Health, Population Growth Population Structure, Income, Employment, Water Right, Institutional Activities, Historic Sites, Cultivation, Livestock, Domestic Water Supply

(3) Conclusion

Most of existing DADs have contributed to the sustainable use of renewable natural resources and to the reduction of natural disasters. The contributions have resulted in securing a sure means of human living and a prosperity of social communities.

The environmental impacts caused by the changes of the aspects were assumed for proposed DADs, considering the trends and impacts for existing DADs. As for the almost DADs, it was anticipated to contribute to the decline of groundwater level and to reduction of flood damages. It implies that DAD project creates the positive impacts of the sustainable use of renewable natural resources and area development. While some negative impacts are anticipated though minor level. Those are as follows:

1) Changes in the surface water hydrology causes the deprivation of water use for flood irrigation and domestic in the downstream area,

2) Apartness of traffic route due to construction of dam and related facilities causes loss of traffic approach for social life and economic activities.

Although the results of the IEE revealed that there were some potential negative impacts, EIA was not required, because the negative impacts minimized by means of conservation plans and measures established in the study were permissible magnitude, extent and frequency.

In addition, as carried out as originally conceived in the PC-1 of the Project, in the Phase (II) study, the IEE was reviewed as conceived on development plan. The review of the IEE was reviewed by means of collection of supplemental information and data, Social Environment and Farm Household Survey conducted by local consultant. The results are reflected in Revised Initial Environmental Examination Table.

Table J.1 Revised Initial Environmental Examination (IEE) Checklist for Existing Delay Action Dams

Dam Site No.		1			2			3			4			5			6			7			8			9			10		
Impacts		(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)
Environmental Component	Environmental Issue																														
Physical Environment																															
Land and Soil	Land Use		0			0			0			0			0			0			0			0			0			0	
	Soil Erosion		0			0			0			0			0			0			0			0			0			0	
	Soil Salinity		0			0			0			0			0			0			0			0			0			0	
	Soil Contamination		0			0			0			0			0			0			0			0			0			0	
Water	Surface Water Availability	N				P			C			P			C			C			C			P			C			C	
	Groundwater Availability		C		0				C			C			C			C			C			C			C			C	
	Groundwater Level		C			C			C			C			C			C			C			C			C			C	
	Groundwater Quality		0			0			0			0			0			0			0			0			0			0	
	Flooding	N				C			C			C			C			C			C			C			C			C	
	Siltation		0			0			0			0			0			0			0			0			0			0	
	River Morphology	N				P			P			P			P			P			P			P			P			P	
Biotic Environment																															
Fauna and Flora	Fauna Community/Habits		0			0			0			0			0			0			0			0			0			0	
	Vegetation		0			0			0			0			0			0			0			0			0			0	
Human Environment																															
Social and Life	Settlement		0			0			0			0			0			0			0			0			0			0	
	Resettlement		0			0			0			0			0			0			0			0			0			0	
	Social Equity		0			0			0			0			0			0			0			0			0			0	
	Lifestyle		0			0			P			P			0			P			0			0			P			0	
	Health		0			0			0			0			0			0			0			0			0			0	
Population	Growth		0			0			0			0			0			0			0			0			0			0	
	Structure		0			0			0			0			0			0			0			0			0			0	
Economic	Income		0			0			P			P			P			P			0			0			P			0	
	Employment		0			0			P			P			0			P			0			0			P			0	
Institution	Water Right		0			0			0			0			0			0			0			0			0			0	
	Other Activities		0			0			0			0			0			0			0			0			0			0	
Culture	Historic Sites		0			0			0			0			0			0			0			0			0			0	
Human Use	Agriculture		0			0			0			P			0			P			0			0			0			0	
	Livestock		0			0			0			0			0			0			0			0			0			0	
	Domestic Water Supply			P		0			0			P			P			P			P			0			P			P	

Dam Number
1 : Khora Manda
2 : Manum
3 : Bostan
4 : Khushab
5 : Turkha
6 : Amach
7 : Kad Kocha II
8 : Gorpad
9 : Laghmigir
10 : Sarbund

Impacts
S : Major Negative (-2)
N : Minor Negative (-1)
0 : No impacts 0
U : Uncertainty ?
P : Minor Positive (+1)
C : Major Positive (+2)

1. Physical Environment

Division
- I : Catchment area
- II : Dam and reservoir area
- III : River and riverside
- IV : Beneficial area
- V : Downstream area other than beneficial area

Dam Name
- 1 : Khora Manda
- 2 : Marium
- 3 : Bostan
- 4 : Khushab
- 5 : Tirkha
- 6 : Amach
- 7 : Kad Kocha I
- 8 : Gorpad
- 9 : Laghmgir
- 10 : Sarbund

Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
LAND and SOIL	Land use	IV	· Any changes of land use by the dam project are not recognized. The land has been utilized as orchards or upland cultivation lands or grass lands.	· Any impacts are not recognized.		1
		IV	· Any changes of land use by the dam project are not recognized. Almost of the land has been utilized as orchards.	· Any impacts are not recognized.		2
		IV	· Any changes of land use by the dam project are not recognized. The land has been utilized as orchards or upland cultivation lands.	· Any impacts are not recognized.		3 4 5 6 7 8 9 10
	Soil erosion	I II III	· Any changes of soil erosion by the dam project are not recognized. Soil erosion has been caused by some or almost of physical factors such as rainfall amount and intensity, slope angle and length, land cover and soil condition.	· Silting has been observed.	II	1 2 3 4 5 6 7 8 9 10
	Soil Salinity	IV	· Soil salinity caused by the dam project are not observed as well as before.	· Any impacts are not recognized.		1 2 4 5 7 9 10
		I IV	· Any changes of soil salinity by the dam project are not observed. Soil salinity is observed in the catchment area as before though it is not in the beneficial area.	· Any impacts are not recognized.		3 6
		I II III IV	· Any changes of soil salinity by the dam project are not observed. Soil salinity is observed in the area including beneficial area as before.	· The aspects affect deterioration of water quality and soil fertility in the downstream.		8
	Soil contamination	IV	· Soil contamination caused by the dam project has not been recognized due to low dosages of chemical fertilizer and pesticide as before.	· Any impacts are not evaluated.		1 2 3 4 5 6 7 9 10
		IV	· Soil contamination caused by the dam project has not been recognized due to scarce dosages of chemical fertilizer and pesticide as before.	· Any impacts are not evaluated.		8

Division
- I : Catchment area
- II : Dam and reservoir area
- III : River and riverside
- IV : Beneficial area
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Dam Name
- 1 : Khora Manda
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- 10 : Sarbund

Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
		I II III IV V			I II III IV V	1 2 3 4 5 6 7 8 9 10
WATER	Surface water availability	IV	· The surface water availability has been replaced to groundwater availability through the dam. The surface water, however, was discharged through the escape directly due to insufficient infiltration.	· An effective use of water resource has not been attained and flood damages are has not been reduced.	III IV V	1
		I IV	· The surface water derived from springs has been utilized as irrigation and domestic water. Surface water availability of Nullah has been replaced to groundwater availability through the dam. However, groundwater availability is low.	· Although an effective use of water resource has not been attained, flood damages are has not been reduced merely.	III IV V	2
		IV	· Surface water availability of Nullah has been replaced to groundwater availability through the dam.	· An effective use of water resource has been attained and flood damages has been reduced.	III IV V	3 5 6 7 10
		IV	· Surface water availability of Nullah has been replaced to groundwater availability through the dam.	· Although an effective use of water resource has not been attained, flood damages are has not been reduced merely.	III IV V	4 8
		I IV	· The surface water derived from springs has been utilized as irrigation and domestic water. Surface water availability of Nullah has been replaced to groundwater availability through the dam.	· An effective use of water resource has been attained and flood damages has been reduced.	III IV V	9
	Groundwater availability	IV	· Although groundwater availability pumped up by tubewells is not increased, sustainable use of groundwater for irrigation and domestic has been ensured.	· The aspect has created the potential availability for productive and social activities.	IV V	1 5 7
		IV	· Groundwater is not utilized.	· The aspect has contributed to the rehabilitation of groundwater resource	IV V	2 8
		IV	· Although groundwater availability pumped up by tubewells is not increased, sustainable use of groundwater for irrigation has been ensured.	· The aspect has created the potential availability for productive activities.	IV V	3
		IV	· Although groundwater availability pumped up by tubewells and karezes is not increased, sustainable use of groundwater for irrigation and domestic has been ensured.	· The aspect has created the potential availability for productive and social activities.	IV V	4 9 10
		IV	· Although groundwater availability pumped up by karezes is not increased, sustainable use of groundwater for irrigation and domestic has been ensured.	· The aspect has created the potential availability for productive and social activities.	IV V	6

Division
- I : Catchment area
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Dam Name
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Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
	Groundwater levels	IV	・ The excessive declines of the groundwater level has been held by the recharge of groundwater.	・ Although social and economic effectiveness is not taken up, the aspects contribute to the sustainable use of indispensable water resource.	IV V	1 3 4 5 7 9 10
		IV	・ The declines of groundwater level has been restrained because the installation of tubewell is not progressed.	・ Although social and economic effectiveness is not taken up, the aspects contribute to the sustainable use of indispensable water resource.	IV V	2 6 8
	Groundwater quality	IV	・ Any changes of groundwater quality by the dam project are not recognized. The groundwater quality is suitable to use for irrigation water, but unstable for the domestic water supply without any treatments.	・ The utilization of contaminated groundwater as domestic water without treatments causes the deterioration of health condition as before.		1 3 4
		IV	・ Any changes of groundwater quality by the dam project are not recognized. The groundwater quality is suitable for both domestic water supply and irrigation water.	・ Any impacts are not evaluated.		2 5 6 7 9 10
		IV	・ Any changes of groundwater quality by the dam project are not recognized. The groundwater quality is not suitable for both domestic water supply and irrigation water.	・ The utilization of contaminated groundwater as domestic water without treatments causes the deterioration of health condition and as irrigation water affects the restriction of produced crops as before.		8
	Flooding	III IV	・ Floods occurred due to the insufficient technical consideration regarding the design of facilities for the dam.	・ Social and economic losses resulted from flood damages were recognized.	IV V	1
		III IV	・ Flush floods has not been reduced.	・ Flood damages have been minimized, so that social and economic losses has been reduced considerably.	IV V	2 3 4 5 6 7 8 9 10
	Siltation	II	・ Sediment flowed into the reservoir is observed merely .	・ Any impacts are not observed.		1 2 3 4 6 7 8 9 10
		II	・ Sediment flowed into the reservoir is observed considerably.	・ Both the function by dam and groundwater recharge have been reduced.	II IV V	5
	River morphology	III	・ River morphology were changed by the construction of dam.	・ Flood damages were caused.	III	1 2 3 4 5 6 7 8 9 10
		III	・ Any changes of river morphology were reduced by the construction of dam.	・ The expansion of flood damages has been mitigated.	III	1 2 3 4 5 6 7 8 9 10

2. Biotic Environment

Division
- I : Catchment area
- II : Dam and reservoir area
- III : River and riverside
- IV : Beneficial area
- V : Downstream area other than beneficial area

Dam Name
- 1 : Khora Manda
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Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
		I II III IV V			I II III IV V	1 2 3 4 5 6 7 8 9 10
FAUNA and FLORA	Fauna community/ habitats	I	• Notable inhabitants are not observed because the ecosystems had been deprived.	• Any adverse impacts are not observed.		1 2 3 4 5 6 7 8 9 10
	Vegetation	I	• Scarce shrubs and grasses are observed only because vegetation had been deprived.	• As before construction of DAD, soil erosion and loss occurs.		1 2 3 4 5 6 7 8 9 10

3. Human Environmental Impacts

Division
- I : Catchment area
- II : Dam and reservoir area
- III : River and riverside
- IV : Beneficial area
- V : Downstream area other than beneficial area

Dam Name
- 1 : Khora Manda
- 2 : Marium
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- 7 : Kad Kocha I
- 8 : Gorpad
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- 10 : Sarbund

Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
SOCIAL and LIFE	Settlement	IV	• Settlement is not recommended.	• Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10
	Resettlement	I II III IV V	• Involuntary resettlement has not occurred.	• Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10
	Social equity	IV	• The traditional power structures observed in the area is not governing power structures which often cause the social inequity.	• Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10
	Lifestyle (quality of life)	IV	• Remarkable changes of lifestyle are not observed.	• Any impacts are not recognized.		1 2 7 8 10
		IV	• The stability or the improvement of lifestyle is observed due to increases of incomes derived from the stability of agricultural productivity.	• Any impacts are not recognized.		3 4 5 6 9
	Health	IV	• Any changes of health condition by the dam project are not recognized.	• Serious incidences of diseases such as water-related disease, diarrhea indication and parasitism related with the high mortality are still in existence as before.	IV	1 3 5 7 8
		IV	• Although health and sanitary conditions deteriorate in the dry season particularly, some changes of health condition by the dam project are recognized.	• Incidences of diseases such as water-related disease, diarrhea indication and parasitism related with the high mortality are still in existence as before.	IV	9 10
		IV	• There is a basic health center which has simple facilities and provides some services. However, health and sanitary conditions is not so good.	• Although adverse impacts caused by the construction of dam are not observed, incidences of disease such as water-related disease, diarrhea indication and parasitism related with the high mortality are still in existence .	IV	2 4 6
POPULATION	Population growth	IV	• Remarkable population growth is not observed.	• Any impacts are not evaluated.		1 2 3 4 5 6 7 8 9 10
	Demographic Structure	IV	• Remarkable changes of demographic structure is not observed.	• Any impacts are not evaluated.		1 2 3 4 5 6 7 8 9 10

Division
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Dam Name 1 : Khora Manda 6 : Amach
2 : Marium 7 : Kad Kocha I
3 : Bostan 8 : Gorpad
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5 : Tirkha 10 : Sarbund

Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
ECONOMIC	Income	IV	· Increases of incomes are not observed due to the stagnation of agricultural productivity.	· Although adverse impacts caused by the construction of dam have not been observed regarding the issue, farmers are obliged to work as seasonal or side worker as before.		1 2 7 8 10
		IV	· Incomes are on the increase merely due to the stability or the increase of agricultural productivity by means of the positive use of tubewells or the restoration of Karez discharge, so that saving is brought.	· The aspects affect the decrease of non-farm income rate and of the unemployment rate and the improvement of life standards.	IV	3 4 5 6 9
	Employment	IV	· Supplemented opportunities of the employment relative to agricultural activities are not observed.	· Although adverse impacts caused by the construction of dam have not been observed regarding the issue, the insufficiency of incomes and the stagnation of life standard are residual impacts.		1 2 5 7 8 10
		IV	· Although supplemented opportunities of the employment relative to agricultural activities are not observed, stable employment opportunities are acquired comparatively.	· The insufficiency of incomes and the stagnation of life standard are mitigated merely.	IV	3 4 6 9
INSTITUTION	Water Right	IV V	· Water and water use rights obeyed in the beneficial and downstream area are not restricted and deprived by the construction of dam.	· Any impacts are not evaluated.	IV	1 2 3 4 5 6 7 8 9 10
	other Activities and Effectiveness	IV	· Remarkable social activities are not observed as before.	· Any impacts are not evaluated.	IV	1 2 3 4 5 6 7 8 9 10
CULTURAL	Historic/ archaeological sites	I II III IV V	· Any aspects regarding the issue are not observed.	· Any impacts are not evaluated.		1 2 3 4 5 6 7 8 9 10
HUMAN USE	Cultivation	IV	· Although orchards irrigation and upland cultivation are farmed by means of tubewells, the increases of agricultural productivity are not so much.	· Although adverse impacts caused by the construction of dam have not been observed regarding the issue, as before the insufficiency of incomes and the stagnation of life standard are residual impacts.		1 5 7 10
		IV	· Increases of agricultural productivity by means of the construction of dam are hardly observed.	· Although adverse impacts caused by the construction of dam have not been observed regarding the issue, as before the insufficiency of incomes and the stagnation of life standard are very serious.		2 8

Division
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Environmental component	Environmental Issue	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
		IV	· Agricultural productivity derived from orchards irrigation and upland cultivation is increased notably by positive use of tubewells.	· Although excessive use of groundwater causes declines of groundwater level as before, the aspects lead to stabilizes or increases of incomes merely.	IV	3, 9
		IV	· Agricultural productivity tend to stability or increases due to the restoration of discharge by Karez.	· The aspects lead to the stability or the increases of incomes merely.	IV	4, 6
	Livestock	IV	· Livestock are grazed for the purpose of internal consumption as before.	· Any impacts are not evaluated.		1, 2, 3, 4, 5
		IV	· Grazing is extended for the purpose of stock farming as before.	· The overgrazing causes the watershed devegetation and the acceleration of soil erosion.		6, 7, 8, 9, 10
	Domestic Water Supply	IV	· The domestic water supply is derived from tubewells as before. Sustainable use of groundwater for domestic has been ensured.	· The aspect has created the potential availability for social activities.	IV	1, 5, 7
		IV	· The domestic water supply is derived from springs as before.	· Any impacts are not evaluated.		2, 8
		IV	· The domestic water supply is derived from facilities constructed by PHED as before.	· Any impacts are not evaluated.		3
		IV	· The domestic water supply is derived from tubewells and Karez system. In the dry season the availability of water supplies is increased due to increases of discharges by Karez .	· Health and sanitary conditions deteriorated in the dry season particularly are reduced merely.	IV	4
		IV	· The domestic water supply is derived from Karez system. In the dry season the availability of water supplies is increased due to increases of discharges by Karez .	· Health and sanitary conditions deteriorated in the dry season particularly are reduced merely.	IV	6
		IV	· The domestic water supply is derived from tubewells, Karez systems and springs. In the dry season the availability of water supplies is increased due to increases of discharges by Karez.	· Health and sanitary conditions deteriorated in the dry season particularly are reduced merely.	IV	9
		IV	· The domestic water supply is derived from tubewells, Karez systems and facilities constructed by PHED. In the dry season the availability of the water supply are increased due to the increase of discharge by Karez .	· Health and sanitary conditions deteriorated in the dry season particularly are reduced merely.	IV	10

Table J.2 Revised Initial Environmental Examination (IEE) Checklist for Proposed Delay Action Dams

Dam Site No.		1			2			3			4			5			6			7			8			9			10			11			12			13		
Impacts		(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)	(-)	0	(+)
Environmental Component	Environmental Issue																																						
Physical Environment																																							
Land and Soil	Land Use		0			0			0			0			0			0			0			0			0			0			0			0		
	Soil Erosion		0			0			0			0			0			0			P			0			0			0			0			0		
	Soil Salinity		0			0			0			0			0			0			0			0			0			0			0			0		
	Soil Contamination		0			0			0			0			0			0			0			0			0			0			0			0		
Water	Surface Water Availability	N				C			C			C			C			C			C			C			C	N			C	N						C
	Groundwater Availability			C		C			C			C			C			C			C			C			C			C			C			C		C
	Groundwater Level			C		C			C			C			C			C			C			C			C			C			C			C		C
	Groundwater Quality		0			0			0			0			0			0			0			0			0			0			0			0		
	Flooding			C		C			C			C			C			C			C			C			C			C			C			C		C
	Siltation		0			0			0			0			0			0			0			0			0			0			0			0		
	River Morphology			P		P			P			P			P			P			P			P			P			P			P			P		P
Biotic Environment																																							
Fauna and Flora	Fauna Community/Habits			P		0			0			0			0			0			0			0			0			0			0			0		
	Vegetation			P		0			0			0			0			0			0			0			0			0			0			0		
Human Environment																																							
Social and Life	Settlement		0			0			0			0			0			0			0			0			0			0			0			0		
	Resettlement		0			0			0			0			0			0			0			0			0			0			0			0		
	Social Equity		0			0			0			0			0			0			0			0			0			0			0			0		
	Lifestyle	N			U			N			N			N			N			N			N			N			N			N			N			N	
	Health		0			0			0			0			P			0			P			P			0			0			0			0			P
Population	Growth		0			0			0			0			0			0			0			0			0			0			0			0		
	Structure		0			0			0			0			0			0			0			0			0			0			0			0		
Economic	Income		0		U				0			0			0			0			P		P			P			P			0			0		
	Employment		0			0			0			0			0			0			P			0			0			0			0			0		
Institution	Water Right	N				0			0			0			0			0			0			0			0	N			0			0			0		
	Other Activities		0			0			0			0			0			0			0			0			0			0			0			0		
Culture	Historic Sites		0			0			0			0			0			0			0			0			0			0			0			0		
Human Use	Agriculture		0			0			0			0			0			0			P		P			P			0			0			0			P
	Livestock		0			0			0			0			0			0			0			0			0			0			0			0		
	Domestic Water Supply	N				0			0			0				P		0			P		P			0			0			0			0			P

Dam Number	1 : Brewary	8 : Sanzali	Impacts	S : Major Negative	(-2)		
	2 : Ghutai Shela	9 : Arambi		N : Minor Negative	(-1)		
	3 : Wali Dad	10 : Sakhol		0 : No impacts	0		
	4 : Dara	11 : Mangi		U : Uncertainty	?		
	5 : Murgi Kotal	12 : Kad Kocha II		P : Minor Positive	(+1)		
	6 : Kach	13 : Iskalkoo		C : Major Positive	(+2)		
	7 : Jigda						

1. Physical Environment

Division
- I : Catchment area
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Dam Name
- 1 : Brewary
- 2 : Ghutai Shela
- 3 : Wali Dad
- 4 : Dara
- 5 : Murghi Kotal
- 6 : Kach
- 7 : Jigda
- 8 : Sanzali
- 9 : Arambi
- 10 : Sakhoi
- 11 : Mangi
- 12 : Kad Kocha II
- 13 : Iskalkoo

Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
LAND and SOIL	Land use	Actual	IV	• The land is utilized as orchards or grass lands.	• Any impacts are not recognized.		1
		Actual	IV	• The land is scarcely utilized.	• Any impacts are not recognized.		2
		Actual	IV	• The land is utilized as orchards or upland cultivation lands or grass lands.	• Any impacts are not recognized.		3 4 6 9 13
		Actual	IV	• Almost of the land is utilized as upland cultivation lands	• Any impacts are not recognized.		5 7 8 10
		Actual	IV	• The land is utilized as orchards or upland cultivation lands.	• Any impacts are not recognized.		11 12
		Potential	IV	• Land use development for agriculture is impossible due to the limitation of water availability. Therefore, any changes of aspects are not assumed.	• Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Soil erosion	Actual	I II III	• Although caused by some physical factors such as slope angle and length, soil erosion has been reduced by means of the rehabilitation of vegetation covers managed by Forest Department.	• Certain changes of river course and morphology caused by sediment are observed but any adverse impacts are not recognized.		1
		Potential	I II III	• Any changes of aspects are not assumed.	• Any impacts are not anticipated.		1
		Actual	I II III	• Soil erosion of which scale is comparatively low has been caused by some or almost of physical factors such as rainfall amount and intensity, slope angle and length, land cover and soil condition.	• Frequent changes of river course and morphology caused by sediment affect flood damages.	IV V	2 10 12 13
		Actual	I II III	• Soil erosion of which scale is comparatively high has been caused by some or almost of physical factors mentioned above.	• The sediment by soil erosion had silted up the reservoir of the existing dams, so that the dams are destroyed. Consequently flood damages have been caused again.	IV V	3 5 6
		Actual	I II III	• Soil erosion of which scale is comparatively moderate has been caused by some or almost of physical factors mentioned above.	• Frequent changes of river course and morphology caused by sediment affect flood damages.	IV V	4 8 9 11

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- 8 : Sanzali
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- 10 : Sakhol
- 11 : Mangi
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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
		Potential	I II III	· Any changes of aspects are not assumed.	· Although flood damages are reduced by the construction of dam, the sediment is silted up the reservoir.	II	2 3 4 5 6 8 9 10 11 12 13
		Actual	I II III	· Soil erosion of which scale is comparatively moderate has been caused by some or almost of physical factors mentioned above.	· Frequent changes of river course and morphology caused by sediment affect flood damages.	IV V	7
		Potential	I II III	· Although any changes of aspects are not assumed by the dam project, the erosion is reduced by soil conservation program under-implemented by Forest Department.	· Flood damages are reduced by the construction of dam. In addition, silting in the reservoir is reduced merely.	IV V	7
	Soil Salinity	Actual	IV	· Soil salinity is not observed.	· Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential	IV	· Any changes of aspects are not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Soil Contamination	Actual	IV	· Soil contamination is not observed due to low dosages of chemical fertilizer and pesticide.	· Any impacts are not evaluated.		1 3 4 5 6 7 8 9 10 11 12 13
		Actual	IV	· Soil contamination is not observed due to scarce dosages of chemical fertilizer and pesticide.	· Any impacts are not evaluated.		2
		Potential	IV	· Even if chemical fertilizers and pesticides are applied to the orchard positively, excessive dosages of them which cause the soil contamination are not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
WATER	Surface Water Availability	Actual	I IV	· The discharges led from springs in the catchment through the river area are utilized as mainly domestic water.	· Any impacts are not recognized.		1
		Potential	IV	· The surface water availability is limited by the construction of the dam.	· Some inconveniences are caused by that surface water availability is replaced to the groundwater availability.	IV	1
		Actual	III IV	· Flood water is not utilized.	· The flood water causes flood damages.	III IV V	2 3 5 7 8 11 12
		Actual	IV	· The surface water derived from springs and other catchment is utilized as irrigation and domestic water. Flood water is not utilized.	· The flood water causes flood damages.	III IV V	4 6

Division I : Catchment area
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Dam Name 1 : Brewary 8 : Sanzali
2 : Ghutai Shela 9 : Arambi
3 : Wali Dad 10 : Sakhol
4 : Dara 11 : Mangi
5 : Murghi Kotal 12 : Kad Kocha II
6 : Kach 13 : Iskalkoo
7 : Jigda

Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects					Environmental Aspect	Environmental Impact	Division of Environmental Impact					Related Dams											
			I	II	III	IV	V			I	II	III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13
		Actual				IV		· The surface water derived from springs is utilized as mainly domestic water. Flood water is not utilized.	· The flood water causes flood damages.			III	IV	V									9				
		Actual				IV		· The surface water derived from springs is utilized as irrigation and domestic water. Flood water is not utilized.	· The flood water which is not distributed there causes flood damages.			III	IV	V													13
		Potential		II				· The surface water which infiltrates to the ground by means of the dam is recharged as groundwater.	· An effective use of water resource is attained and flood damages are mitigated.			III	IV	V		2	3	4	5	6	7	8	9		11		13
		Actual				IV		· The flood water which is distributed by means of simple facilities constructed by inhabitants is utilized as flood irrigation water.	· An effective use of water resource has been attained and flood damages to the downstream are mitigated.				IV	V										10		12	
		Potential		II	III	IV		· Although being replaced to groundwater availability, surface water availability for flood irrigation is deprived by the construction of the dam.	· Although an effective use of water resource is ensured, lapses of traditional irrigation method and relocation of bases on the cultivation activities are caused.				IV	V										10		12	
	Groundwater Availability	Actual				IV		· The groundwater pumped up by tubewells is utilized as irrigation and domestic water.	· Serious declines of the groundwater has been caused. It implies that future social communities and economic activities faces at a crisis of collapse.				IV		1	2	3		5							12	
		Actual				IV		· The groundwater pumped up by tubewells and led by Karez is utilized as irrigation and domestic water.	· Serious declines of the groundwater has been caused. It implies that future social communities and economic activities faces at a crisis of collapse.				IV					4		6			9	10	11		
		Potential				IV		· Opportunities of the sustainable use of groundwater is provided.	· A crisis of collapse in the future social communities and economic activities is reduced.				IV		1	2	3	4	5	6			9	10	11	12	
		Actual				IV		· The groundwater led by Karez is utilized as irrigation and domestic water. However, the discharges are decreased in the dry season.	· The decline of the discharge derived from Karez system has caused the insufficient water supply for of irrigation and domestic.				IV								7	8					13
		Potential				IV		· It is expected that the discharge derived from Karez systems increases and stabilizes.	· The insufficiency of irrigation and domestic water supply is eliminated.				IV								7	8					13

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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
	Groundwater Levels	Actual	IV	· The groundwater level has declined year by year.	· The aspects has been caused the loss of water resource and the decrease of agricultural productivity.	IV V	1 2 3 5 12
		Potential	IV	· The excessive declines of the groundwater level are mitigated by the recharge of groundwater.	· The opportunities of sustainable use of groundwater are provided.	IV V	1 2 3 5 12
		Actual	IV	· The groundwater level has declined year by year.	· The declines cause decreases of discharges extracted from Karez systems.	IV V	4 6 7 8 9 10 11 13
		Potential	IV	· The excessive declines of the groundwater level are mitigated by the recharge of groundwater.	· The opportunities of sustainable use of groundwater are provided and it becomes possible to increase the discharges of Karez by means of an appropriate water management .	IV V	4 6 7 8 9 10 11 13
	Groundwater quality	Actual	IV	· The groundwater quality is suitable for both domestic water supply and irrigation water.	· Any impacts are not recognized .		1 3 4 5 6 7 8 9 11 12 13
		Actual	IV	· The groundwater quality is suitable for irrigation water, but not for the domestic water supply without any treatments.	· The utilization of contaminated groundwater as domestic water without treatments causes the deterioration of health condition.		2 10
		Potential	IV	· Any changes of aspects are not assumed.	· Any impacts are not anticipated. / It is difficult to mitigate the actual impacts.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Flooding	Actual	III IV	· Flooding occurs frequently .	· Flood damages affect the low life standard and the stagnation of economic activities.	IV V	1 2 4 8 9
		Actual	III IV	· Flooding occurs.	· Flood damages affect the low life standard and the stagnation of economic activities.	IV V	3 5 6 7 10 11 12 13
		Potential	III IV	· Flooding are minimized by means of the construction of the dam.	· Flood damage are reduced or avoided, so that the social and economic burdens are lightened.	IV V	1 2 3 4 5 6 7 8 9 10 11 12 13
	Siltation	Actual	II III	· The sediment is observed .	· Any changes of the river morphology and course year by year cause flooding and flood damages.	III IV V	1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential	II	· The sediment is silted up in the reservoir of dam.	· Any changes of the river morphology are reduced and also flood damages are mitigated.	II IV V	1 2 3 4 5 6 7 8 9 10 11 12 13

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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects					Environmental Aspect	Environmental Impact	Division of Environmental Impact					Related Dams										
			I	II	III	IV	V			I	II	III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13
	River morphology	Actual			III			• The river morphology changes due to the sediment and flooding year by year.	• The areas suffered from flood damages are expanded.			III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13
		Potential			III			• The changes of river morphology are reduced by means of the construction of the dam.	• The expansion of flood damages is mitigated.			III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13

2. Biotic Environment

Division
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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
FAUNA and FLORA	Fauna community/ habitats	Actual	I	· The inhabits of reptiles, Mammals and birds are observed.	· Any adverse impacts are not observed.		1
		Potential	I	· Inhabitable environment is formed due to occurrence of surface water hydrology by the reservoir of dam.	· The ecosystem has been restored.	I	1
		Actual	I	· Notable inhabitants are not observed because the ecosystems had been deprived.	· Any adverse impacts are not evaluated.		2 3 4 5 6 7 8 9 10 11 12 13
		Potential	I	· Any changes of aspects are not assumed.	· Any impacts are not anticipated.		2 3 4 5 6 7 8 9 10 11 12 13
	Vegetation	Actual	I	· The catchment area applied to recreational park is conserved as State Forest by Forest Department.	· The aspects contributes to the preservation of soil erosion and to the effectiveness of groundwater recharge.	I	1
		Potential	I	· Afforestation site implemented by Forest Department is not submerged because the altitude is high more than planned full water level of reservoir, so that any changes of aspects are not assumed.	· The aspects lead to the mitigation of sediment flowed into the reservoir.	II	1
		Actual	I	· Scarce shrubs and grasses are observed only because vegetation had been deprived.	· The aspects affect the acceleration of soil erosion directly and flood damages indirectly.	I III IV V	2 3 4 5 6 7 8 9 10 11 12 13
		Potential	I	· Any changes of aspects are not assumed.	· The constructed dams receive the burden of the actual impacts.	II	2 3 4 5 6 7 8 9 10 11 12 13

3. Human Environment

Division
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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
SOCIAL and LIFE	Settlement	Actual	IV	· Settlement is not recommended.	· Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential	IV	· Any changes of aspects is not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Resettlement	Actual	I II III IV V	· Involuntary resettlement has not occurred.	· Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential	I II III IV V	· Involuntary resettlement caused by the construction of dam is not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Social equity	Actual	IV	· The traditional power structures observed in the area is not governing power structures which often cause the social inequity.	· Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential		· Any changes of aspects are not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Lifestyle (quality of life)	Actual	IV	· The lifestyle is comparatively high level at the rural area in Pakistan.	· Any impacts are not recognized.		1 3 6
		Actual	IV	· The lifestyle is comparatively standard level at the rural area in Pakistan.	· Any impacts are not recognized.		4 12 13
		Actual	IV	· The lifestyle is comparatively low level at the rural area in Pakistan.	· The low level of the lifestyle affects the deterioration of health condition.		5 7 8 9 10 11
		Potential	IV	· Remarkable changes of aspects are not assumed./ Traffic routes laid on riverbed and riverside are cut off by the dam and related facilities.	· Any impacts are not anticipated./ The actual adverse impacts are hardly reduced./ Loss of traffic approach for social and economic activities is caused.	III IV	1 3 4 5 6 7 8 9 10 11 12 13
		Actual	IV	· not clear	· not clear		2
		Potential	IV	· not available	· not available		2
	Health	Actual	IV	· Although there is a dispensary, the facilities and services are insufficient. Health and sanitary conditions deteriorate in the dry season particularly.	· The aspects cause high incidences of diseases such as water-related disease, diarrhea indication and parasitism.	IV	1 9 11
		Actual	IV	· The facilities and services relative to the health are not observed. Health and sanitary conditions deteriorate considerably.	· The aspects cause serious incidences of diseases such as water-related disease, diarrhea indication and parasitism of which diseases are related with the high mortality.	IV	2 10 12

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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects	Environmental Aspect	Environmental Impact	Division of Environmental Impact	Related Dams
		Actual	IV	· Although there is a dispensary, the facilities and services are insufficient. Health and sanitary conditions deteriorate in the dry season particularly.	· The aspects cause high incidences of diseases such as water-related disease, diarrhea indication and parasitism.	IV	3
		Actual	IV	· There is a basic health center which has simple facilities and provides some services. However, health and sanitary conditions is not so good.	· The conditions cause incidences of disease such as water-related diseases, diarrhea indication and parasitism.	IV	4
		Potential	IV	· Remarkable changes of aspects is hardly observed.	· The actual adverse impacts are scarcely mitigated.	IV	1 2 3 4 6 9 10 11 12
		Actual	IV	· The facilities and services relative to the health are not observed. Health and sanitary conditions deteriorate considerably.	· The aspects cause serious incidences of diseases such as water-related disease, diarrhea indication and parasitism of which diseases are related with the high mortality.	IV	5 7 8
		Actual	IV	· Although there is a dispensary, the facilities and services are insufficient. Health and sanitary conditions deteriorate in the dry season particularly.	· The aspects cause high incidences of diseases such as water-related disease, diarrhea indication and parasitism.	IV	13
		Potential	IV	· Opportunities for improvement regarding health and sanitary condition are given due to increase of groundwater availability during dry	· The adverse condition are mitigated merely.	IV	5 7 8 13
POPULATION	Population growth	Actual	IV	· Remarkable population growth is not observed.	· Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential	IV	· Any changes of aspects are not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13
	Demographic Structure	Actual	IV	· The demographic structure standard at the rural area in Pakistan is observed.	· Any impacts are not recognized.		1 2 3 4 5 6 7 8 9 10 11 12 13
		Potential	IV	· Any changes of aspects are not assumed.	· Any impacts are not anticipated.		1 2 3 4 5 6 7 8 9 10 11 12 13

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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects					Environmental Aspect	Environmental Impact	Division of Environmental Impact					Related Dams											
			I	II	III	IV	V			I	II	III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13
ECONOMIC	Income	Actual				IV		• The whole income in the area is considerably high, compared with the rural area in Pakistan. Savings are produced. The income derived from cultivation activities is confined to a half of the whole approximately.	• Any impacts are not recognized.				IV		1		3										
		Actual				IV		• The whole income in the area is high, compared with the rural area in Pakistan. Savings are produced. The income derived from cultivation activities is confined to a half of the whole approximately.	• Any impacts are not recognized.				IV					4	5								
		Actual				IV		• The whole income in the area is standard level, compared with the rural area in Pakistan. Savings are produced. The income derived from cultivation activities is confined to a half of the whole approximately.	• Any impacts are not recognized.				IV										9				13
		Actual				IV		• As the whole income in the area is considerably high, savings are produced. Since the majority of the whole income is derived from cultivation activities, it fluctuates according as water supplies are	• Opportunities of investing the savings are deprived, so that agricultural productivity has not increased so remarkably.				IV							6							13
		Actual				IV		• As the whole income in the area is comparatively standard, savings are produced barely. Since the majority of the whole income is derived from cultivation activities, it is fluctuated by water supplies.	• The fluctuation of incomes affects the dullness of lifestyle level.				IV													11	12	
		Potential				IV		• Remarkable increases of incomes are not attained because it is impossible to expand the agricultural productivity due to the limitation of groundwater availability. Consequently any changes of aspects are not assumed.	• Any changes of impacts are not observed. / The actual adverse impacts are not mitigated.				IV		1		3	4	5	6					11	12	13

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Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects					Environmental Aspect	Environmental Impact	Division of Environmental Impact					Related Dams											
			I	II	III	IV	V			I	II	III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13
		Actual				IV		· As the whole income in the area is comparatively low, savings are not produced or expenditures are over.	· The aspects affect the very low level of lifestyle, thus farmers are reduced to poverty. Farmers suffer from a heavy burden of other economic activities or seasonal work.				IV									7	8	9	10			
		Potential				IV		· Incomes are stable due to increases or intensities of the agricultural productivity because increases or stability of the discharges by Karez are expected.	· A heavy burden of other economic activities or seasonal work is alleviated.				IV									7	8	9	10			
		Actual				IV		· not clear	· not clear				IV			2											
		Potential				IV		· not available	· not available				IV			2											
	Employment	Actual				IV		· The employment relative to agricultural activities is not so much. Many inhabitants engage other economic activities.	· Any impacts are not recognized.						1		3	4		6							
		Actual				IV		· The employment relative to agricultural activities is a little. Many inhabitants engage other economic activities.	· Any impacts are not recognized.							2			5							
		Actual				IV		· The employment relative to agricultural activities is little. Many inhabitants lose their employment due to no other economic activities.	· The aspects of the employment cause the insufficiency of incomes and the low level of lifestyles.				IV										10			
		Actual				IV		· The employment relative to agricultural activities is little. (Nomads is superior.)	· Any impacts are not recognized.																12	
		Actual				IV		· The employment relative to agricultural activities is roughly the half. Thus the employment is decreased due to the insufficiency of water in the dry season.	· The aspects affect the increase of both the unemployment rate and seasonal work in the dry season.				IV								8					
		Actual				IV		· The employment relative to agricultural activities is more than the half. Thus the employment is decreased due to the insufficiency of water in the dry season.	· The aspects affect the increase of both the unemployment rate and seasonal work in the dry season.				IV										9		11		13
		Potential				IV		· Remarkable increases of the employment are not assumed.	· Any impacts are not anticipated. / The actual adverse impacts are not mitigated.						1	2	3	4	5	6		8	9	10	11	12	13

Division
I : Catchment area
II : Dam and reservoir area planned
III : River and riverside
IV : Beneficial area
V : Downstream area other than beneficial area

Dam Name
1 : Brewary
2 : Ghutai Shela
3 : Wali Dad
4 : Dara
5 : Murgi Kotal
6 : Kach
7 : Jigda
8 : Sanzali
9 : Arambi
10 : Sakhol
11 : Mangi
12 : Kad Kocha II
13 : Iskalkoo

Environmental compooent	Environmental Issue	Actual or Potential	Division of Environmental Aspects					Environmental Aspect	Environmental Impact	Division of Environmental Impact					Related Dams											
			I	II	III	IV	V			I	II	III	IV	V	1	2	3	4	5	6	7	8	9	10	11	12	13
		Actual				IV		· The employment relative to agricultural activities is roughly the half. Thus the employment is decreased due to the insufficiency of water in the dry season.	· The aspects affect the increase of both the unemployment rate and seasonal work in the dry season.				IV						7							
		Potential				IV		· As it is expected that the discharge extracted from Karez in the dry season increases, the employment tends to stable .	· The rates of unemployment and seasonal work are reduced merely.				IV						7							
INSTITUTION	Water Right	Actual				IV		· The traditional water rights regarding springs has been determined.	· Any impacts are not recognized.						1											
		Actual				IV		· Although water rights regarding flood water have not been determined obviously , the water use rights which upper riparian has the prior are confirmed.	· Any impacts are not recognized.														10			
		Potential				IV		· It is feared that water rights or use rights are deprived or restricted.	· The aspects causes the troubles regarding the agricultural and social activities.				IV		1								10			
		Actual				IV		· Water rights are not determined.	· Any impacts are not recognized.							2	3	4	5	6					11	12	
		Actual				IV		· The traditional water rights regarding Karez systems has been determined.	· Any impacts are not recognized.												7	8	9				
		Actual				IV		· The traditional water rights regarding both Karez systems and springs have been determined.	· Any impacts are not recognized.																		13
		Potential				IV		· Any changes of aspects are not assumed.	· Any impacts are not anticipated.							2	3	4	5	6	7	8	9		11	12	13
	other Activities and Effectiveness	Actual				IV		· Remarkable social activities are not observed.	· Incentives to incorporate the finance and/or the technical innovation for the agricultural activities has not risen.				IV		1	2	3	4	5	6	7	8	9	10	11	12	13
		Potential				IV		· Any changes of aspects are not assumed.	· The actual situation are not improved.						1	2	3	4	5	6	7	8	9	10	11	12	13
CULTURAL	Historic/ archaeological sites	Actual	I	II	III	IV	V	· Any aspects are not observed.	· Any impacts are not recognized.						1	2	3	4	5	6	7	8	9	10	11	12	13
		Potential	I	II	III	IV	V	· Any changes of aspects are not assumed.	· Any impacts are not anticipated.						1	2	3	4	5	6	7	8	9	10	11	12	13

Division
- I : Catchment area
- II : Dam and reservoir area planned
- III : River and riverside
- IV : Beneficial area
- V : Dowostream area other than beneficial area

Dam Name
- 1 : Brewary
- 2 : Ghutai Sbela
- 3 : Wali Dad
- 4 : Dara
- 5 : Murgi Kotal
- 6 : Kach
- 7 : Jigda
- 8 : Sanzali
- 9 : Arambi
- 10 : Sakhol
- 11 : Mangi
- 12 : Kad Kocha II
- 13 : Iskalkoo

Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects I	II	III	IV	V	Environmental Aspect	Environmental Impact	Division of Environmental Impact I	II	III	IV	V	Related Dams
HUMAN USE	Cultivation	Actual				IV		· Mainly orchards irrigation has been farmed by means of tubewells and springs.	· Excessive use of groundwater causes the declines of both groundwater level.				IV		1 11
		Actual				IV		· Orchards irrigation and upland cultivation has been farmed by means of tubewells.	· Excessive use of groundwater causes the declines of groundwater level.				IV		3
		Actual				IV		· Orchards irrigation and upland cultivation has been farmed by means of tubewells, canals and springs.	· Excessive use of groundwater causes the declines of both groundwater level.				IV		4
		Actual				IV		· Mainly orchards irrigation has been farmed by means of tubewells and in some parts rainfed cultivation are done.	· Excessive use of groundwater causes the declines of groundwater level.				IV		5 10
		Actual				IV		· Mainly orchards irrigation has been farmed by means of tubewells positively.	· Excessive use of groundwater causes serious declines of groundwater level.				IV		6 11 12
		Potential				IV		· It is difficult to increase or to intensify the agricultural productivity due to insufficient water supply resulted from the limitation of groundwater availability.	· The declines of groundwater level are mitigated.				IV		1 3 4 5 6 10 11 12
		Actual				IV		· Orchards irrigation and upland cultivation has been farmed by means of Karez systems. The agricultural productivity is decreased due to the insufficient water supply in the dry season.	· The aspects affect the fluctuation of incomes.				IV		7 8
		Potential				IV		· In case that Karez systems are controlled appropriately, it is expected that the agricultural productivity increases.	· The aspects lead to the stability or the increase of incomes.				IV		7 8
		Actual				IV		· Orchards irrigation and upland cultivation has been farmed by means of tubewells and Karez systems.	· Excessive use of groundwater by means of tubewells causes decreases of the discharges by Karez systems.				IV		9
		Potential				IV		· It is difficult to increase or to intensify the agricultural productivity due to insufficient water supply resulted from the limitation of groundwater availability.	· Serious declines of groundwater level are mitigated and it is expected that the discharges by Karez systems increases.				IV		9

Division I : Catchment area
II : Dam and reservoir area planned
III : River and riverside
IV : Beneficial area
V : Downstream area other than beneficial area

Dam Name 1 : Brewary 8 : Sanzali
2 : Ghutai Shela 9 : Arambi
3 : Wali Dad 10 : Sakhoi
4 : Dara 11 : Mangi
5 : Murgi Kotal 12 : Kad Kocha II
6 : Kach 13 : Iskalkoo
7 : Jigda

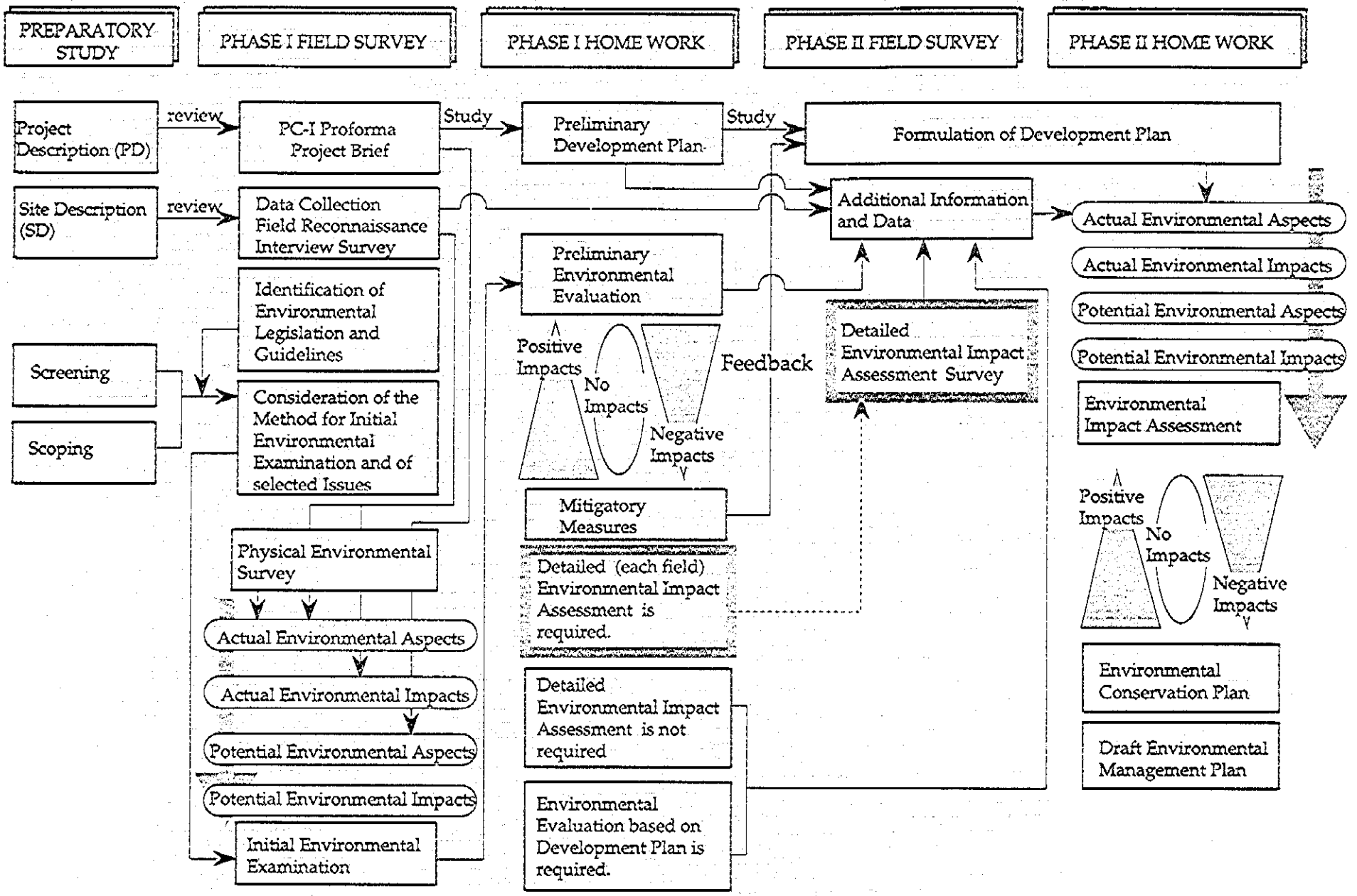
Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects I	II	III	IV	V	Environmental Aspect	Environmental Impact	Division of Environmental Impact I	II	III	IV	V	Related Dams 1	2	3	4	5	6	7	8	9	10	11	12	13
		Actual				IV		· Mainly orchards irrigation has been farmed by means of springs and in some parts rainfed cultivation are done. The agricultural productivity has decreased due to the insufficient water supply in the dry season.	· The aspects affect the instability of incomes.				IV													13
		Potential				IV		· Increases of the agricultural productivity are expected due to the restoration of groundwater level.	· The aspects lead to the stability or the increase of incomes.				IV													13
		Actual				IV		· Cultivation activities are scarcely observed.	· Any impacts are not recognized .							2										
		Potential				IV		· Remarkable changes of aspects are not assumed.	· Any changes of impacts are not anticipated.							2										
	Livestock	Actual				IV		· Livestock are grazed for the purpose of internal consumption.	· Any impacts are not recognized.						1	2	3			6	7		9			12	13
		Potential				IV		· Any changes of aspects are not assumed.	· Any impacts are not anticipated.						1	2	3			6	7		9			12	13
		Actual				IV		· Grazing is extended for the purpose of stock farming.	· The overgrazing causes both the watershed devegetation and the acceleration of soil erosion.	I								4	5			8		10	11		
		Potential				IV		· Any changes of aspects are not assumed.	· Any impacts are not anticipated./ The actual adverse situation are hardly improved.									4	5			8		10	11		
	Domestic Water Supply	Actual				IV		· The domestic water supply has been derived from tubewells and springs originated from catchment area.	· Any impacts are not observed.						1												
		Potential				IV		· The domestic water deprived from or through the surface water is restricted or deprived.	· The aspects affect the social and life of inhabitants adversely.				IV		1												
		Actual				IV		· The domestic water supply has been derived from facilities constructed by PHED.	· Any impacts are not recognized.							2	3										
		Actual				IV		· The domestic water supply has been derived from tubewell, springs and surface water originated from other catchment.	· Any impacts are not recognized.									4									

Division
- I : Catchment area
- II : Dam and reservoir area planned
- III : River and riverside
- IV : Beneficial area
- V : Downstream area other than beneficial area

Dam Name
- 1 : Brewary
- 2 : Ghutai Shela
- 3 : Wali Dad
- 4 : Dara
- 5 : Murgi Korai
- 6 : Kach
- 7 : Jigda
- 8 : Sanzali
- 9 : Arambi
- 10 : Sakhol
- 11 : Mangi
- 12 : Kad Kocha II
- 13 : Iskalkoo

Environmental component	Environmental Issue	Actual or Potential	Division of Environmental Aspects I	II	III	IV	V	Environmental Aspect	Environmental Impact	Division of Environmental Impact I	II	III	IV	V	Related Dams 1	2	3	4	5	6	7	8	9	10	11	12	13
		Actual				IV		• The domestic water supply has been derived from springs and facilities constructed by PHED.	• Any impacts are not recognized.											6							
		Actual				IV		• The domestic water supply has been derived from tubewell, springs, Karez systems and surface water.	• Any impacts are not recognized.														9				
		Actual				IV		• The domestic water supply has been derived from Karez systems, tubewells and facilities constructed by PHED.	• Any impacts are not recognized.														9		11		
		Actual				IV		• The domestic water supply has been derived from tubewell and surface	• Any impacts are not recognized.															10			
		Actual				IV		• The domestic water supply has been derived from tubewells.	• Any impacts are not recognized.																	12	
		Potential				IV		• Any changes of aspects are not assumed.	• Any impacts are not anticipated.							2	3	4		6			9	10	11	12	
		Actual				IV		• The domestic water supply has been derived from surface water originated from other catchment. In the dry season the supply has been insufficient.	• The aspects cause the deterioration of health and sanitary conditions.				IV						5							
		Potential				IV		• Opportunities to use the groundwater as domestic water are acquired.	• It is expected that deteriorated health and sanitary conditions are reduced				IV						5							
		Actual				IV		• The domestic water supply has been derived from Karez systems. In the dry season the supply has been insufficient.	• The aspects cause the deterioration of health and sanitary conditions.				IV								7					
		Actual				IV		• The domestic water supply has been derived from Karez systems and opened wells. In the dry season the supply has been insufficient.	• The aspects cause the deterioration of health and sanitary conditions.				IV									8				
		Actual				IV		• The domestic water supply has been derived from springs mainly. In the dry season the supply has been insufficient.	• The aspects cause the deterioration of health and sanitary conditions.				IV													13
		Potential				IV		• Stable supplies of domestic water are expected in the dry season.	• It is expected that deteriorated health and sanitary conditions are reduced				IV								7	8				13

Fig. J.1 Working Flow for Environment Study and Evaluation



Annex K
Cost Estimation

ANNEX K COST ESTIMATION

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ANNEX K COST ESTIMATION

K.1 GENERAL

The project cost is estimated under the following conditions.

- The project cost consists of construction cost, engineering cost, administration cost and contingency.

- The civil works are contracted on the contract basis. The construction machinery and equipment required for construction works will be provided by the contractors. Therefore, depreciation costs of machinery and equipment are included in the estimated construction cost.

- The exchange rate between Pakistan Rupee and U.S.Dollar/Japanese Yen is adopted based on the average from October to December in 1996 as follows.

  1.00 U.S.Dollar = 40 Rupees = 120 Yen

- Land acquisition cost is not necessary because project sites belong to public properties.

K.2 CONSTRUCTION AND PROJECT COST

Unit costs for various items of work have been analyzed at the time of December 1996 based on Composite Schedule of Rates for Balochistan Province in 1992 and current prices.

Construction costs are estimated by these unit costs for individual components. And cost of temporary works and preparatory works is assumed to be 15% of direct construction cost. Project cost includes contingencies, engineering & administration cost.

Costs of administration and engineering are included as 5% and 10% of the construction cost respectively. This percentages are adopted based on the other similar projects. In addition, physical contingency is estimated at 10% of capital cost. These project costs are estimated divided into foreign and local currency portion.

Project Cost Component

Project Cost	Construction Cost	Dam works, Spillway works Intake Facilities, Infiltration Facilities Erosion Control Facilities, Karez Rehabilitation, Temporary works
	Associated Cost	Administration Cost, Engineering Cost
	Physical Contingency	

K.3 OPERATION AND MAINTENANCE COST

Operation and maintenance cost consists of the annual salaries and wages of O/M organization staff, administration, general expenditure, facility repair and maintenance cost and fuel cost. These costs are calculated on the basis of the unit cost.

(1) Salary and Wage

The annual salaries and wages of staff for O/M is calculated under assumption as follows.

- XEN	1 person x 1day/month/site x 12months	
	= 20,000Rs./month x 1/30 x 12	= 8,000 Rs.
- SDO	1 person x 2days/month/site x 12months	
	= 15,000Rs./month x 2/30 x 12	= 12,000 Rs.
- Sub-Engineer	1 person x 3days/month/site x 12months	
	= 10,000Rs./month x 3/30 x 12	= 12,000 Rs.
- Coolie	2 persons x 10days x 2times/year	
	= 88Rs./day x 2 x 10 x 2	= 3,520 Rs.
	Total	35,520 Rs.

(2) Depreciation and Fuel Cost

It is possible to estimate depreciation and fuel cost by annual operating time, unit depreciation and fuel cost as follows.

- Annual Depreciation and Fuel Cost = annual operating time x (unit depreciation + fuel cost)

a) Unit depreciation cost of vehicle (Pickup Truck 2,800cc , Diesel 88PS)

- Vehicle 1,500,000Rs./unit x 1/ (6hours/day x 365days x 10 years) = 68Rs./hour

b) Unit fuel cost

- 0.037liter/PS/hour x 88PS x 10.65Rs/liter = 35Rs./hour

c) Operating time

- 4~6hours/site x 6times/month x 12months = 288~432 hours

(3) Maintenance Cost of Facilities

Maintenance cost of facilities are estimated under assumption as follows.

- dam slope : annual repair will be conducted over 3.3% of whole dam slope
- link canal : annual repair will be conducted over 6.7% of whole link canal
- infiltration pond : dredging is necessary in frequency as one time in two years (dredging depth is assumed to be 0.5m)

(4) Administration and General Expenditure Cost

Administration and general expenditure cost is assumed to be 5% of personnel expenses.

Table K.1.1 Project Cost of Brewary

Project Cost of Brewary

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Hard rock)	cu.m	1,140	168	42	192	48	240	
	Excavation (Ordinary soil)	cu.m	--	26	7	--	--	--	
	Backfilling	cu.m	180	29	8	5	1	6	
	Dam Concrete	cu.m	9,580	1,040	1,559	9,963	14,935	24,898	
	Miscellaneous works (5%)	LS				508	749	1,257	
	Sub Total					10,668	15,733	26,401	
2	Spillway								
	Excavation (Hard rock)	cu.m	66	168	42	11	3	14	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	6,396	26	7	166	45	211	
	Backfilling	cu.m	1,981	29	8	57	16	73	
	Plain Concrete	cu.m	945	837	1,256	791	1,187	1,978	
	Reinforced Concrete	cu.m	285	1,272	1,908	363	544	907	
	Steel reinforcement	t	9	1,725	1,725	16	16	32	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	--	891	2,078	--	--	--	
	Miscellaneous works (5%)	LS				70	90	160	
	Sub Total					1,463	1,898	3,361	
3	Intake Facilities								
	Steel pipe ϕ250	m	17	2,437	1,044	41	18	59	Intake pipe
	Steel pipe ϕ250	m	32	2,306	988	74	32	106	Conduit
	Sluice valve ϕ250	No.	1	4,676	1,169	5	1	6	
	Miscellaneous works (5%)	LS				6	3	9	
	Sub Total					126	54	180	
4	Infiltration Facility								
	Infiltration Pond	cu.m	12,514	98	24	1,226	300	1,526	
	Stone Masonry (Wet)	cu.m	64	891	2,078	57	133	190	
	Gabion riprap	sq.m	225	127	190	29	43	72	
	Link Canal	m	--			--	--	--	
	Sub Total					1,312	476	1,788	
5	Erosion Conrtrol Facility	LS	--			--	--	--	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				2,035	2,724	4,760	15% of 1 ~6 above
8	Construction Cost					15,604	20,885	36,489	
9	Adminstration Cost					780	1,044	1,824	5% of 8 above
10	Engineering Cost					1,560	2,089	3,649	10% of 8 above
11	Contingency					1,794	2,402	4,196	10% of 8 ~10 above
12	Project Cost					19,738	26,420	46,158	

Table K.1.2 Project Cost of Dara

Project Cost of Dara

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	15,400	26	7	400	108	508	
	Excavation for Trench	cu.m	13,000	71	18	923	234	1,157	
	Embankment A	cu.m	201,100	71	18	14,278	3,620	17,898	
	Embankment B	cu.m	70,900	67	16	4,750	1,134	5,884	
	Riprap (Dry stone pitching) A	cu.m	—	129	514	—	—	—	
	Riprap (Dry stone pitching) B	cu.m	9,500	94	377	893	3,582	4,475	
	Toe drain (Rockfill)	cu.m	5,800	287	123	1,665	713	2,378	
	Toe drain filter	cu.m	1,680	307	132	516	222	738	
	Stone Masonry (Dry)	cu.m	—	190	759	—	—	—	
	Miscellaneous works (5%)	LS				1,171	481	1,652	
	Sub Total					24,596	10,094	34,690	
2	Spillway								
	Excavation (Hard rock)	cu.m	—	168	42	—	—	—	
	Excavation (Midium hard rock)	cu.m	80,400	121	30	9,728	2,412	12,140	
	Excavation (Rock)	cu.m	—	116	29	—	—	—	
	Excavation (Ordinaly Soil)	cu.m	—	26	7	—	—	—	
	Plain Concrete	cu.m	—	1,040	1,559	—	—	—	
	Reinforced Concrete	cu.m	—	1,272	1,908	—	—	—	
	Steel reinforcement	t	—	1,725	1,725	—	—	—	
	Gabion riprap	sq.m	—	127	190	—	—	—	
	Grouted riprap	cu.m	—	634	1,481	—	—	—	
	Stone Masonry (Wet)	cu.m	—	891	2,078	—	—	—	
	Miscellaneous works (5%)	LS				486	121	607	
	Sub Total					10,214	2,533	12,747	
3	Intake Facilities								
	Excavation (Rock)	cu.m	29	116	29	3	1	4	
	Excavation (Gravel & Shingle)	cu.m	—	71	18	—	—	—	
	Plain Concrete	cu.m	28	1,040	1,559	29	44	73	
	Steel reinforcement	t	1,960	1,380	2,070	3	4	7	
	Steel pipe ϕ400	m	24	8,010	3,433	192	82	274	
	Sluice valve ϕ400	Ls	1	23,116	5,779	23	6	29	
	Intake Conduit (Tyoe A)	m	50	9,243	3,961	462	198	660	
	Intake Conduit (Type B)	m	120	10,005	4,288	1,201	515	1,716	
	Intake conduit (Type C)	m	35	3,776	2,518	132	88	220	
	Miscellaneous works (5%)	LS				102	47	149	
	Sub Total					2,147	985	3,132	
4	Infiltration Facility								
	Infiltration Pond	cu.m	4,952	98	24	485	119	604	
	Link Canal	m	1,100	67	77	74	85	159	
	Sub Total					559	204	763	
5	Erosion Conrtrol Facility	LS	1			2,534	1,832	4,366	
6	Rehabilitation of Karez	m	—			—	—	—	
7	Temporary Works	LS				5,901	2,305	8,206	15% of 1 ~6 above
8	Construction Cost					45,951	17,953	63,904	
9	Adminstration Cost					2,298	898	3,195	5% of 8 above
10	Engineering Cost					4,595	1,795	6,390	10% of 8 above
11	Contingency					5,284	2,065	7,349	10% of 8 ~10 above
12	Project Cost					58,128	22,711	80,838	

Table K.1.3.1 Project Cost of Murgi Kotal (upstream)

Project Cost of Murgi Kotal (upstream)

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	96,000	26	7	2,496	672	3,168	
	Excavation for Trench	cu.m	11,000	71	18	781	198	979	
	Embankment A	cu.m	124,700	71	18	8,854	2,245	11,099	
	Embankment B	cu.m	156,000	67	16	10,452	2,496	12,948	
	Riprap (Dry stone pitching) A	cu.m	4,300	129	514	555	2,210	2,765	
	Riprap (Dry stone pitching) B	cu.m	--	94	377	--	--	--	
	H. V. Drain	cu.m	2,400	287	123	689	295	984	
	H. V. Drain filter	cu.m	1,600	307	132	491	211	702	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				1,216	416	1,632	
	Sub Total					25,534	8,743	34,277	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	156,000	26	7	4,056	1,092	5,148	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Reinforced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	--	891	2,078	--	--	--	
	Miscellaneous works (5%)	LS				203	55	258	
	Sub Total					4,259	1,147	5,406	
3	Intake Facilities								
	Excavation (Rock)	cu.m	50	116	29	6	1	7	
	Excavation (Gravel & Shingle)	cu.m	--	71	18	--	--	--	
	Plain Concrete	cu.m	41	1,040	1,559	43	64	107	
	Steel reinforcement	t	2,870	1,380	2,070	4	6	10	
	Steel pipe ϕ400	m	30	8,010	3,433	240	103	343	
	Sluice valve ϕ400	Ls	1	23,116	5,779	23	6	29	
	Intake Conduit (Tyoe A)	m	75	9,243	3,961	693	297	990	
	Intake Conduit (Type B)	m	130	9,181	3,934	1,194	511	1,705	
	Intake conduit (Type C)	m	315	3,776	2,518	1,189	793	1,982	
	Miscellaneous works (5%)	LS				170	89	259	
	Sub Total					3,562	1,870	5,432	
4	Infiltration Facility								
	Infiltration Pond	cu.m	4,556	98	24	446	109	555	
	Link Canal	m	200	67	77	13	15	28	
	Sub Total					459	124	583	
5	Erosion Conrtrol Facility	LS	1			2,634	655	3,289	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				5,467	1,881	7,348	15% of 1 ~6 above
8	Construction Cost					41,915	14,420	56,335	
9	Adminstration Cost					2,096	721	2,817	5% of 8 above
10	Engineering Cost					4,192	1,442	5,634	10% of 8 above
11	Contingency					4,820	1,658	6,478	10% of 8 ~10 above
12	Project Cost					53,023	18,241	71,264	

Table K.1.3.2 Project Cost of Murgi Kotal (downstream)

Project Cost of Murgi Kotal (downstream)

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	86,000	26	7	2,236	602	2,838	
	Excavation for Trench	cu.m	4,700	71	18	334	85	419	
	Embankment A	cu.m	440,120	71	18	31,249	7,922	39,171	
	Embankment B	cu.m	2,500	67	16	168	40	208	
	Riprap (Dry stone pitching) A	cu.m	—	129	514	—	—	—	
	Riprap (Dry stone pitching) B	cu.m	6,100	94	377	573	2,300	2,873	
	H. V. Drain	cu.m	9,140	287	123	2,623	1,124	3,747	including Toe Drain
	H. V. Drain filter	cu.m	4,840	307	132	1,486	639	2,125	
	Stone Masonry (Dry)	cu.m	—	190	759	—	—	—	
	Miscellaneous works (5%)	LS				1,933	636	2,569	
	Sub Total					40,602	13,348	53,950	
2	Spillway								
	Excavation (Hard rock)	cu.m	—	168	42	—	—	—	
	Excavation (Midium hard rock)	cu.m	—	121	30	—	—	—	
	Excavation (Rock)	cu.m	8,600	116	29	998	249	1,247	
	Excavation (Ordinaly Soil)	cu.m	—	26	7	—	—	—	
	Plain Concrete	cu.m	780	1,040	1,559	811	1,216	2,027	
	Reinforced Concrete	cu.m	610	1,272	1,908	776	1,164	1,940	
	Steel reinforcement	t	61	1,725	1,725	105	105	210	
	Gabion riprap	sq.m	—	127	190	—	—	—	
	Grouted riprap	cu.m	—	634	1,481	—	—	—	
	Stone Masonry (Wet)	cu.m	—	891	2,078	—	—	—	
	Miscellaneous works (5%)	LS				135	137	272	
	Sub Total					2,825	2,871	5,696	
3	Intake Facilities								
	Excavation (Rock)	cu.m	32	116	29	4	1	5	
	Excavation (Gravel & Shingle)	cu.m	—	71	18	—	—	—	
	Plain Concrete	cu.m	30	1,040	1,559	31	47	78	
	Steel reinforcement	t	2,100	1,380	2,070	3	4	7	
	Steel pipe φ400	m	25	8,010	3,433	200	86	286	
	Sluice valve φ400	Ls	1	23,116	5,779	23	6	29	
	Intake Conduit (Tyoe A)	m	84	9,243	3,961	776	333	1,109	
	Intake Conduit (Type B)	m	163	10,005	4,288	1,631	699	2,330	
	Intake conduit (Type C)	m	47	3,776	2,518	177	118	295	
	Miscellaneous works (5%)	LS				142	65	207	
	Sub Total					2,987	1,359	4,346	
4	Infiltration Facility								
	Infiltration Pond	cu.m	4,556	98	24	446	109	555	
	Link Canal	m	200	67	77	13	15	28	
	Sub Total					459	124	583	
5	Erosion Conrtrol Facility	LS	1			2,634	655	3,289	
6	Rehabilitation of Karez	m	—			—	—	—	
7	Temporary Works	LS				7,257	2,691	9,948	15% of 1 ~6 above
8	Construction Cost					56,764	21,048	77,812	
9	Adminstration Cost					2,838	1,052	3,891	5% of 8 above
10	Engineering Cost					5,676	2,105	7,781	10% of 8 above
11	Contingency					6,528	2,421	8,949	10% of 8 ~10 above
12	Project Cost					71,806	26,626	98,432	

Table K.1.4.1 Project Cost of Kach (existing dam site)

Project Cost of Kach (Existing dam site)

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	18,600	26	7	484	130	614	
	Excavation for Trench	cu.m	--	71	18	--	--	--	
	Embankment A	cu.m	426,740	71	18	30,299	7,681	37,980	
	Embankment B	cu.m	159,000	67	16	10,653	2,544	13,197	
	Riprap (Dry stone pitching) A	cu.m	12,400	129	514	1,600	6,374	7,974	
	Riprap (Dry stone pitching) B	cu.m	--	94	377	--	--	--	
	H. V. Drain	cu.m	5,030	287	123	1,444	619	2,063	
	H. V. Drain filter	cu.m	5,030	307	132	1,544	664	2,208	
	Stone Masonry (Dry)	cu.m	140	190	759	27	106	133	
	Miscellaneous works (5%)	LS				2,303	906	3,209	
	Sub Total					48,354	19,024	67,378	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	159,000	26	7	4,134	1,113	5,247	
	Plain Concrete	cu.m	3,780	1,040	1,559	3,931	5,893	9,824	
	Reinforced Concrete	cu.m	2,140	1,272	1,908	2,722	4,083	6,805	
	Steel reinforcement	t	214	1,725	1,725	369	369	738	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	1,000	891	2,078	891	2,078	2,969	
	Miscellaneous works (5%)	LS				602	677	1,279	
	Sub Total					12,649	14,213	26,862	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	21	71	18	1	0	1	
	Plain Concrete	cu.m	17	1,040	1,559	18	27	45	
	Steel reinforcement	t	1,190	1,380	2,070	2	2	4	
	Steel pipe ϕ250	m	12	3,149	1,350	38	16	54	
	Sluice valve ϕ250	Ls	1	4,676	1,169	5	1	6	
	Intake Conduit (Tyoe A)	m	130	3,725	1,596	484	207	691	
	Intake Conduit (Type B)	m	177	3,462	1,484	613	263	876	
	Intake conduit (Type C)	m	--	2,570	1,713	--	--	--	
	Miscellaneous works (5%)	LS				58	26	84	
	Sub Total					1,219	542	1,761	
4	Infiltration Facility								
	Infiltration Pond	cu.m	1,068	98	24	105	26	131	
	Link Canal	m	3,450	49	59	169	204	373	
	Sub Total					274	230	504	
5	Erosion Conrtrol Facility	LS	1			1,290	321	1,611	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				9,568	5,150	14,718	15% of 1 ~6 above
8	Construction Cost					73,354	39,480	112,834	
9	Adminstration Cost					3,668	1,974	5,642	5% of 8 above
10	Engineering Cost					7,335	3,948	11,283	10% of 8 above
11	Contingency					8,436	4,540	12,976	10% of 8 ~10 above
12	Project Cost					92,793	49,942	142,735	

Table K.1.4.2 Project Cost of Kach (downstream)

Project Cost of Kach (Downstream site)

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	19.700	26	7	512	138	650	
	Excavation for Trench	cu.m	--	71	18	--	--	--	
	Embankment A	cu.m	515.000	71	18	36.565	9.270	45.835	
	Embankment B	cu.m	78.000	67	16	5.226	1.248	6.474	
	Riprap (Dry stone pitching) A	cu.m	11.200	129	514	1.445	5.757	7.202	
	Riprap (Dry stone pitching) B	cu.m	--	94	377	--	--	--	
	H. V. Drain	cu.m	6.000	287	123	1.722	738	2.460	
	H. V. Drain filter	cu.m	6.000	307	132	1.842	792	2.634	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works	LS				11.654	4.792	16.446	
	Sub Total					58.966	22.735	81.701	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	78.000	26	7	2.028	546	2.574	
	Plain Concrete	cu.m	3.780	1.040	1.559	3.931	5.893	9.824	
	Reinforced Concrete	cu.m	2.140	1.272	1.908	2.722	4.083	6.805	
	Steel reinforcement	t	214	1.725	1.725	369	369	738	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1.481	--	--	--	
	Stone Masonry (Wet)	cu.m	1.000	891	2.078	891	2.078	2.969	
	Miscellaneous works (5%)	LS				497	648	1.145	
	Sub Total					10.438	13.617	24.055	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	40	71	18	3	1	4	
	Plain Concrete	cu.m	33	1.040	1.559	34	51	85	
	Steel reinforcement	t	2.310	1.380	2.070	3	5	8	
	Steel pipe ϕ250	m	29	3.149	1.350	91	39	130	
	Sluice valve ϕ250	Ls	1	4.676	1.169	5	1	6	
	Intake Conduit (Tyoe A)	m	125	3.725	1.596	466	200	666	
	Intake Conduit (Type B)	m	180	3.462	1.484	623	267	890	
	Intake conduit (Type C)	m	--	2.570	1.713	--	--	--	
	Miscellaneous works (5%)	LS				61	28	89	
	Sub Total					1.286	592	1.878	
4	Infiltration Facility								
	Infiltration Pond	cu.m	1.068	98	24	105	26	131	
	Link Canal	m	1.500	49	59	74	89	163	
	Sub Total					179	115	294	
5	Erosion Conrtrol Facility	LS	1			1.290	321	1.611	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				10.824	5.607	16.431	15% of 1 ~6 above
8	Construction Cost					82.983	42.987	125.970	
9	Adminstration Cost					4.149	2.149	6.298	5% of 8 above
10	Engineering Cost					8.298	4.299	12.597	10% of 8 above
11	Contingency					9.543	4.944	14.487	10% of 8 ~10 above
12	Project Cost					104.973	54.379	159.352	

Table K.1.5 Project Cost of Jigda

Project Cost of Jigda

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	8,300	26	7	216	58	274	
	Excavation for Trench	cu.m	9,300	71	18	660	167	827	
	Embankment A	cu.m	106,800	71	18	7,583	1,922	9,505	
	Embankment B	cu.m	7,400	67	16	496	118	614	
	Riprap (Dry stone pitching) A	cu.m	--	129	514	--	--	--	
	Riprap (Dry stone pitching) B	cu.m	4,400	94	377	414	1,659	2,073	
	Toe drain (Rockfill)	cu.m	3,600	287	123	1,033	443	1,476	
	Toe drain filter	cu.m	1,100	307	132	338	145	483	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				537	226	763	
	Sub Total					11,277	4,738	16,015	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	11,800	121	30	1,428	354	1,782	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	--	26	7	--	--	--	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Reinforced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	1,090	891	2,078	971	2,265	3,236	
	Miscellaneous works (5%)	LS				120	131	251	
	Sub Total					2,519	2,750	5,269	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	49	71	18	3	1	4	
	Plain Concrete	cu.m	41	1,040	1,559	43	64	107	
	Steel reinforcement	t	2,870	1,380	2,070	4	6	10	
	Steel pipe ϕ400	m	33	8,010	3,433	264	113	377	
	Sluice valve ϕ400	Ls	1	23,116	5,779	23	6	29	
	Intake Conduit (Type A)	m	80	9,243	3,961	739	317	1,056	
	Intake Conduit (Type B)	m	123	9,181	3,934	1,129	484	1,613	
	Intake conduit (Type C)	m	36	3,776	2,518	136	91	227	
	Miscellaneous works (5%)	LS				117	54	171	
	Sub Total					2,458	1,136	3,594	
4	Infiltration Facility								
	Infiltration Pond	cu.m	10,500	98	24	1,029	252	1,281	
	Link Canal (open)	m	3,350	115	29	385	97	482	
	Link Canal (pipe)	m	470	543	542	255	255	510	
	Sluice valve ϕ400	set	1	23,116	5,779	23	6	29	
	Sub Total					1,669	604	2,273	
5	Erosion Conrtrol Facility	LS	1			15,540	14,723	30,263	
6	Rehabilitation of Karez	m	2,100	309	463	649	972	1,621	
7	Temporary Works	LS				5,117	3,738	8,855	15% of 1 ~6 above
8	Construction Cost					39,229	28,661	67,890	
9	Adminstration Cost					1,961	1,433	3,394	5% of 8 above
10	Engineering Cost					3,923	2,866	6,789	10% of 8 above
11	Contingency					4,511	3,296	7,807	10% of 8 ~10 above
12	Project Cost					49,624	36,256	85,880	

Table K.1.6 Project Cost of Sanzali

Project Cost of Sanzali

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	7,900	26	7	205	55	260	
	Excavation for Trench	cu.m	15,000	71	18	1,065	270	1,335	
	Embankment A	cu.m	57,600	71	18	4,090	1,037	5,127	
	Embankment B	cu.m	53,000	67	16	3,551	848	4,399	
	Riprap (Dry stone pitching) A	cu.m	4,500	129	514	581	2,313	2,894	
	Riprap (Dry stone pitching) B	cu.m	--	94	377	--	--	--	
	Toe drain (Rockfill)	cu.m	3,800	287	123	1,091	467	1,558	
	Toe drain filter	cu.m	2,100	307	132	645	277	922	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				561	263	824	
	Sub Total					11,789	5,530	17,319	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	53,000	26	7	1,378	371	1,749	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Reinforced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	5,200	634	1,481	3,297	7,701	10,998	
	Stone Masonry (Wet)	cu.m	--	891	2,078	--	--	--	
	Miscellaneous works (5%)	LS				234	404	638	
	Sub Total					4,909	8,476	13,385	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	34	71	18	2	1	3	
	Plain Concrete	cu.m	28	1,040	1,559	29	44	73	
	Steel reinforcement	t	1,960	1,380	2,070	3	4	7	
	Steel pipe ϕ200	m	24	2,437	1,044	58	25	83	
	Sluice valve ϕ200	Ls	1	4,033	1,009	4	1	5	
	Intake Conduit (Type A)	m	22	3,036	1,301	67	29	96	
	Intake Conduit (Type B)	m	90	2,997	1,285	270	116	386	
	Intake conduit (Type C)	m	27	1,772	1,182	48	32	80	
	Miscellaneous works (5%)	LS				24	13	37	
	Sub Total					505	265	770	
4	Infiltration Facility								
	Infiltration Pond	cu.m	1,081	98	24	106	26	132	
	Link Canal	m	1,300	49	59	64	77	141	
	Sub Total					170	103	273	
5	Erosion Conrtrol Facility	LS	1			2,361	587	2,948	
6	Rehabilitation of Karez	m	2,700	309	463	834	1,250	2,084	
7	Temporary Works	LS				3,085	2,432	5,517	15% of 1 ~6 above
8	Construction Cost					23,653	18,643	42,296	
9	Adminstration Cost					1,183	932	2,115	5% of 8 above
10	Engineering Cost					2,365	1,864	4,229	10% of 8 above
11	Contingency					2,720	2,144	4,864	10% of 8 ~10 above
12	Project Cost					29,921	23,583	53,504	

Table K.1.7 Project Cost of Sakhol

Project Cost of Sakhol

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	20,700	26	7	538	145	683	
	Excavation for Trench	cu.m	45,500	71	18	3,231	819	4,050	
	Embankment A	cu.m	212,300	71	18	15,073	3,821	18,894	
	Embankment B	cu.m	--	67	16	--	--	--	
	Riprap (Dry stone pitching) A	cu.m	11,700	129	514	1,509	6,014	7,523	
	Riprap (Dry stone pitching) B	cu.m	--	94	377	--	--	--	
	Toe drain (Rockfill)	cu.m	6,000	287	123	1,722	738	2,460	
	Toe drain filter	cu.m	2,500	307	132	768	330	1,098	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				1,142	593	1,735	
	Sub Total					23,983	12,460	36,443	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	--	26	7	--	--	--	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Reinorced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	990	634	1,481	628	1,466	2,094	
	Stone Masonry (Wet)	cu.m	1,040	891	2,078	927	2,161	3,088	
	Miscellaneous works (5%)	LS				78	181	259	
	Sub Total					1,633	3,808	5,441	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	--	71	18	--	--	--	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Steel reinforcement	t	--	1,380	2,070	--	--	--	
	Steel pipe ϕ150	m	--	--	--	--	--	--	
	Sluice valve ϕ150	Ls	1	3,380	844	3	1	4	
	Intake Conduit (Tyoe A)	m	190	2,131	944	405	179	584	
	Intake Conduit (Type B)	m	68	2,104	932	143	63	206	
	Intake conduit (Type C)	m	18	1,507	1,004	27	18	45	
	Miscellaneous works (5%)	LS				29	13	42	
	Sub Total					607	274	881	
4	Infiltration Facility								
	Infiltration Pond	cu.m	840	98	24	82	20	102	
	Link Canal	m	--	--	--	--	--	--	
	Sub Total					82	20	102	
5	Erosion Conrtrol Facility	LS	--			--	--	--	
6	Rehabilitation of Karez	m	2,500	309	463	773	1,158	1,931	
7	Temporary Works	LS				4,062	2,658	6,720	15% of 1 ~6 above
8	Construction Cost					31,140	20,378	51,518	
9	Adminstration Cost					1,557	1,019	2,576	5% of 8 above
10	Engineering Cost					3,114	2,038	5,152	10% of 8 above
11	Contingency					3,581	2,344	5,925	10% of 8 ~10 above
12	Project Cost					39,392	25,779	65,171	

Table K.1.8 Project Cost of Mangi

Project Cost of Mangi

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	13,500	26	7	351	95	446	
	Excavation for Trench	cu.m	17,400	71	18	1,235	313	1,548	
	Embankment A	cu.m	163,400	71	18	11,601	2,941	14,542	
	Embankment B	cu.m	5,100	67	16	342	82	424	
	Riprap (Dry stone pitching) A	cu.m	8,500	129	514	1,097	4,369	5,466	
	Riprap (Dry stone pitching) B	cu.m	—	94	377	—	—	—	
	Toe drain (Rockfill)	cu.m	7,900	287	123	2,267	972	3,239	
	Toe drain filter	cu.m	3,300	307	132	1,013	436	1,449	
	Stone Masonry (Dry)	cu.m	—	190	759	—	—	—	
	Miscellaneous works (5%)	LS				895	460	1,355	
	Sub Total					18,801	9,668	28,469	
2	Spillway								
	Excavation (Hard rock)	cu.m	—	168	42	—	—	—	
	Excavation (Midium hard rock)	cu.m	—	121	30	—	—	—	
	Excavation (Rock)	cu.m	—	116	29	—	—	—	
	Excavation (Ordinaly Soil)	cu.m	5,100	26	7	133	36	169	
	Plain Concrete	cu.m	4,190	1,040	1,559	4,358	6,532	10,890	
	Reinforced Concrete	cu.m	—	1,272	1,908	—	—	—	
	Steel reinforcement	t	—	1,725	1,725	—	—	—	
	Gabion riprap	sq.m	—	127	190	—	—	—	
	Grouted riprap	cu.m	300	634	1,481	190	444	634	
	Stone Masonry (Wet)	cu.m	110	891	2,078	98	229	327	
	Miscellaneous works (5%)	LS				239	362	601	
	Sub Total					5,018	7,603	12,621	
3	Intake Facilities								
	Excavation (Rock)	cu.m	—	116	29	—	—	—	
	Excavation (Gravel & Shingle)	cu.m	33	71	18	2	1	3	
	Plain Concrete	cu.m	27	1,040	1,559	28	42	70	
	Steel reinforcement	t	1,890	1,380	2,070	3	4	7	
	Steel pipe ϕ500	m	16	9,902	4,244	158	68	226	
	Sluice valve ϕ500	Ls	1	50,732	12,683	51	13	64	
	Intake Conduit (Tyoe A)	m	145	11,334	4,857	1,643	704	2,347	
	Intake Conduit (Type B)	m	72	11,468	4,915	826	354	1,180	
	Intake conduit (Type C)	m	57	5,301	3,534	302	201	503	
	Miscellaneous works (5%)	LS				151	69	220	
	Sub Total					3,164	1,456	4,620	
4	Infiltration Facility								
	Infiltration Pond	cu.m	3,300	98	24	323	79	402	
	Link Canal	m	—	—	—	—	—	—	
	Sub Total					323	79	402	
5	Erosion Control Facility	LS	—			—	—	—	
6	Rehabilitation of Karez	m	6,000	309	463	1,854	2,778	4,632	
7	Temporary Works	LS				4,374	3,238	7,612	15% of 1 ~6 above
8	Construction Cost					33,534	24,822	58,356	
9	Adminstration Cost					1,677	1,241	2,918	5% of 8 above
10	Engineering Cost					3,353	2,482	5,835	10% of 8 above
11	Contingency					3,856	2,855	6,711	10% of 8 ~10 above
12	Project Cost					42,420	31,400	73,820	

Table K.1.9 Project Cost of Kad Kocha

Project Cost of Kad Kocha

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	14,100	26	7	367	99	466	
	Excavation for Trench	cu.m	33,500	71	18	2,379	603	2,982	
	Embankment A	cu.m	151,600	71	18	10,764	2,729	13,493	
	Embankment B	cu.m	11,300	67	16	757	181	938	
	Riprap (Dry stone pitching) A	cu.m	8,800	129	514	1,135	4,523	5,658	
	Riprap (Dry stone pitching) B	cu.m	—	94	377	—	—	—	
	Toe drain (Rockfill)	cu.m	9,700	287	123	2,784	1,193	3,977	
	Toe drain filter	cu.m	4,100	307	132	1,259	541	1,800	
	Stone Masonry (Dry)	cu.m	—	190	759	—	—	—	
	Miscellaneous works (5%)	LS				972	493	1,465	
	Sub Total					20,417	10,362	30,779	
2	Spillway								
	Excavation (Hard rock)	cu.m	—	168	42	—	—	—	
	Excavation (Midium hard rock)	cu.m	—	121	30	—	—	—	
	Excavation (Rock)	cu.m	—	116	29	—	—	—	
	Excavation (Ordinaly Soil)	cu.m	11,300	26	7	294	79	373	
	Plain Concrete	cu.m	310	1,272	1,908	394	591	985	
	Reinforced Concrete	cu.m	—	1,040	1,559	—	—	—	
	Steel reinforcement	t	—	1,725	1,725	—	—	—	
	Gabion riprap	sq.m	—	127	190	—	—	—	
	Grouted riprap	cu.m	1,300	634	1,481	824	1,925	2,749	
	Stone Masonry (Wet)	cu.m	1,110	891	2,078	989	2,307	3,296	
	Miscellaneous works (5%)	LS				125	245	370	
	Sub Total					2,626	5,147	7,773	
3	Intake Facilities								
	Excavation (Rock)	cu.m	44	116	29	5	1	6	
	Excavation (Gravel & Shingle)	cu.m	—	71	18	—	—	—	
	Plain Concrete	cu.m	37	1,272	1,908	47	71	118	
	Steel reinforcement	t	2,590	1,380	2,070	4	5	9	
	Steel pipe ϕ600	m	11	12,685	5,436	140	60	200	
	Sluice valve ϕ600	Ls	1	119,765	29,942	120	30	150	
	Intake Conduit (Tyoe A)	m	20	14,414	6,178	288	124	412	
	Intake Conduit (Type B)	m	65	14,722	6,310	957	410	1,367	
	Intake conduit (Type C)	m	—	6,173	4,116	—	—	—	
	Miscellaneous works (5%)	LS				78	35	113	
	Sub Total					1,639	736	2,375	
4	Infiltration Facility								
	Infiltration Pond	cu.m	3,330	98	24	326	80	406	
	Link Canal	m	500	86	92	43	46	89	
	Sub Total					369	126	495	
5	Erosion Conrtrol Facility	LS	—			—	—	—	
6	Rehabilitation of Karez	m	—			—	—	—	
7	Temporary Works	LS				3,758	2,456	6,214	15% of 1 ~6 above
8	Construction Cost					28,809	18,827	47,636	
9	Adminstration Cost					1,440	941	2,381	5% of 8 above
10	Engineering Cost					2,881	1,883	4,764	10% of 8 above
11	Contingency					3,313	2,165	5,478	10% of 8 ~10 above
12	Project Cost					36,443	23,816	60,259	

Table K.1.10 Project Cost of Ghazlona

Project Cost of Ghazlona

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	5,600	26	7	146	39	185	
	Excavation for Trench	cu.m	5,200	71	18	369	94	463	
	Embankment A	cu.m	63,100	71	18	4,480	1,136	5,616	
	Embankment B	cu.m	11,500	67	16	771	184	955	
	Riprap (Ory stone pitching) A	cu.m	--	129	514	--	--	--	
	Riprap (Ory stone pitching) B	cu.m	3,200	94	377	301	1,206	1,507	
	Toe drain (Rockfill)	cu.m	2,600	287	123	746	320	1,066	
	Toe drain filter	cu.m	800	307	132	246	106	352	
	Stone Masonry (Ory)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				353	154	507	
	Sub Total					7,412	3,239	10,651	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	7,700	116	29	893	223	1,116	
	Excavation (Ordinaly Soil)	cu.m	--	26	7	--	--	--	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Reinforced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	1,200	891	2,078	1,069	2,494	3,563	
	Miscellaneous works (5%)	LS				98	136	234	
	Sub Total					2,060	2,853	4,913	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	37	71	18	3	1	4	
	Plain Concrete	cu.m	31	1,040	1,559	32	48	80	
	Steel reinforcement	t	2,170	1,380	2,070	3	4	7	
	Steel pipe ϕ200	m	38	2,437	1,044	93	40	133	
	Sluice valve ϕ200	Ls	1	4,033	1,009	4	1	5	
	Intake Conduit (Tyoe A)	m	28	3,036	1,301	85	36	121	
	Intake Conduit (Type B)	m	100	2,997	1,285	300	129	429	
	Intake conduit (Type C)	m	18	1,772	1,182	32	21	53	
	Miscellaneous works (5%)	LS				28	14	42	
	Sub Total					580	294	874	
4	Infiltration Facility								
	Infiltration Pond	cu.m	247	98	24	24	6	30	
	Link Canal	m	1,300	28	36	36	47	83	
	Sub Total					60	53	113	
5	Erosion Conrtrol Facility	LS	1			1,395	347	1,742	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				1,726	1,018	2,744	15% of 1 ~6 above
8	Construction Cost					13,233	7,804	21,037	
9	Adminstration Cost					662	390	1,052	5% of 8 above
10	Engineering Cost					1,323	780	2,103	10% of 8 above
11	Contingency					1,522	897	2,419	10% of 8 ~10 above
12	Project Cost					16,740	9,871	26,611	

Table K.1.11 Project Cost of Ghutai Shela

Project Cost of Ghutai Shela

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	7,500	26	7	195	53	248	
	Excavation for Trench	cu.m	8,000	71	18	568	144	712	
	Embankment A	cu.m	24,700	71	18	1,754	445	2,199	
	Embankment B	cu.m	7,900	67	16	529	126	655	
	Riprap (Dry stone pitching) A	cu.m	2,100	129	514	271	1,079	1,350	
	Riprap (Dry stone pitching) B	cu.m	—	94	377	—	—	—	
	Toe drain (Rockfill)	cu.m	1,900	287	123	545	234	779	
	Toe drain filter	cu.m	800	307	132	246	106	352	
	Stone Masonry (Dry)	cu.m	—	190	759	—	—	—	
	Miscellaneous works (5%)	LS				205	109	314	
	Sub Total					4,313	2,296	6,609	
2	Spillway								
	Excavation (Hard rock)	cu.m	—	168	42	—	—	—	
	Excavation (Midium hard rock)	cu.m	—	121	30	—	—	—	
	Excavation (Rock)	cu.m	—	116	29	—	—	—	
	Excavation (Ordinaly Soil)	cu.m	7,900	26	7	205	55	260	
	Plain Concrete	cu.m	90	1,040	1,559	94	140	234	
	Reinforced Concrete	cu.m	—	1,272	1,908	—	—	—	
	Steel reinforcement	t	—	1,725	1,725	—	—	—	
	Gabion riprap	sq.m	—	127	190	—	—	—	
	Grouted riprap	cu.m	510	634	1,481	323	755	1,078	
	Stone Masonry (Wet)	cu.m	—	891	2,078	—	—	—	
	Miscellaneous works (5%)	LS				31	48	79	
	Sub Total					653	998	1,651	
3	Intake Facilities								
	Excavation (Rock)	cu.m	—	116	29	—	—	—	
	Excavation (Gravel & Shingle)	cu.m	—	71	18	—	—	—	
	Plain Concrete	cu.m	—	1,040	1,559	—	—	—	
	Steel reinforcement	t	—	1,380	2,070	—	—	—	
	Steel pipe ϕ200	m	15	2,437	1,044	37	16	53	
	Sluice valve ϕ200	Ls	1	4,033	1,009	4	1	5	
	Intake Conduit (Type A)	m	80	3,036	1,301	243	104	347	
	Intake Conduit (Type B)	m	90	2,997	1,285	270	116	386	
	Intake conduit (Type C)	m	70	1,772	1,182	124	83	207	
	Miscellaneous works (5%)	LS				34	16	50	
	Sub Total					712	336	1,048	
4	Infiltration Facility								
	Infiltration Pond	cu.m	1,160	98	24	114	28	142	
	Link Canal	m	500	67	77	34	39	73	
	Sub Total					148	67	215	
5	Erosion Conrtrol Facility	LS	—			—	—	—	
6	Rehabilitation of Karez	m	—			—	—	—	
7	Temporary Works	LS				874	555	1,429	15% of 1 ~6 above
8	Construction Cost					6,700	4,252	10,962	
9	Adminstration Cost					335	213	548	5% of 8 above
10	Engineering Cost					670	425	1,095	10% of 8 above
11	Contingency					771	489	1,260	10% of 8 ~10 above
12	Project Cost					8,476	5,379	13,855	

Table K.1.12 Project Cost of Wali Dad

Project Cost of Wali Dad

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Hard rock)	cu.m	250	168	42	42	11	53	
	Excavation (Ordinaly Soil)	cu.m	--	26	7	--	--	--	
	Backfilling	cu.m	--	29	8	--	--	--	
	Dam Concrete	cu.m	3,700	1,040	1,559	3,848	5,768	9,616	
	Miscellaneous works (5%)	LS				195	289	484	
	Sub Total					4,085	6,068	10,153	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	1,970	26	7	51	14	65	
	Backfilling	cu.m	--	29	8	--	--	--	
	Plain Concrete	cu.m	--	1,272	1,908	--	--	--	
	Reinforced Concrete	cu.m	622	1,040	1,559	647	970	1,617	
	Steel reinforcement	t	44	1,725	1,725	76	76	152	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	--	891	2,078	--	--	--	
	Miscellaneous works (5%)	LS				39	53	92	
	Sub Total					813	1,113	1,926	
3	Intake Facilities								
	Steel pipe ϕ300	m	10	4,283	1,835	43	18	61	Intake pipe
	Steel pipe ϕ300	m	53	4,034	1,729	214	92	306	Conduit
	Intake Conduit (Type C)	m	3,250	2,898	1,932	9,419	6,279	15,698	
	Sluice valve ϕ300	No.	1	9,352	2,338	9	2	11	
	Miscellaneous works (5%)	LS				484	320	804	
	Sub Total					10,169	6,711	16,880	
4	Infiltration Facility								
	Infiltration Pond	cu.m	8,323	98	24	816	200	1,016	
	Link Canal	m	--			--	--	--	
	Sub Total					816	200	1,016	
5	Erosion Conrtrol Facility	LS	--			--	--	--	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				2,382	2,114	4,496	15% of 1 ~6 above
8	Construction Cost					18,265	16,206	34,471	
9	Adminstration Cost					913	810	1,723	5% of 8 above
10	Engineering Cost					1,827	1,621	3,448	10% of 8 above
11	Contingency					2,101	1,864	3,965	10% of 8 ~10 above
12	Project Cost					23,106	20,501	43,607	

Table K.1.13 Project Cost of Samaki

Project Cost of Samaki

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	5,500	26	7	143	39	182	
	Excavation for Trench	cu.m	1,900	71	18	135	34	169	
	Embankment A	cu.m	29,200	71	18	2,073	526	2,599	
	Embankment B	cu.m	6,200	67	16	415	99	514	
	Riprap (Dry stone pitching) A	cu.m	--	129	514	--	--	--	
	Riprap (Dry stone pitching) B	cu.m	1,500	94	377	141	566	707	
	Toe drain (Rockfill)	cu.m	1,100	287	123	316	135	451	
	Toe drain filter	cu.m	500	307	132	154	66	220	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				169	73	242	
	Sub Total					3,546	1,538	5,084	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	--	121	30	--	--	--	
	Excavation (Rock)	cu.m	7,700	116	29	893	223	1,116	
	Excavation (Ordinaly Soil)	cu.m	--	26	7	--	--	--	
	Plain Concrete	cu.m	--	1,040	1,559	--	--	--	
	Reinforced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	--	634	1,481	--	--	--	
	Stone Masonry (Wet)	cu.m	1,200	891	2,078	1,069	2,494	3,563	
	Miscellaneous works (5%)	LS				98	136	234	
	Sub Total					2,060	2,853	4,913	
3	Intake Facilities								
	Excavation (Rock)	cu.m	28	116	29	3	1	4	
	Excavation (Gravel & Shingle)	cu.m	--	71	18	--	--	--	
	Plain Concrete	cu.m	24	1,040	1,559	25	37	62	
	Steel reinforcement	t	1,680	1,380	2,070	2	3	5	
	Steel pipe ϕ200	m	15	2,437	1,044	37	16	53	
	Sluice valve ϕ200	Ls	1	4,033	1,009	4	1	5	
	Intake Conduit (Tyoe A)	m	20	3,036	1,301	61	26	87	
	Intake Conduit (Type B)	m	85	2,997	1,285	255	109	364	
	Intake conduit (Type C)	m	10	1,772	1,182	18	12	30	
	Miscellaneous works (5%)	LS				20	10	30	
	Sub Total					425	215	640	
4	Infiltration Facility								
	Infiltration Pond	cu.m	742	98	24	73	18	91	
	Link Canal	m	65	44	53	3	3	6	
	Sub Total					76	21	97	
5	Erosion Conrtrol Facility	LS	--			--	--	--	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				916	694	1,610	15% of 1 ~6 above
8	Construction Cost					7,023	5,321	12,344	
9	Adminstration Cost					351	266	617	5% of 8 above
10	Engineering Cost					702	532	1,234	10% of 8 above
11	Contingency					808	612	1,420	10% of 8 ~10 above
12	Project Cost					8,884	6,731	15,615	

Table K.1.14 Project Cost of Iskalkoo

Project Cost of Iskalkoo

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (1000Rs)			Note
				F.C.	L.C.	F.C.	L.C.	Total	
1	Dam								
	Excavation (Ordinaly Soil)	cu.m	3,700	26	7	96	26	122	
	Excavation for Trench	cu.m	3,300	71	18	234	59	293	
	Embankment A	cu.m	41,200	71	18	2,925	742	3,667	
	Embankment B	cu.m	5,200	67	16	348	83	431	
	Riprap (Dry stone pitching) A	cu.m	--	129	514	--	--	--	
	Riprap (Dry stone pitching) B	cu.m	2,000	94	377	188	754	942	
	Toe drain (Rockfill)	cu.m	1,100	287	123	316	135	451	
	Toe drain filter	cu.m	500	307	132	154	66	220	
	Stone Masonry (Dry)	cu.m	--	190	759	--	--	--	
	Miscellaneous works (5%)	LS				213	93	306	
	Sub Total					4,474	1,958	6,432	
2	Spillway								
	Excavation (Hard rock)	cu.m	--	168	42	--	--	--	
	Excavation (Midium hard rock)	cu.m	7,200	121	30	871	216	1,087	
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Ordinaly Soil)	cu.m	--	26	7	--	--	--	
	Plain Concrete	cu.m	300	1,040	1,559	312	468	780	
	Reinforced Concrete	cu.m	--	1,272	1,908	--	--	--	
	Steel reinforcement	t	--	1,725	1,725	--	--	--	
	Gabion riprap	sq.m	--	127	190	--	--	--	
	Grouted riprap	cu.m	1,500	634	1,481	951	2,222	3,173	
	Stone Masonry (Wet)	cu.m	900	891	2,078	802	1,870	2,672	
	Miscellaneous works (5%)	LS				147	239	386	
	Sub Total					3,083	5,015	8,098	
3	Intake Facilities								
	Excavation (Rock)	cu.m	--	116	29	--	--	--	
	Excavation (Gravel & Shingle)	cu.m	15	71	18	1	0	1	
	Plain Concrete	cu.m	13	1,040	1,559	14	20	34	
	Steel reinforcement	t	0.910	1,380	2,070	1	2	3	
	Steel pipe ϕ200	m	10	2,437	1,044	24	10	34	
	Sluice valve ϕ200	Ls	2	4,033	1,009	8	2	10	
	Intake Conduit (Tyoe A)	m	20	3,036	1,301	61	26	87	
	Intake Conduit (Type B)	m	85	2,997	1,285	255	109	364	
	Intake conduit (Type C)	m	500	1,772	1,182	886	591	1,477	
	Miscellaneous works (5%)	LS				63	38	101	
	Sub Total					1,313	798	2,111	
4	Infiltration Facility								
	Infiltration Pond	cu.m	1,081	98	24	106	26	132	
	Link Canal	m	--	--	--	--	--	--	
	Sub Total					106	26	132	
5	Erosion Conrtrol Facility	LS	--			--	--	--	
6	Rehabilitation of Karez	m	--			--	--	--	
7	Temporary Works	LS				1,346	1,170	2,516	15% of 1 ~6 above
8	Construction Cost					10,322	8,967	17,684	
9	Adminstration Cost					516	448	884	5% of 8 above
10	Engineering Cost					1,032	897	1,768	10% of 8 above
11	Contingency					1,187	1,031	2,033	10% of 8 ~10 above
12	Project Cost					13,057	11,343	22,369	

Table K.2.1 Unit Construction Cost of Driving Canal (Type A)

Cost of Intake Conduit (Type A)

No.	Description	Unit	Quantity	Unit Rate (Rs		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
1	φ200							
	Excavation	cu.m	0.50	71	18	35	9	44
	Backfilling	cu.m	0.46	759	190	352	88	440
	Pipe fitting (Perforated S.P.	m	1.00	2,373	1,086	2,373	1,086	3,459
	Miscellaneous works (10%)	LS				276	118	394
	Total					3,036	1,301	4,337
2	φ250							
	Excavation	cu.m	0.57	71	18	40	10	50
	Backfilling	cu.m	0.52	759	190	395	99	494
	Pipe fitting (Perforated S.P.	m	1.00	2,951	1,342	2,951	1,342	4,293
	Miscellaneous works (10%)	LS				339	145	484
	Total					3,725	1,596	5,321
2	φ300							
	Excavation	cu.m	0.65	71	18	46	12	58
	Backfilling	cu.m	0.58	759	190	440	110	550
	Pipe fitting (Perforated S.P.	m	1.00	4,243	1,808	4,243	1,808	6,051
	Miscellaneous works (10%)	LS				473	193	666
	Total					5,202	2,123	7,325
3	φ400							
	Excavation	cu.m	0.88	71	18	62	16	78
	Backfilling	cu.m	0.75	759	190	573	143	716
	Pipe fitting (Perforated S.P.	m	1.00	7,768	3,442	7,768	3,442	11,210
	Miscellaneous works (10%)	LS				840	360	1,200
	Total					9,243	3,961	13,204
4	φ500							
	Excavation	cu.m	1.25	71	18	89	23	112
	Backfilling	cu.m	1.05	759	190	800	200	1,000
	Pipe fitting (Perforated S.P.	m	1.00	9,415	4,192	9,415	4,192	13,607
	Miscellaneous works (10%)	LS				1,030	442	1,472
	Total					11,334	4,857	16,191
5	φ600							
	Excavation	cu.m	1.68	71	18	119	30	149
	Backfilling	cu.m	1.48	759	190	1,126	282	1,408
	Pipe fitting (Perforated S.P.	m	1.00	11,859	5,304	11,859	5,304	17,163
	Miscellaneous works (10%)	LS				1,310	562	1,872
	Total					14,414	6,178	20,592

Table K.2.2 Unit Construction Cost of Driving Canal (Type B)

Cost of Intake Conduit (Type B)

No.	Description	Unit	Quantity	Unit Rate (Rs		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
	Excavation	cu.m	0.78	71	18	56	14	70
	Reinforced Concrete	cu.m	0.30	1,272	1,908	385	577	962
	Reinforced Steel	t	0.021	1,725	1,725	37	37	74
	Pipe fitting (S.P.)	m	1.00	2,247	540	2,247	540	2,787
	Miscellaneous works (10%)	LS				272	117	389
	Total					2,997	1,285	4,282
2	φ250							
	Excavation	cu.m	0.90	71	18	64	16	80
	Reinforced Concrete	cu.m	0.36	1,272	1,908	458	687	1,145
	Reinforced Steel	t	0.025	1,725	1,725	43	43	86
	Pipe fitting (S.P.)	m	1.00	2,582	603	2,582	603	3,185
	Miscellaneous works (10%)	LS				315	135	450
	Total					3,462	1,484	4,946
3	φ300							
	Excavation	cu.m	1.02	71	18	73	18	91
	Reinforced Concrete	cu.m	0.42	1,272	1,908	537	806	1,343
	Reinforced Steel	t	0.030	1,725	1,725	51	51	102
	Pipe fitting (S.P.)	m	1.00	4,044	1,239	4,044	1,239	5,283
	Miscellaneous works (10%)	LS				471	211	682
	Total					5,176	2,325	7,501
4	φ400							
	Excavation	cu.m	1.44	71	18	102	26	128
	Reinforced Concrete	cu.m	0.64	1,272	1,908	814	1,221	2,035
	Reinforced Steel	t	0.045	1,725	1,725	77	77	154
	Pipe fitting (S.P.)	m	1.00	7,353	2,252	7,353	2,252	9,605
	Miscellaneous works (10%)	LS				835	358	1,193
	Total					9,181	3,934	13,115
5	φ500							
	Excavation	cu.m	2.10	71	18	149	38	187
	Reinforced Concrete	cu.m	1.00	1,272	1,908	1,272	1,908	3,180
	Reinforced Steel	t	0.070	1,725	1,725	121	121	242
	Pipe fitting (S.P.)	m	1.00	8,883	2,401	8,883	2,401	11,284
	Miscellaneous works (10%)	LS				1,043	447	1,490
	Total					11,468	4,915	16,383
6	φ600							
	Excavation	cu.m	2.88	71	18	204	52	256
	Reinforced Concrete	cu.m	1.44	1,272	1,908	1,832	2,748	4,580
	Reinforced Steel	t	0.101	1,725	1,725	174	174	348
	Pipe fitting (S.P.)	m	1.00	11,174	2,762	11,174	2,762	13,936
	Miscellaneous works (10%)	LS				1,338	574	1,912
	Total					14,722	6,310	21,032

Table K.2.3 Unit Construction Cost of Driving Canal (Type C)

Cost of Intake Conduit (Type C)

No.	Description	Unit	Quantity	Unit Rate (Rs		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
	Excavation	cu.m	0.42	71	18	30	8	38
	Backfilling	cu.m	0.29	29	8	8	2	10
	Sand Foundation	cu.m	0.10	86	202	9	20	29
	Pipe fitting (D.C.I.P.)	m	1.00	1,564	1,045	1,564	1,045	2,609
	Miscellaneous works (10%)	LS				161	108	269
	Total					1,772	1,183	2,955
2	φ250							
	Excavation	cu.m	0.64	71	18	45	12	57
	Backfilling	cu.m	0.45	29	8	13	4	17
	Sand Foundation	cu.m	0.14	86	202	12	28	40
	Pipe fitting (D.C.I.P.)	m	1.00	2,266	1,513	2,266	1,513	3,779
	Miscellaneous works (10%)	LS				234	156	390
	Total					2,570	1,713	4,283
3	φ300							
	Excavation	cu.m	0.72	71	18	51	13	64
	Backfilling	cu.m	0.50	29	8	15	4	19
	Sand Foundation	cu.m	0.15	86	202	13	30	43
	Pipe fitting (D.C.I.P.)	m	1.00	2,556	1,709	2,556	1,709	4,265
	Miscellaneous works (10%)	LS				263	176	439
	Total					2,898	1,932	4,830
4	φ400							
	Excavation	cu.m	0.90	71	18	64	16	80
	Backfilling	cu.m	0.59	29	8	17	5	22
	Sand Foundation	cu.m	0.18	86	202	15	36	51
	Pipe fitting (D.C.I.P.)	m	1.00	3,337	2,232	3,337	2,232	5,569
	Miscellaneous works (10%)	LS				343	229	572
	Total					3,776	2,518	6,294
5	φ500							
	Excavation	cu.m	1.30	71	18	92	23	115
	Backfilling	cu.m	0.87	29	8	25	7	32
	Sand Foundation	cu.m	0.23	86	202	20	46	66
	Pipe fitting (D.C.I.P.)	m	1.00	4,682	3,137	4,682	3,137	7,819
	Miscellaneous works (10%)	LS				482	321	803
	Total					5,301	3,534	8,835
6	φ600							
	Excavation	cu.m	1.54	71	18	109	28	137
	Backfilling	cu.m	0.99	29	8	29	8	37
	Sand Foundation	cu.m	0.27	86	202	23	55	78
	Pipe fitting (D.C.I.P.)	m	1.00	5,451	3,651	5,451	3,651	9,102
	Miscellaneous works (10%)	LS				561	374	935
	Total					6,173	4,116	10,289

Table K.3 Unit Construction Cost of Link Canal

Cost of Link Canal

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
1	B0.10m x H0.20							
	Excavation	cu.m	0.05	71	18	3	1	4
	Embankment	cu.m	0.02	38	9	1	0	1
	Concrete Lining	m2	0.67	29	44	19	29	48
	Miscellaneous works (20%)	LS				5	6	11
	Total					28	36	64
2	B0.10m x H0.30							
	Excavation	cu.m	0.10	71	18	7	2	9
	Embankment	cu.m	0.05	38	9	2	0	2
	Concrete Lining	m2	0.95	29	44	28	42	70
	Miscellaneous works (20%)	LS				7	9	16
	Total					44	53	97
3	B0.20m x H0.30							
	Excavation	cu.m	0.12	71	18	9	2	11
	Embankment	cu.m	0.06	38	9	2	1	3
	Concrete Lining	m2	1.05	29	44	30	46	76
	Miscellaneous works (20%)	LS				8	10	18
	Total					49	59	108
4	B0.20m x H0.40							
	Excavation	cu.m	0.20	71	18	14	4	18
	Embankment	cu.m	0.09	38	9	3	1	4
	Concrete Lining	m2	1.33	29	44	39	59	98
	Miscellaneous works (20%)	LS				11	13	24
	Total					67	77	144
5	B0.20m x H0.50							
	Excavation	cu.m	0.29	71	18	20	5	25
	Embankment	cu.m	0.13	38	9	5	1	6
	Concrete Lining	m2	1.61	29	44	47	71	118
	Miscellaneous works (20%)	LS				14	15	29
	Total					86	92	178

Table K.4.1 Unit Construction Cost of Erosion Control Facilities (1)

Construction Cost of Erosion Control Facility

DARA

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
1	DARA No.1							
	Excavation (Midium Hard Rock)	cu.m	202	121	30	24,442	6,060	30,502
	Excavation (Gravel & Shingle)	cu.m	586	71	18	41,606	10,548	52,154
	Backfilling	cu.m	31	29	8	899	248	1,147
	Embankment	cu.m	757	71	18	53,747	13,626	67,373
	Concrete	cu.m	1,050	1,378	1,221	1,446,900	1,282,050	2,728,950
	Steel Reinforcement	t	31	1,380	2,070	42,780	64,170	106,950
	Stone Masonry (Wet)	cu.m	37	891	2,078	32,967	76,886	109,853
	Miscellaneous works (15%)	LS				246,501	218,038	464,539
	Sub Total					1,889,842	1,671,626	3,561,468
2	DARA No.2							
	Excavation	cu.m	490	71	18	34,790	8,820	43,610
	Gabion Riprap	sq.m	1,850	254	63	469,900	116,550	586,450
	Stone Masonry (Wet)	cu.m	34	2,375	594	80,750	20,196	100,946
	Miscellaneous works (10%)	LS				58,544	14,557	73,101
	Sub Total					643,984	160,123	804,107
	Total					2,533,826	1,831,749	4,365,575

Murgi Kotal

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
1	Murgi Kotal No.1							
	Excavation	cu.m	506	71	18	35,926	9,108	45,034
	Gabion Riprap	sq.m	1,898	254	63	482,092	119,574	601,666
	Stone Masonry (Wet)	cu.m	70	2,375	594	166,250	41,580	207,830
	Miscellaneous works (10%)	LS				68,427	17,026	85,453
	Sub Total					752,695	187,288	939,983
2	Murgi Kotal No.2							
	Excavation	cu.m	322	71	18	22,862	5,796	28,658
	Gabion Riprap	sq.m	1,197	254	63	304,038	75,411	379,449
	Stone Masonry (Wet)	cu.m	45	2,375	594	106,875	26,730	133,605
	Miscellaneous works (10%)	LS				118,647	29,523	148,170
	Sub Total					552,422	137,460	689,882
3	Murgi Kotal No.3							
	Excavation	cu.m	243	71	18	17,253	4,374	21,627
	Gabion Riprap	sq.m	1,224	254	63	310,895	77,112	388,008
	Stone Masonry (Wet)	cu.m	34	2,375	594	80,750	20,196	100,946
	Miscellaneous works (10%)	LS				96,132	23,914	120,046
	Sub Total					505,031	125,596	630,627
4	Murgi Kotal No.4							
	Excavation	cu.m	507	71	18	35,997	9,126	45,123
	Gabion Riprap	sq.m	1,973	254	63	501,142	124,299	625,441
	Stone Masonry (Wet)	cu.m	70	2,375	594	166,250	41,580	207,830
	Miscellaneous works (10%)	LS				120,842	30,080	150,902
	Sub Total					824,231	205,065	1,029,296
	Total					2,634,379	655,409	3,289,788

Kach

No.	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C.	L.C.	Total
1	Kach No.1							
	Excavation	cu.m	481	71	18	34,151	8,658	42,809
	Gabion Riprap	sq.m	1,669	254	63	423,926	105,147	529,073
	Stone Masonry (Wet)	cu.m	67	2,375	594	159,125	39,798	198,923
	Miscellaneous works (10%)	LS				61,720	15,360	77,080
	Sub Total					678,922	168,963	847,885
2	Kach No.2							
	Excavation	cu.m	477	71	18	33,867	8,586	42,453
	Gabion Riprap	sq.m	1,194	254	63	303,276	75,222	378,498
	Stone Masonry (Wet)	cu.m	66	2,375	594	156,750	39,204	195,954
	Miscellaneous works (10%)	LS				117,282	29,198	146,480
	Sub Total					611,175	152,210	763,385
	Total					1,290,097	321,173	1,611,270

Table K.4.2 Unit Construction Cost of Erosion Control Facilities (2)

Sanzali

No	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C	L.C.	Total
1	Sanzali No. 1							
	Excavation	cu.m	277	71	18	19.667	4.986	24.653
	Gabion Riprap	sq.m	1.370	254	63	347.980	86.310	434.290
	Stone Masonry (Wet)	cu.m	39	2.375	594	92.625	23.166	115.791
	Miscellaneous works (10%)	LS				46.027	11.446	57.473
	Sub Total					506.299	125.908	632.207
2	Sanzali No. 2							
	Excavation	cu.m	246	71	18	17.466	4.428	21.894
	Gabion Riprap	sq.m	1.277	254	63	324.358	80.451	404.809
	Stone Masonry (Wet)	cu.m	34	2.375	594	80.750	20.196	100.946
	Miscellaneous works (10%)	LS				92.887	23.098	115.985
	Sub Total					515.461	128.173	643.634
3	Sanzali No. 3							
	Excavation	cu.m	273	71	18	19.383	4.914	24.297
	Gabion Riprap	sq.m	1.300	254	63	330.200	81.900	412.100
	Stone Masonry (Wet)	cu.m	38	2.375	594	90.250	22.572	112.822
	Miscellaneous works (10%)	LS				95.529	23.756	119.285
	Sub Total					535.362	133.142	668.504
4	Sanzali No. 4							
	Excavation	cu.m	374	71	18	26.554	6.732	33.286
	Gabion Riprap	sq.m	2.094	254	63	531.876	131.922	663.798
	Stone Masonry (Wet)	cu.m	52	2.375	594	123.500	30.888	154.388
	Miscellaneous works (10%)	LS				121.729	30.268	151.997
	Sub Total					803.659	199.810	1.003.469
	Total					2.360.781	587.033	2.947.814

Jigda

No	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C	L.C.	Total
1	Jigda No. 1							
	Excavation	cu.m	3.087	71	18	219.177	55.566	274.743
	Backfilling	cu.m	248	29	8	7.192	1.984	9.176
	Grouted Boulder (Wet)	cu.m	2.331	634	1.481	1.477.854	3.452.211	4.930.065
	Gabion Riprap	sq.m	1.144	127	190	170.422	350.976	521.398
	Miscellaneous works (10%)	LS				187.465	386.074	573.539
	Sub Total					2.062.110	4.246.811	6.308.921
2	Jigda No. 2							
	Excavation	cu.m	6.095	71	18	432.745	109.710	542.455
	Backfilling	cu.m	490	29	8	14.210	3.920	18.130
	Grouted Boulder (Wet)	cu.m	3.683	634	1.481	2.335.022	5.454.523	7.789.545
	Gabion Riprap	sq.m	2.259			503.155	1.020.104	1.523.259
	Miscellaneous works (10%)	LS				328.513	659.826	987.339
	Sub Total					3.613.645	7.247.083	10.860.728
3	Jigda No. 3							
	Excavation	cu.m	5.958	71	18	423.018	107.244	530.262
	Backfilling	cu.m	479	29	8	13.891	3.832	17.723
	Grouted Boulder (Wet)	cu.m	4.348	1.692	423	7.356.816	1.839.204	9.196.020
	Gabion Riprap	sq.m	2.208			1.173.538	985.619	2.159.207
	Miscellaneous works (10%)	LS				896.731	293.590	1.190.321
	Sub Total					9.864.044	3.229.489	13.093.533
	Total					15.539.799	14.723.383	30.263.182

Ghazlona

No	Description	Unit	Quantity	Unit Rate (Rs)		Construction Cost (Rs)		
				F.C.	L.C.	F.C	L.C.	Total
1	Ghazlona No. 1							
	Excavation	cu.m	294	71	18	20.874	5.292	26.166
	Gabion Riprap	sq.m	1.235	254	63	313.690	77.805	391.495
	Stone Masonry (Wet)	cu.m	41	2.375	594	97.375	24.354	121.729
	Miscellaneous works (10%)	LS				43.194	10.745	53.939
	Sub Total					475.133	118.196	593.329
2	Ghazlona No. 2							
	Excavation	cu.m	516	71	18	36.778	9.324	46.102
	Gabion Riprap	sq.m	2.306	254	63	585.724	145.278	731.002
	Stone Masonry (Wet)	cu.m	72	2.375	594	171.000	42.768	213.768
	Miscellaneous works (10%)	LS				126.861	31.557	158.421
	Sub Total					920.366	229.927	1.149.293
						1.395.499	347.123	1.742.622

Table K.5.1 Summary of Unit Construction Cost (1)

Summary of Unit Construction Cost

Description	Unit	Unit Cost		
		F.C.	L.C.	Total
A. Earth Work				
Excavation (Hard Rock)	Cu.m	168	42	210
Excavation (Medium hard rock)	Cu.m	121	30	151
Excavation (Rock)	Cu.m	116	29	145
Excavation (Ordinary Soi)	Cu.m	26	7	33
Excavation (Gravel & Shingle formation)	Cu.m	71	18	89
Excavation for Trench	Cu.m	71	18	89
Backfilling	Cu.m	29	8	37
Backfilling with Gravel	Cu.m	759	190	949
Embankment (Removing Material & Compaction)	Cu.m	71	18	89
Embankment (Compaction only)	Cu.m	67	16	83
Sand Foundation	Cu.m	86	202	288
B. Stonework				
Riprap (Dry stone pitching, including Material)	Cu.m	129	514	643
Riprap (Dry stone pitching)	Cu.m	94	377	471
Grouted Riprap	Cu.m	634	1,481	2,115
Drain	Cu.m	287	123	410
Filter drain	Cu.m	307	132	439
Gabion riprap (t=50cm)	Sq.m	127	190	317
Stone Masonry (Wet)	Cu.m	891	2,078	2,969
Stone Masonry (Dry)	Cu.m	190	759	949
C. Concrete Work				
Reinforced Concrete	Cu.m	1,272	1,908	3,180
Dam Concrete	Cu.m	1,040	1,559	2,599
Plain Concrete 1:3:6	Cu.m	837	1,256	2,093
Steel reinforcement	t	1,725	1,725	3,450
Steel reinforcement for small structure	t	1,380	2,070	3,450
Lining of Canal (50mm thick, cement mortar1:3)	Sq.m	29	44	949
D. Other Works				
Pipe Fitting for Inclined Pipe				
Steel pipe φ200 fitting for Inclined pipe	R.m	2,437	1,044	3,481
Steel pipe φ250 fitting for Inclined pipe	R.m	3,149	1,350	4,499
Steel pipe φ400 fitting for Inclined pipe	R.m	8,010	3,433	11,443
Steel pipe φ500 fitting for Inclined pipe	R.m	9,902	4,244	14,146
Steel pipe φ600 fitting for Inclined pipe	R.m	12,685	5,436	18,121
Perforated Pipe Fitting				
Steel pipe φ200	R.m	2,373	1,086	3,459
Steel pipe φ250	R.m	2,951	1,342	4,293
Steel pipe φ300	R.m	4,243	1,808	6,051
Steel pipe φ400	R.m	7,768	3,442	11,210
Steel pipe φ500	R.m	9,415	4,192	13,607
Steel pipe φ600	R.m	11,859	5,304	17,163
Pipe Fitting				
Steel pipe φ200	R.m	2,247	540	2,787
Steel pipe φ250	R.m	2,582	603	3,185
Steel pipe φ300	R.m	4,044	1,239	5,283
Steel pipe φ400	R.m	7,353	2,252	9,605
Steel pipe φ500	R.m	8,883	2,401	11,284
Steel pipe φ600	R.m	11,174	2,762	13,936

Table K.5.2 Summary of Unit Construction Cost (2)

Summary of Unit Construction Cost Description	Unit	Unit Cost		
		F.C.	L.C.	Total
D. Other Works				
Pipe Fitting				
Ductile Iron pipe φ200	R.m	1,564	1,045	2,609
Ductile Iron pipe φ250	R.m	2,266	1,513	3,779
Ductile Iron pipe φ300	R.m	2,556	1,709	4,265
Ductile Iron pipe φ400	R.m	3,337	2,232	5,569
Ductile Iron pipe φ500	R.m	4,682	3,137	7,819
Ductile Iron pipe φ600	R.m	5,451	3,651	9,102
P.V.C. pipe φ200	R.m	543	542	1,085
Valve Installation				
Sluice valve φ200	Each	4,033	1,009	5,042
Sluice valve φ250	Each	4,676	1,169	5,845
Sluice valve φ300	Each	9,352	2,338	11,690
Sluice valve φ400	Each	23,116	5,779	28,895
Sluice valve φ500	Each	50,732	12,683	63,415
Sluice valve φ600	Each	119,765	29,942	149,707
Rehabilitation of Karez	m	306	463	769

Table K.6 Annual Cost of Operation and Maintenance

Annual Cost of Operation and maintenance

Dam Site	Salary and Wages	Equipment Operation				Materials and Supplies				Administration and General Expenditure (1,000Rs.)	Grand Total (1,000Rs.)
		Operating Time (hours)	Unit Depreciation Cost (Rs./hour)	Unit Fuel Cost (Rs./hour)	Depriciation & Fuel Cost (1,000Rs.)	Delay Action Dam (Rs.)	Link Canal (Rs.)	Infiltration Pond (Rs.)	Total (1,000Rs.)		
			68	21	26	-	-	10	10	-	36
Brewry	36	288	-	14	4	-	-	3	3	2	45
					30	-	-		13	2	81
			68	21	26	30	0	75	105	-	131
Dara	36	288	-	14	4	119	1	20	140	2	182
					30	-	-		245	2	313
			68	21	26	19	1	59	79	-	105
Murgi Kotal	36	288	-	14	4	74	1	16	91	2	133
					30	-	-		170	2	238
			68	21	26	40	11	39	90	-	116
Kach	36	288	-	14	4	158	14	11	183	2	225
					30	-	-		273	2	341
			68	21	26	14	17	98	129	-	155
Jigda	36	288	-	14	4	55	17	26	98	2	140
					30	-	-		227	2	295
			68	21	26	19	4	20	43	-	69
Sanzali	36	288	-	14	4	77	5	5	87	2	129
					30	-	-		130	2	198
			68	21	26	50	-	8	58	-	84
Sakhoi	36	288	-	14	4	200	-	2	202	2	244
					30	-	-		260	2	328
			68	21	32	37	-	98	135	-	167
Mangi	36	360	-	14	5	146	-	26	172	2	215
					37	-	-		307	2	382
			68	21	26	38	3	98	139	-	165
Kad Kocha	36	288	-	14	4	151	3	26	180	2	222
					30	-	-		319	2	387
			68	21	38	10	2	5	17	-	55
Ghazlona	36	432	-	14	6	40	3	1	44	2	88
					44	-	-		61	2	143
			68	21	26	9	2	32	43	-	69
Ghutai Shela	36	288	-	14	4	36	3	9	48	2	90
					30	-	-		91	2	159
			68	21	26	-	-	55	55	-	81
Wali Dad	36	288	-	14	4	-	-	15	15	2	57
					30	-	-		70	2	138
			68	21	38	5	0	10	15	-	53
Samaki	36	432	-	14	6	19	0	3	22	2	66
					44	-	-		37	2	119
			68	21	32	6	-	20	26	-	58
Iskalkoo	36	360	-	14	5	25	-	5	30	2	73
					37	-	-		56	2	131

Note) Upper : Foreign Portion Middle : Local Portion Lower : Total