

Name of Work	PC - II for Feasibility Study for Pail Tehsil & District Mianwali.
Nature of Project	Land Development for Human inhal
Tail RD	18050
New Culvert	3+800
Deck Slab	10+200
Location	At Farooqabad, 20 km from She
MRS	1st July, 2021 to 31st December
District	Mianwali
Zone	Irrigation Zone Sargodha
Circle	Thal Canal Circle, Mianwali
Division	Kalabagh Headworks Division,]
Sub Divisional Officer	Executive Engineer
Isakhel Sub Division	Kalabagh Headworks Division
Daudkhel, Mianwali	Daudkhel, Mianwali

Daudkhel Lift Irrigation Scheme

Location

Sheikhupura, on Sargodha - Sheikhupura road.
, 2021, Lowest Market Rates and Govt. Notified Rates.

Daudkhel, Mianwali

Superintending Engineer
Thal Canal Circle
Mianwali

GOVERNMENT OF THE PUNJAB
IRRIGATION DEPARTMENT



PC - II

**Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.**

**Cost Rs. 32.354 Million based on Market Rates System for Bi Annual Period 1st
July, 2021 to 31st December, 2021, Lowest Market Rates and Govt. Notified Rates.
for District Mianwali.**

**Irrigation Zone Sargodha
Thal Canal Circle, Mianwali
Kalabagh Headworks Division, Daudkhel, Mianwali**

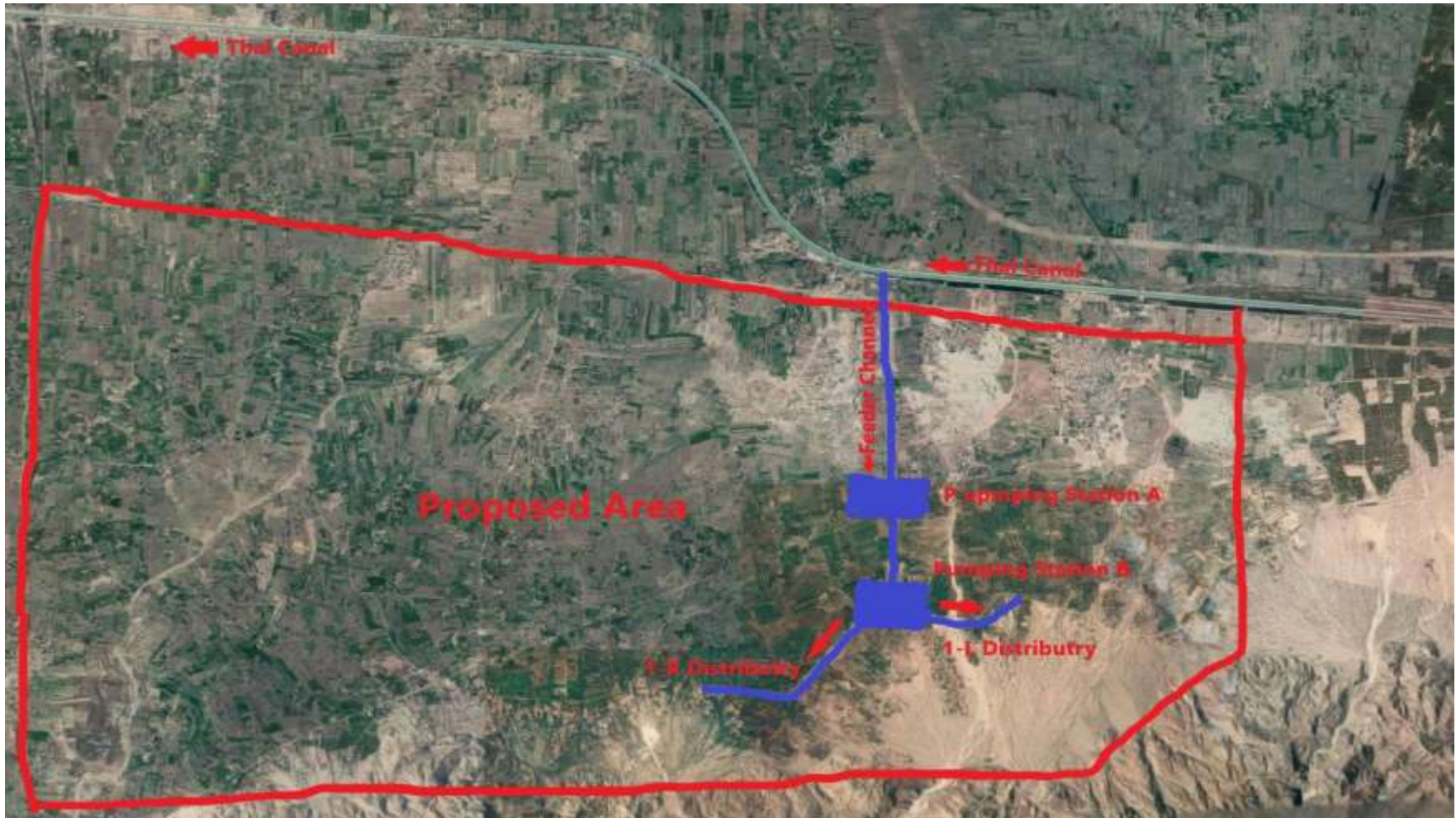
PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.

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PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.

Location Map



Section - A
PC - II Forms

PC-II FORM
GOVERNMENT OF THE PUNJAB
IRRIGATION DEPARTMENT PROFORMA FOR DEVELOPMENT
(SURVEY AND FEASIBILITY STUDIES)
PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.

1	Name by which the survey / study shall be identified.	Feasibility Study For Paikhel Lift Irrigation Scheme of Tehsil and District Mianwali
2	Administrative authorities responsible for:-	
	a. Sponsoring	Government of the Punjab, Irrigation Department.
	b. Execution	Government of the Punjab, Irrigation Department.
	c. Operating	Government of the Punjab, Irrigation Department.
3	Central Ministry concerned with:-	Ministry of Water & Power.
	a. Sponsoring	
	b. Execution	
4	Detail of Survey and Feasibility Study:-	
	a. General description / Justification.	<p>Necessity to conduct a detailed Feasibility and economic study.</p> <p>The project area situates in between Thal canal and salt ranges in Union Councils Daudkhel, Dher Umeed Ali Shah, Paikhel, Swance, Musakhel and Chhidru, District Mianwali. The area comprises highly fertile land. However, because of mountainous terrain, most of the area cannot be irrigated through natural gravity flow. Keeping in view the fertility and high crop yield, Government of the Punjab launched the project namely "Paikhel Lift Irrigation Scheme" worth Rs. 48.20 Million in 1995. Administrative Approval was granted by the Secretary to the Government of Punjab, Irrigation and Power Department, Lahore vide No. SG.S.O (P)/94 dated 28-06-1995. The proposal of original scheme was to construct a lined feeder channel of 100 cusec discharge capacity in length of 2.46 Canal Miles. The channel off takes at RD: 57+736/L of Thal Canal Main Line Upper. Two number irrigation channels namely 1-R & 1-L distributary were proposed to be constructed in length of 7.80 and 6.80 Canal Miles respectively.</p>

		<p>Funds were allocated to the scheme during the financial year 1994 to 2003. During execution, certain technical problems arose regarding safe passage of torrential rain water across the channel alignment. Thereby requiring additional X-Drainage Works for which provision did not exist in the project. Therefore, the project could not continue within the approved cost and the work remained suspended after 1998. On the demand of public representatives, the scheme was again started in December 2004. The PC-I was revised amounting to Rs. 316.298 million by the Secretary Irrigation Department, Lahore vide No.S-41-SO(P)/2000 dated 4.9.2004. The increase in cost was attributed to increase in scope of work for provision of extra X-Drainage Structures and escalation of rates. Even then, the task couldn't be achieved within that cost and second revision of PC-I amounting Rs 630.298 Million was granted by the Secretary Irrigation Department Lahore vide No. S-41-SO(Prog)2000 dated 28.11.2007.</p> <p>Core reason for these technical problems is that the hydrology of the hill torrents of the area is unknown. This led to the imperfect alignment of the channels and improper design of X-drainage works in terms of capacity and location ...etc.</p> <p>Provision of carrying out Feasibility Study amounting to Rs. 4.00 Million was also made in the revised PC-I. However, the provision proved to be insufficient because the scope of work for feasibility study was too high to be completed within this cost. Consequently the Scheme was terminated by the competent authority vide 7475/WI/134/2018 dated: 30-04-2020. It was decided to conduct a comprehensive feasibility study before further advancement for completion of the project.</p> <p>This feasibility study primarily focuses on the estimation of the rainfall and quantum of resulting discharge through remote sensing, GIS and modern computer aided modeling. It is utmost necessary to conduct detailed Geotechnical and hydrological investigation of the catchment area for proper designing of Paikhel lift irrigation scheme and all other structures so that flashy flood water may safely be drained out across the canal.</p>
		<p><u>Existing / Pre-Build Infrastructure.</u> Following infrastructure has already been constructed under the previously launched projects:-</p> <ul style="list-style-type: none"> * Feeder Channel. Constructed = 2.46 Canal Miles PCC Lining = 2.46 Canal Miles * 1-R Distributary Channel = 13.6 Canal Miles.

		<p> Constructed = 12.00 Canal Miles PCC Lining = 0.8 Canal Miles Brick Lining = 1.20 Canal Miles Earthen = 10.00 Canal Miles * 1-L Distributary Channel Constructed = 8.80 Canal Miles PCC Lining = 4.00 Canal Miles Earthen = 4.80 Canal Miles * Power House No. 1, comprises one 1500 KV Transformer and Distribution Panel. * Pumping House No. 1, comprises Three Pumps of 375 HP, 50 Cusec Capacity) * Power House No. 2, comprises one 1500 KV Transformer and Distribution Panel. * Pumping House No. 2, comprises Three Pumps of 375 HP, 50 Cusec Capacity) * Bridges / Culverts: Feeder Channel = 07 Nos. 1-R Distributary = 34 Nos. 1-L Distributary = 16 Nos. * X-Drainage Works: Feeder Channel = 02 Nos. 1-R Distributary = 52 Nos. 1-L Distributary = 74 Nos. * One number gated Head Regulator at RD: 57+736/L of Thal Main Line Upper. * 12 Number residential quarters, 6 each at every pumping station. * Temporary Pipe Outlets: Feeder Channel = Nil. 1-R Distributary = 11 Nos.. 1-L Distributary = 7 Nos. * GCA = 29100 Acres. * CCA = 27600 Acres. <u>Present Status of Constructed Infrastructure.</u> Above mentioned infrastructure is supplying almost 40 cusecs of canal water to roughly 10000 acres. However, the working of this infrastructure is neither economical nor efficient. Present physical status of the constructed infrastructure is as under: * Feeder Channel. Constructed = 2.46 Canal Miles Operational = 2.46 Canal Miles * 1-R Distributary Channel = 13.6 Canal Miles. Constructed = 12.00 Canal Miles Operational = 2.4 Canal Miles * 1-L Distributary Channel Constructed = 8.80 Canal Miles Operational = 1.6 Canal Miles </p>
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			<p>* Power House No. 1, The distribution panels are outdated.</p> <p>* Pumping House No. 1, All installation are outdated. Though in workable conditions.</p> <p>* Power House No. 2, The building has settled beyond permissible limits. Therefore, the supply has been disconnected. The distribution panels are outdated.</p> <p>* Pumping House No. 2, All installation are outdated. Though in workable conditions except one number pump.</p> <p>* Bridges / Culverts: Feeder Channel = 7 Nos. All operational. 1-R Distributary = 34 Nos. All operational. 1-L Distributary = 16 Nos. All operational.</p> <p>* X-Drainage Works: Feeder Channel = 02 Nos. All operational. 1-R Distributary = 52 Nos. 5 Nos. are not operational. 1-L Distributary = 74 Nos. 3 Nos. are not operational.</p> <p>(The channels are not in operation in their entire constructed length and have been breached at many locations. Therefore, the torrential water finds its way through these breaches. As such it is not sure whether the balance X-Drainage works are operational or not).</p> <p>* One number gated Head Regulator at RD: 57+736/L of Thal Main Line Upper, Operational.</p> <p>* 12 Number residential quarters, 6 each at every pumping station, Operational, just require routine M&R.</p> <p>* Temporary Pipe Outlets: Feeder Channel = Nil. 1-R Distributary = 11 Nos., Working 1-L Distributary = 7 Nos., Working</p> <p>* GCA = Approximately 11000 Acres. * CCA = Approximately 10000 Acres.</p>
			<p><u>Main Features of Study.</u></p> <p>This feasibility study primarily focuses on the estimation of the rainfall and quantum of resulting discharge through modern remote sensing, GIS and computer aided modeling techniques. Under the study, the hired consultants would study the following, though not limited to:-</p> <p>* Estimation of rainfall through remote sensing, GIS and modern computer aided modeling techniques.</p>

		<p>* Estimation of generated runoff and sediment charge.</p> <p>* Assessment whether the irrigation is economically feasible through pumping or otherwise.</p> <p>* If feasible; making all related studies and design like Geotechnical Investigations, Hydraulic Design, PC-I, Land Acquisition Documentations and Re-settlement Plan, Environmental Impact Assessment, Structural Design, Agronomy, Financial Analysis, Cost Estimate and Bidding documentation ...etc.</p> <p>* Study for optimum utilization of already constructed infrastructure, need for its possible rehabilitation, remodeling or relocation. Preparation of all related documents accordingly.</p> <p>Economic Analysis The Consultants will prepare Economic Analysis of the scheme.</p>
b.	Months commencement & completion (Give detail of phasing).	Hiring of Consultants = 6 Months. Feasibility Study Period = 7 Months. Completion Period = 8 Months.
c.	Estimated Cost (Rs. In Millions)	
	i. Local Cost.	Rs. 32.354 (Million)
	ii. Foreign Cost.	
	iii. Total Cost	Rs. 32.354 (Million)
d.	Personal required (Category / Numbers)	The feasibility study has been proposed to be carried out by the consultants through Irrigation Department.
e.	Mode of financing. Give Budget Provision etc.	Financing mode will be grant of the Government of the Punjab through ADP provision.
f.	If foreign exchange is involved, indicate whether a Firm commitment is available.	
g.	Detail of scheme likely to be submitted after survey and studies are completed.	
i.	General description.	Depending on the outcome of the feasibility study, a scheme namely "Paikhel lift irrigation scheme, Phase - II" will be submitted for approval.
ii.	Location	The project area situates in Tehsil and District Mianwali at the foot hills of Koh e Suleiman.
iii.	Estimated Cost.	The estimated cost of the project will be evaluated by the consultants after the completion of feasibility study and the design of irrigation channels, structures and Pumping Stations.

	iv.	Benefits of the projects Economic, Financial and non quantifiable.	Depending on the outcome, this feasibility would bring following benefits:- 1) This project completion will bring about 27600 acres of barren land under cultivation. 2) This project will provide assured irrigation supply and other benefits to the near abadies. 3) It will ensure reliable and smooth water supply to crops at every stage vis sowing, maturity etc., after completion of this scheme. Ultimately it will result in increase of yield per acre. 4) After the execution of this scheme, all these problems will be redressed.
	v.	Probable mode of Financing.	Government of the Punjab Irrigation Department.
	vi.	Member of the persons likely to be employed during implementation of the scheme and after completion.	
		1) Local personnel	This will be determined by the consultants in the feasibility study.
		2) Foreign personnel	
	vii	Material and parts required yearly after completion of the project.	This will be determined and proposed by the consultants in the feasibility study.
		i) Local costs.	Normal O&M cost as per approved yardstick of the Government.
		ii) Foreign costs.	No foreign cost will be involved.

NAME OF WORK:

Feasibility Study For Paikhel Lift Irrigation Scheme of
Tehsil and District Mianwali
Estimated Cost = 32.354 (Million)

Prepared by

(Imtiaz Hussain)
Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Recommended by

(Muhammad Azeem)
Superintending Engineer
Thal Canal Circle
Mianwali

Recommended by

(GHULAM MURTAZA)
Chief Engineer
Irrigation Sargodha Zone
Sargodha

Approved by

(SAIF ANJUM)
Secretary
Government of the Punjab
Irrigation Department, Lahore

**PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.**

PROJECT SUMMARY / REPORT

This PC-II amounting to Rs. 32.354 million is framed to cover the probable cost of the subject cited project.

BRIEF HISTORY:-

The project area situates in between Thal canal and salt ranges in Union Councils Daudkhel, Dher Umeed Ali Shah, Paikhel, Swance, Musakhel and Chhidru, District Mianwali. The area comprises highly fertile land. However, because of mountainous terrain, most of the area cannot be irrigated through natural gravity flow. Keeping in view the fertility and high crop yield, Government of the Punjab launched the project namely "Paikhel Lift Irrigation Scheme" worth Rs. 48.20 Million in 1995. Administrative Approval was granted by the Secretary to the Government of Punjab, Irrigation and Power Department, Lahore vide No. SG.S.O (P)/94 dated 28-06-1995. The proposal of original scheme was to construct a lined feeder channel of 100 cusec discharge capacity in length of 2.46 Canal Miles. The channel off takes at RD: 57+736/L of Thal Canal Main Line Upper. Two number irrigation channels namely 1-R & 1-L distributary were proposed to be constructed in length of 7.80 and 6.80 Canal Miles respectively.

Funds were allocated to the scheme during the financial year 1994 to 2003. During execution, certain technical problems arose regarding safe passage of torrential rain water across the channel alignment. Thereby requiring additional X-Drainage Works for which provision did not exist in the Technical Sanction. Therefore, the project could not continue within the approved cost and the work remained suspended after 1998.

Core reason for these technical problems is that the hydrology of the hill torrents of the area is unknown. Entire area is un-gauged and as such, rainfall data is not available. This led to the imperfect alignment of the channels and improper design of X-drainage works in terms of capacity and location ...etc.

On the demand of public representatives, the scheme was again started in December 2004. The PC-I was revised amounting to Rs. 316.298 million by the Secretary Irrigation Department, Lahore vide No.S-41-SO(P)/2000 dated 4.9.2004. The increase in cost was attributed to increase in scope of work for provision of extra X-Drainage Structures and escalation of rates. Even then, the task couldn't be achieved within that cost and second revision of PC-I amounting Rs 630.298 Million was granted by the Secretary Irrigation Department Lahore vide No. S-41-SO(Prog)2000 dated 28.11.2007.

Keeping in view of the technical issues, provision of carrying out Feasibility Study amounting to Rs. 4.00 Million was also made in the revised PC-I. However, the provision proved to be insufficient because the scope of work for feasibility study was too high to be completed within this provision. Consequently the Scheme was terminated by the competent authority vide 7475/WI/134/2018 dated: 30-04-2020. It was decided to conduct a comprehensive model study before further advancement for completion of the project.

The project comprised a feeder channel and two distributaries including allied mechanical and electrical components. Design capacity of feeder channel is 100 cusecs (200 Cusec inbuilt capacity). It off takes at RD: 57+536/L of Thal Main Line and its overall length is 12300 ft. The supply has been lifted in two stages; by 50 ft. each with one pumping station at RD 9500 and the other at RD 12300. A bifurcating structure is constructed for equitable distribution of canal water in the two distributaries, 1-L and 1-R. Design capacity of I-L distributary is 20 cusecs and its proposed length is 44,000 ft. Design capacity of 1-R distributary is 80 cusecs and its proposed length is 68500 ft. Three pumping sets are installed at each pump house. Two pumping sets are operated at a time whereas the third serves as the standby. In total, 128 X-Drainage works are provided on the whole canal network. Similarly 57 culverts / bridges have also been provided for cross overs.

NECESSITY:-

As mentioned supra in the brief history, the proposed channel network entangles with the natural drainage pattern of the area. Further, the probe report vide letter No. CE/PI, P/2015/2002 dated 23.6.2015 has revealed that the constructed cross drainage structures have inadequate design and lacks geotechnical investigations.

Therefore, there is a dire need to hire consultants for carrying out a comprehensive Feasibility Study. The study would include detailed Geotechnical and Hydrological investigations of the entire catchment area for proper designing of Paikhel lift irrigation scheme and all other structures so that flashy flood water may safely be drained out across the canals. It will primarily focus on the estimation of the rainfall and quantum of resulting discharge through remote sensing techniques, GIS and other modern computer aided modeling.

Hence the necessity of this PC-II.

PROPOSAL AND COMPONENTS:-

In view of the aforementioned situation and to minimize the damages to crops, public properties and the proposed irrigation channels, most suitable alignment is required to be re-evaluated. The proposed alignment should emphasize on minimum requirement of cross-drainage works. In this context, optimum use of already constructed structures would be a pre requisite. Detailed hydraulic and structural design of structures, irrigation channels, chakbandi of proposed area , land acquisition and re-settlement details would also be required.

In general, the study comprises of two phases:-

Assignment-A:

Estimation of torrential discharge, sediment charge, topographic survey and analysis as to whether a successful channel network or networks for gravity or lift irrigation is economically possible or otherwise.

Assignment-B:

In case the analysis under Assignment-A suggests a successful Channel network or networks are possible, then additional study would be carried out under Assignment-B. Otherwise, this assignment would be limited to the study for optimum utilization of already constructed channel network. In case the study under Assignment-A suggests that a successful channel network or networks can be economically constructed, then study under Assignment-B would include proposed channel alignment, Geological investigation along proposed routes, design of structures and pumping stations, Land acquisition, chakbandi and other related studies. Study for optimum utilization of already constructed infrastructure and fresh chakbandi from this irrigation network would always be carried out even if a new channel network is not economically possible. The proposed Feasibility Study would include following, but not limited to:-

- 1 Topographic survey of the entire area proposed to be irrigated.
- 2 Assessment of torrential flood water discharge through modern techniques using GIS, Remote Sensing and Computer aided modeling ...etc.
- 3 Sediment Analysis of the torrential flood water.
- 4 Evaluation of the existing storage practices of torrential waters in the area, its quantum and utilization by the locals.
- 5 Evaluation of the most suitable and sustainable alignment of the channel(s) irrespective of the already constructed infrastructure. The proposed alignment must avoid cross drainage works as far as possible.
- 6 Optimum use of already constructed structures and channels.
- 7 Hydraulic and structural design of falls, cross drainage works, bridges and all other allied structures.
- 8 New chakbandi of proposed area to be irrigated.

- 9 Amendments in Chakbandi of already irrigated area through previously constructed Canal Network.
- 10 Land Acquisition.
- 11 Soil Investigation.
- 12 Hydrological Investigation.
- 13 Design of Lift system.
- 14 Likelihood of water logging and evaluation of water allowance for the area proposed for irrigation through Paikhel Lift Scheme.
- 15 Any other necessary civil works as per site requirement.

Pumping Levy:-

Pumping levy of this scheme will be worked out by the consultants based on energy consumption, maintenance charges and staff to be employed at the pumping stations. This work out by consultant as per decision taken by the Government.

Stake Holders:-

- 1 Irrigation Department.
- 2 Irrigators.
- 3 Representative of Public MNA/MPA etc.
- 4 Public.

ECONOMIC ANALYSIS:-

Economic Analysis will be prepared by the consultant during the feasibility study.

WATER ALLOWANCE:-

Water allowance will be evaluated by the consultants during the feasibility study.

PUMPING STATIONS:-

Number, Location and capacity of pumping stations will be evaluated by the consultants during the feasibility study.

EXISTING / PRE-BUILD INFRASTRUCTURE:-

Following infrastructure has already been constructed under the previously launched projects:-

- * Feeder Channel.
Constructed = 2.46 Canal Miles
PCC Lining = 2.46 Canal Miles
- * 1-R Distributary Channel = 13.6 Canal Miles.
Constructed = 12.00 Canal Miles
PCC Lining = 0.8 Canal Miles
Brick Lining = 1.20 Canal Miles
Earthen = 10.00 Canal Miles
- * 1-L Distributary Channel
Constructed = 8.80 Canal Miles
PCC Lining = 4.00 Canal Miles
Earthen = 4.80 Canal Miles
- * Power House No. 1, comprises one 1500 KV Transformer and Distribution Panel.
- * Pumping House No. 1, comprises Three Pumps of 375 HP, 50 Cusec Capacity)
- * Power House No. 2, comprises one 1500 KV Transformer and Distribution Panel.
- * Pumping House No. 2, comprises Three Pumps of 375 HP, 50 Cusec Capacity)
- * Bridges / Culverts:
Feeder Channel = 07 Nos.
1-R Distributary = 34 Nos.
1-L Distributary = 16 Nos.
- * X-Drainage Works:
Feeder Channel = 02 Nos.
1-R Distributary = 52 Nos.
1-L Distributary = 74 Nos.
- * One number gated Head Regulator at RD: 57+736/L of Thal Main Line Upper.

- * 12 Number residential quarters, 6 each at every pumping station.
- * Temporary Pipe Outlets:
 - Feeder Channel = Nil.
 - 1-R Distributary = 11 Nos..
 - 1-L Distributary = 7 Nos.
- * GCA = 29100 Acres.
- * CCA = 27600 Acres.

PRESENT STATUS OF CONSTRUCTED INFRASTRUCTURE:-

Above mentioned infrastructure is supplying almost 40 cusecs of canal water to roughly 10000 acres. However, the working of this infrastructure is neither economical nor efficient. Present physical status of the constructed infrastructure is as under:

- * Feeder Channel.
 - Constructed = 2.46 Canal Miles
 - Operational = 2.46 Canal Miles
- * 1-R Distributary Channel = 13.6 Canal Miles.
 - Constructed = 12.00 Canal Miles
 - Operational = 2.4 Canal Miles
- * 1-L Distributary Channel
 - Constructed = 8.80 Canal Miles
 - Operational = 1.6 Canal Miles
- * Power House No. 1, The distribution panels are outdated.
- * Pumping House No. 1, All installation are outdated. Though in workable conditions.
- * Power House No. 2, The building has settled beyond permissible limits. Therefore, the supply has been disconnected. The distribution panels are outdated.
- * Pumping House No. 2, All installation are outdated. Though in workable conditions except one number pump.
- * Bridges / Culverts:
 - Feeder Channel = 7 Nos. All operational.
 - 1-R Distributary = 34 Nos. All operational.
 - 1-L Distributary = 16 Nos. All operational.
- * X-Drainage Works:
 - Feeder Channel = 02 Nos. All operational.
 - 1-R Distributary = 52 Nos. 5 Nos. are not operational.
 - 1-L Distributary = 74 Nos. 3 Nos. are not operational.

(The channels are not in operation in their entire constructed length and have been breached at many locations. Therefore, the torrential water finds its way through these breaches. As such it is not sure whether the balance X-Drainage works are operational or not).
- * One number gated Head Regulator at RD: 57+736/L of Thal Main Line Upper, Operational.
- * 12 Number residential quarters, 6 each at every pumping station, Operational, just require routine M&R.
- * Temporary Pipe Outlets:
 - Feeder Channel = Nil.
 - 1-R Distributary = 11 Nos., Working
 - 1-L Distributary = 7 Nos., Working
- * GCA = Approximately 11000 Acres.
- * CCA = Approximately 10000 Acres.

DURATION OF STUDY:-

06-Months.

GENERAL:-

An early approval of this PC-II is requested.

Superintending Engineer
Thal Canal Circle
Mianwali

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Section - B
Cost Estimate

**PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.**

General Summary of Cost

Sr. No.	Description	Cost
1	Remunerations	16,715,000
2	Direct Cost	3,600,000
3	Topographic Survey	8,916,188
4	Sub-Soil Investigations	1,195,000
5	Publication and Printing of Land Acquisition Documents	387,500
Sub Total (Rs.) =		30,813,688
<i>Add 5% PST=</i>		<i>1,540,684</i>
Total (Rs.) =		32,354,372
Say Rs. (million) =		32.354

Executive Engineer

Kalabagh Headworks Division
Daudkhel, Mianwali

Certified that I have inspected the site and has satisfied my self about the items, rates, quantities and provisions made in the estimate through visual inspection.

Sub Divisional Officer

Isakhel Sub Division
Daudkhel, Mianwali

Certified that the items, rates, quantities and provisions made in the estimate are correct to my entire satisfaction.

Executive Engineer

Kalabagh Headworks Division
Daudkhel, Mianwali

Sub Divisional Officer

Isakhel Sub Division
Daudkhel, Mianwali

Recommended

Superintending Engineer

Thal Canal Circle
Mianwali

Consultancy Charges

Remunerations

S/N	Specialist	Assignment-A Man Months		Assignment-B, Man Months				Total Man Months	Rate/Month ¹	Amount
		Person	Month	Limited Scope ²		Extended Scope ³				
				Person	Month	Person	Month			
1	Team Leader / Project Manager	1	3	1	1	1	2	6	60000	360000
2	Principal Hydraulic Design Engineer	1	0.25	1	0.5	1	1.25	2	45000	90000
3	Principal Structural Design Engineer	1	0.25	1	1	1	1.75	3	45000	135000
4	Principle Hydrologist	1	2.25	1	0.25	1	0.5	3	45000	135000
5	Senior Mechanical Engineer	1	0.25	1	0.5	1	1.25	2	45000	90000
6	Principal Geotechnical Engineer	1	0.25	1	0.5	1	0.75	1.5	45000	67500
7	Principal Procurement and Contracts Engineer	0	0	1	0.5	1	0.5	1	45000	45000
8	Senior GIS Specialist	1	2.5	0	0	1	0.5	3	35000	105000
9	Senior Economist	1	0.75	0	0	1	0.25	1	35000	35000
10	Senior Electrical Engineer	1	0.25	1	0.5	1	1.25	2	35000	70000
11	Senior Agronomist	1	1	1	0.25	1	0.75	2	30000	60000
12	Principal Sediment Specialist	1	2.5	1	0.25	1	0.25	3	45000	135000
13	Junior Engineer	2	3	2	1	2	2	12	17500	210000
14	Sociologist	1	1	1	0.25	1	0.75	2	17500	35000
15	AutoCAD Operator	1	0.5	1	1	1	1.5	3	5000	15000
16	Computer operator	1	1.5	1	0.5	1	1	3	4000	12000
17	Patwari	1	1.5	1	1	4	2.375	12	4000	48000
18	Gardawar	0	0	1	1	2	2.5	6	4000	24000
Total For Remunerations carried over to Summary of cost										16715000

¹ = All Salaries Include 16% PST

^{2,3} = Detailed definition of Limited Scope and Extended Scope is given in "Terms of References (TORs)" under Detailed Scope.

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Direct Cost Components

S/N	Description	Assignment-A		Assignment-B				Qty	Rate/Month	Amount
				Limited Scope ¹		Extended Scope ²				
		No	Month	No	Month	No	Month			
A	Vehicles									
1	Hiring/ running, maintaining vehicles including POL driver complete (for field use only).	2	3	2	1	2	2	12	125,000	1,500,000
B	Office Rent Maintenance/ Equipment									
1	For Study/Consultancy where separate project office is established. (Rent/Maintenance of office building including all necessary accessories i.e. Air conditioning, heating, internet facility, utilities bills & furniture.)	1	3	1	1	1	2	6	200,000	1,200,000
C	Travelling Allowance/ Daily Allowance									
1	Travelling Allowance/ Daily Allowance (At Lump Sum rate of 100,000/- per month)	1	3	1	1	1	2	6	100,000	600,000
D	Equipment/ Stationary/ Printing etc.									
1	For Study/Consultancy for design/feasibility/supervision (At Lump Sum rate of 50,000/- per month).	1	3	1	1	1	2	6	50,000	300,000
Total For Direct Charges carried over to Summary of cost										3,600,000

^{1,2} = Detailed definition of Limited Scope and Extended Scope is given in "Terms of References (TORs)" under Detailed Scope.

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Topographic Survey

S/N	Description	Ref	Qty	Unit	Rate	Amount
1	<p>Surveying and supplying maps as per prevailing coordinate system in Pakistan (3 copies on paper, one on tracing paper and one soft copy of all survey on CD), Proposed Irrigation Channels, Existing Irrigation Channels for Paikhel Lift Irrigation Scheme at 500 ft. interval & 2% contour interval, Thal Canal from RD 40+000 to 80+000 at 250 ft. interval including R.O.W and plantation line with all related details, N.S.L, F.S.L, Bed Level, Bank Level, L-Section and R.L of land per Acre for chakbandi plan, contour plan of command area and all outlets, X-sections of earthen channel or lined channel with detail, vertical and horizontal tolerance ± 0.25", shifting and fixing B.Ms. Standard Boundary pillars at suitable places, drawings of all hydraulic structures with their location and GPS coordinates, data of hill torrents, discharge data, routs of hill torrents, critical x-section of torrents \ road crossing, railway crossing etc. All drawing and maps showing important features complete in all respects with signature and stamps. Shifting of B.M from nearest Survey of Pakistan point, B.M and closing on same B.M (recording readings on level book and their availability for checking agency). As per direction and entire satisfaction of Engineering in-charge. All level books, Check Level Books, B.M register and other Project record, chakbandi plan of outlets, design calculations & drawing of outlets ...etc. will be handed over to the client with the feasibility report (The 35000 acre area for topographic survey of the project is taken as Tentative)</p>	Rate Analysis	35000	Acre	250.77	8776812

Topographic Survey

S/N	Description	Ref	Qty	Unit	Rate	Amount
2	<p>Observing X- Sections and L- Sections of channels: Existing Feeder Channel: 0+000 to 12+300 (Tail) @ 500 ft. Interval. Existing 1-R Minor: 0+000 to 68+500 (Previously proposed Tail) @ 500 ft. Interval. Existing 1-L Minor: 0+000 to 44+000 (Previously proposed Tail) @ 500 ft. Interval. Thal Canal: 40+000 to 80+000 @ 250 ft. Interval. Proposed New Channels (Tentative Length): 60000 Rft @ 500 ft. Interval. Including calculation of areas used in cost estimate, showing ROW line and plantation line. Calibration of gates and gearing machinery drawing for repairing and construction of head regulator, cross regulator and all hydraulic structures. Five soft copy on CD and five printouts on graphical sheets. Complete in all respects to entire satisfaction of the engineer in-charge.</p>	Rate Analysis	224800	Rft	0.62	139376.00
Total For Survey and Investigations carried over to Summary of cost						8916188

Sub Divisional Officer
 Isakhel Sub Division
 Daudkhel, Mianwali

Executive Engineer
 Kalabagh Headworks Division
 Daudkhel, Mianwali

Soil Investigations

S/N	Description	Ref	Qty	Unit	Rate	Amount
1	Direct Rotary/Reverse Rotary drilling of bore for Soil Investigation, in all types of soil except shingle, gravel and rock including analysis report:- 6" (150 mm) i/d	Lowest Market Rate	500	Rft	450.00	225000
2	Direct Rotary/Reverse Rotary drilling of bore for Soil Investigation, in shingle, gravel and rock including analysis report:- 6" (150 mm) i/d	Lowest Market Rate	500	Rft	1200.00	600000
3	Shifting of drilling machinery from site to site.	Lowest Market Rate	10	Job	5500.00	55000
4	Obtaining disturbed soil samples from bores, labelling, storing as per standards in Air Tight containers.	Lowest Market Rate	10	Job	7500.00	75000
5	Performing standard penetration test (SPT) at different location within project area as identified by the Engineer In-charge.	Lowest Market Rate	10	Job	3500.00	35000
6	Performing Direct Shear Strength test (SPT) over soil samples collected from within the project area or from bore holes as identified by the Engineer In-charge.	Lowest Market Rate	10	Job	5500.00	55000
7	Performing Point Load test over rock samples collected from within the project area or from bore holes as identified by the Engineer In-charge.	Lowest Market Rate	10	Job	15000.00	150000
Total For Soil Investigations carried over to Summary of cost						1195000

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Publication and Printing of Land Acquisition Documents

S/N	Description	Ref	Qty	Unit	Rate	Amount
1	Publication of Gazette Notification		20	Acre	4750.00	95000
2	Stationary Charges (Tracing Paper, Tracing pens, maps)				LS	250000
3	Photocopies of revenue/ Existing record		1500	No	15.00	22500
4	Printing Charges		1000	No	20.00	20000
<i>Total For Publication and Printing carried over to Summary of cost</i>						387500

Sub Divisional Officer

Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer

Kalabagh Headworks Division
Daudkhel, Mianwali

PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme Tehsil & District Mianwali.

Analysis of Rates

Description of Item:

Surveying and supplying maps as per prevailing coordinate system in Pakistan (3 copies on paper, one on tracing paper and one soft copy of all survey on CD), Proposed Irrigation Channels, Existing Irrigation Channels for Paikhel Lift Irrigation Scheme at 500 ft. interval & 2% contour interval, Thal Canal from RD 40+000 to 80+000 at 250 ft. interval including R.O.W and plantation line with all related details, N.S.L, F.S.L, Bed Level, Bank Level, L-Section and R.L of land per Acre for chakbandi plan, contour plan of command area and all outlets, X-sections of earthen channel or lined channel with detail, vertical and horizontal tolerance $\pm 0.25''$, shifting and fixing B.Ms. Standard Boundary pillars at suitable places, drawings of all hydraulic structures with their location and GPS coordinates, data of hill torrents, discharge data, routs of hill torrents, critical x-section of torrents \ road crossing, railway crossing etc. All drawing and maps showing important features complete in all respects with signature and stamps. Shifting of B.M from nearest Survey of Pakistan point, B.M and closing on same B.M (recording readings on level book and their availability for checking agency). As per direction and entire satisfaction of Engineering in-charge. All level books, Check Level Books, B.M register and other Project record, chakbandi plan of outlets, design calculations & drawing of outlets ...etc. will be handed over to the client with the feasibility report (The 35000 acre area for topographic survey of the project is taken as Tentative)

Item No.	Description	Unit rate per Acre.					Reference
		For Analysis purpose, 500 Acres					
		Quantity		Rate per		Amount	
	Material						
	<u>Material required for maps</u> Scale of map = 1Sft : 15 Acres Size of map = 5'x3.5' = 17.50 Sft No. of acres for which 17.50 Sft is required = 262.50 acres No. of 17.50 Sft sheets required for 500 acres = $500 / 262.50 = 1.905$ Sheets Total number of maps required = 3 Therefore, number of sheets required = $3 \times 1.905 = 5.715$	5.715	No	120.00	No	685.8	Lowest market Rate @ 120/No

PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme Tehsil & District Mianwali.

Analysis of Rates

Description of Item:

<p><u>Material required for Tracing</u> Scale of map = 1Sft : 15 Acres Size of map = 5'x3.5' = 17.50 Sft No. of acres for which 17.50 Sft is required = 262.50 acres No. of 17.50 Sft tracing sheets required for 500 acres = $500 / 262.50 = 1.905$ Total number of tracing maps required = 1 Therefore, number of sheets required = $1 \times 1.905 = 1.905$</p>	1.905	No	80.00	No	152.4	Lowest market Rate @ 80/No
<p><u>Material required for Soft copy on CD</u> No. of writable CDs required for 500 acres = 1 (Computer Operator, CAD operator and other relevant charges have already included under remuneration, Direct cost and Publication Charges).</p>	1.000	No	50.00	No	50.0	Lowest market Rate @ 50/No
Total material Cost					888.2	
Add 20% contractor's profit and overhead charges					177.6	
A Grand Total Material Cost:					1065.8	
Establishment and Labor						
Time required for 1 Acres of Survey = 0.75 hrs. (Average) Time required for 500 Acres of Survey = $0.75 \times 500 = 375$ hrs. = $375/8 = 46.875$ days						
Surveyor	375	Hrs.	92	No	34500.00	Input rates of labor: Additional Item No. 3
Skilled Colly for survey (Staff placement ... etc.).	46.875	Days	950	No	44531.25	Input rates of labor: Item LB-024
Unskilled Colly for carrying.	46.875	Days	725	No	33984.38	Input rates of labor: Item LB-015
Total labor Cost					113015.625	

PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme Tehsil & District Mianwali.

Analysis of Rates

Description of Item:

	Add 10% sundries					11301.563	
B	Grand Total Labor Cost					124317.188	
	Composite rate for 500 Acres. (A+B)					125383.028	
	Composite rate for one Acre					250.77	
	Labor rate for 500 Acres. (B)					124317.188	
	Labor rate for one Acre			Say		248.63	

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Approved:

Superintending Engineer
Thal Canal Circle
Mianwali

PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme Tehsil & District Mianwali.

Analysis of Rates

Description of Item:

Observing X- Sections and L- Sections of channels:

Existing Feeder Channel: 0+000 to 12+300 (Tail) @ 500 ft. Interval.

Existing 1-R Minor: 0+000 to 68+500 (Previously proposed Tail) @ 500 ft. Interval.

Existing 1-L Minor: 0+000 to 44+000 (Previously proposed Tail) @ 500 ft. Interval.

Thal Canal: 40+000 to 80+000 @ 250 ft. Interval.

Proposed New Channels (Tentative Length): 60000 Rft @ 500 ft. Interval.

Including calculation of areas used in cost estimate, showing ROW line and plantation line. Calibration of gates and gearing machinery drawing for repairing and construction of head regulator, cross regulator and all hydraulic structures. Five soft copy on CD and five printouts on graphical sheets. Complete in all respects to entire satisfaction of the engineer in-charge.

Item No.	Description	Unit rate per foot.					Reference
		For Analysis purpose, 250 feet.					
		Quantity		Rate per		Amount	
	Material						
	<u>Material required for maps</u> One X-Section per 250 ft. is required. No. of A4, 100 gm graphical sheets required per 250 ft. = 1 5 number copies are required.	5.000	No	2.00	No	10.0	Lowest market Rate @ 2/No
	<u>Material required for Soft copy on CD</u> No. of writable CDs required for all X-Sections i.e. for 157800 ft. = 1 No. of writable CDs required for 250 ft. (5 copies) = 5/157800 X 250 = 0.00792 (Computer Operator, CAD operator and other relevant charges have already included under remuneration, Direct cost and Publication Charges).	0.00792	No	50.00	No	0.396	Lowest market Rate @ 50/No
	Total material Cost					10.396	
	Add 20% contractor's profit and overhead charges					2.079	
	A Grand Total Material Cost:					12.475	
	Establishment and Labor						

PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme Tehsil & District Mianwali.

Analysis of Rates

Description of Item:

	Time required for 25000 Rft of Survey = 24 hrs. (Average) Time required for 250 Rft of Survey = $24/25000 \times 250 = 0.24$ hrs. = $0.24/8 = 0.03$ days						
	Surveyor (1 No.)	0.24	Hrs.	92	No	22.08	Input rates of labor: Additional Item No. 3
	Skilled Colly for survey (Staff placement, distance measurement... etc.) (3 No.)	0.090	Days	950	No	85.50	Input rates of labor: Item LB-024
	Unskilled Colly for carrying (1 No.).	0.030	Days	725	No	21.75	Input rates of labor: Item LB-015
	Total labor Cost					129.330	
	Add 10% sundries					12.933	
	B Grand Total Labor Cost					142.263	
	Composite rate for one foot. (A+B)					0.619	
				Say		0.620	
	Labor rate for one foot. (B)					0.569	
				Say		0.570	

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Approved:

Superintending Engineer
Thal Canal Circle
Mianwali

Section - C
Implementation Schedule

**PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.**

Activity Program

Sr. No.	Activity	Months from award
	Assignment - A.	
1	Inception Report (10 copies). The report will include the Consultant's detailed work program.	0.5 Month.
2	Progress report.	End of every month.
3	Hydrological Report.	1.5 Months.
4	Topographic Survey.	1.5 Months.
5	Sediment Analysis Report.	1.5 Months.
6	Feasibility Report.	3.0 Months.
	Assignment - B.	
7	Agricultural Study Report.	3.5 Months
8	Canal System alignment and Layout Report.	3.5 Months
9	Hydraulic Report.	4 Months.
10	Land Acquisition Report and Re-settlement Plan.	4 Months.
11	Detailed Structural / Architectural Design including concept, Tender and Construction Drawings.	5 Months.
12	Detailed Design of Pumping System.	5 Months.
13	Detailed Engineers Cost Estimate.	5.5 Months.
14	EIA Report.	5.5 Months.
15	PC - I.	6 Months.
16	Final Bidding Documents.	6 Months.

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

**PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme
Tehsil & District Mianwali.**

Implementation Schedule

Sr. No.	Activity	Duration	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6			
			W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
	Assignment - A.																									
1	Inception Report.	2 W	■	■																						
2	Progress report.				■				■			■			■				■				■			
3	Hydrological Report.	6 W	■	■	■	■	■	■																		
4	Topographic Survey.	6 W	■	■	■	■	■	■																		
5	Sediment Analysis Report.	6 W	■	■	■	■	■	■																		
6	Feasibility Report.	8 W			■	■	■	■	■	■	■	■														
	Assignment - B.																									
7	Agricultural Study Report.	2 W											■	■												
8	Alignment and Layout.	2 W											■	■												
9	Hydraulic Report.	4 W											■	■	■	■										
10	Land Acquisition.	4 W											■	■	■	■										
11	Detailed Structural Design.	6 W													■	■	■	■	■	■						
12	Pumping System Design.	6 W													■	■	■	■	■	■						
13	Engineers Cost Estimate.	2 W																			■	■				
14	EIA Report.	4 W																		■	■	■	■			
15	PC - I.	2 W																					■	■		
16	Final Bidding Documents.	2 W																					■	■		

Sub Divisional Officer
Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer
Kalabagh Headworks Division
Daudkhel, Mianwali

Section - D

Terms of Reference (TORs)

PC - II for Feasibility Study for Paikhel Lift Irrigation Scheme Tehsil & District Mianwali.

Terms of Reference

TERMS OF REFERENCE OF CONSULTANCY SERVICES FOR PREPARATION OF “FEASIBILITY STUDIES, DETAILED DESIGN OF PAIKHEL LIFT IRRIGATION SCHEME A & B OFF TAKING FROM THAL CANAL”

1. INTRODUCTION:

a. BRIEF HISTORY:

The project area situates in between Thal canal and salt ranges in Union Councils Daudkhel, Dher Umeed Ali Shah, Paikhel, Swance, Musakhel and Chhidru, District Mianwali. The area comprises highly fertile land. However, because of mountainous terrain, most of the area cannot be irrigated through natural gravity flow. Keeping in view the fertility and high crop yield, Government of the Punjab launched the project namely "Paikhel Lift Irrigation Scheme" worth Rs. 48.20 Million in 1995. The proposal of original scheme was to construct a lined feeder channel of 100 cusec discharge capacity in length of 2.46 Canal Miles. The channel off takes at RD: 57+736/L of Thal Canal Main Line Upper. Two number irrigation channels namely 1-R & 1-L distributary were proposed to be constructed in length of 7.80 and 6.80 Canal Miles respectively. During execution, certain technical problems arose regarding safe passage of torrential rain water across the channel alignment. Thereby requiring additional X-Drainage Works for which provision did not exist in the project. Therefore, the project could not continue within the approved cost and the work remained suspended after 1998. On the demand of public representatives, the scheme was again started in December 2004. The PC-I was revised for a cost of Rs. 316.298 million. The increase in cost was attributed to increase in scope of work for provision of extra X-Drainage Structures and escalation of rates. Even then, the task couldn't be achieved within that cost and the PC-I was revised for the second time amounting to Rs 630.298 Million.

Core reason for these technical problems is that the hydrology of the hill torrents of the area is unknown. This led to the imperfect alignment of the channels and improper design of X-drainage works in terms of capacity and location ...etc.

Provision of carrying out Feasibility Study amounting to Rs. 4.00 Million was made in the second revised PC-I. However, the provision proved to be insufficient because the scope of work for feasibility study was too high to be completed within this cost. Consequently the Scheme was terminated by the competent authority vide 7475/WI/134/2018 dated: 30-04-2020. It was decided to conduct a comprehensive model study before further advancement for completion of the project.

b. ISSUES:

- 1 Torrential flood water is the main problem for the safe running of existing channels.
- 2 Storm water generated by rains over mountains damages the existing channels, hydraulic structures and agricultural lands, causes erosion and entry of saline water into the agricultural land.
- 3 Rainfall data is not available and the resultant torrential water does not have a specific channelized route. The controlling structures are not available. The torrents change their routes from time to time between the rainy season due to deposition of silt and erosion.
- 4 Control of silt entry and trash into the existing and proposed channel network.
- 5 Optimum use of already constructed structures and channels.

c. IMPLEMENTING AGENCY:

Government of the Punjab, Irrigation Department.

d. PROJECT LOCATION AND GEOGRAPHICAL AREA:

The project area situates in between Thal canal and salt ranges in Union Councils Daudkhel, Dher Umeed Ali Shah, Paikhel, Swance, Musakhel and Chhidru, District Mianwali. Location map is attached.

2. OBJECTIVE OF CONSULTANCY:

a. OVERALL OBJECTIVE:

The main objective of consultant's induction is to conduct feasibility studies to improve conveyance efficiency of the existing infrastructure of Paikhel Lift Irrigation Scheme, and if feasible, design a reliable and durable channel network to irrigate proposed area.

b. SPECIFIC OBJECTIVE:

The study comprises two Assignments:-

Assignment-A:

The consultants shall carryout detailed Topographical survey, Hydrological studies and sediment charge for the entire area, either proposed or already receiving canal supply through already constructed channel infrastructure. Neither rainfall nor sediment data for the area is available and the entire catchment area is ungauged. Therefore, consultants have to use modern techniques of Remote Sensing, GIS and computer aided modeling for reliable estimation of the torrential flow and sediment charge.

The nearest available weather station is Mianwali for which the rainfall data can be obtained from concerned quarter. These data can be utilized after proper interpolation and calibration. The consultants will analyze the data so obtained under Assignment-A and suggest whether an efficient and economical channel network is possible for proposed area or otherwise. The proposed channel network must not entangle with the natural drainage pattern of the area. The suggested channels must be aligned at the ridge lines as to minimize the requirement for X-Drainage works.

Assignment-B:

In case the analysis under Assignment-A suggests a successful Channel Network (or networks) is possible for proposed area, then additional study for designing the channel network would be carried out under Assignment-B. Otherwise, this assignment will be limited to the study for optimum utilization of already constructed infrastructure and fresh chakbandi for this irrigation network.

Additional study for the new channel network (or networks) includes Geological investigation along proposed routes, design of structures and pumping stations, Land acquisition documentations, chakbandi and other related studies. Consultants shall carryout detail design of all civil, electrical and mechanical component of the proposed project and shall provide the detail construction drawings, cost estimate, BOQ and tender documents of each individual structures (Civil, Electrical, Mechanical) involved in the proposal. The drawings, designs, specifications, documents, environmental and economic studies should be in accordance with the client's requirements, scope of work and strictly adhering to the rules and instructions of the Irrigation Department, Government of Punjab.

Study for optimum utilization of already constructed infrastructure would include its detailed condition survey. The scope is to improve conveyance, efficiency, reliability and durability of the existing system as per discharge required for the area under irrigation. The consultants shall carryout detailed condition survey of existing civil, electrical and mechanical infrastructure and analyze their condition in context of rehabilitation requirements, suitability of location and alignment with respect to impact of torrential waters. The consultants would also suggest safe disposal of flood waters.

Consultants shall carryout detail design of all civil, electrical and mechanical component of the proposed rehabilitation works and shall provide the detail construction drawings, cost estimate, BOQ and tender documents of each individual structures (Civil, Electrical, Mechanical) involved in the proposal. The drawings, designs, specifications, documents, environmental and economic studies should be in accordance with the client's requirements, scope of work and strictly adhering to the rules and instructions of the Irrigation Department, Government of Punjab.

3. SCOPE OF WORK:

a. GENERAL SCOPE:

The general scope of this feasibility study is to improve conveyance, efficiency, reliability and durability of already constructed Paikhel Lift Irrigation system. And if feasible, propose and design an efficient and reliable channel network to irrigate the balance area in Mouza of Daudkhel, Dher Umeed Ali Shah, Paikhel, Swance, Musakhel and Chhidru, District Mianwali.

b. DETAILED SCOPE:

The detailed scope of services required from the consultants will include, but not limited to:

Assignment-A

- 1 The consultant shall carry out topographic survey for entire proposed area.
- 2 The consultants shall investigate the Hydrology and Sediment Charge of the watershed. Entire catchment and proposed area is un-gauged. As such, neither rainfall nor sediment data for the area is available. Therefore, consultants will use modern techniques of Remote Sensing, GIS and computer aided modeling for reliable estimation of the torrential flow and sediment charge. The nearest available weather station is Mianwali for which the rainfall data can be obtained from concerned department. These data can be utilized after proper interpolation and calibration.
- 3 The consultants shall carryout detailed Topographic Survey and review the existing alignment of Feeder Channel, 1-R and 1-L distributaries, keeping in view the incoming hill torrents and current scenario of land usage.
- 4 The consultants shall investigate existing storage practices of torrential waters in the area, its quantum and utilization by the locals and its impact over the existing as well as proposed channel network.
- 5 The consultants shall investigate the root causes of failure of initial Paikhel Lift Irrigation Scheme.
- 6 The consultants shall investigate and recommend different alternative channel networks, irrespective of the existing infrastructure, to irrigate the proposed area or part thereof. The channel networks must be aligned at the ridge lines of the proposed area as to minimize the requirement of X-Drainage structures. It must not entangle with the natural drainage pattern of the proposed area. Causes of failure of Initial Paikhel Lift Irrigation Scheme and impacts of storage/usage of torrential waters must also be considered while suggesting proposed channel networks.
- 7 The consultants shall present before the client different proposals to irrigate the proposed area or its part thereof for making decision. Every option must the economic analysis, concept design and its feasibility. The consultant will assist the client at different fora for explaining the feasibility of the proposals.

Assignment-B

Depending upon the clients' acceptance or rejection of the proposals for new channel networks, the scope under this assignment is sub-divided into two components:-

1. LIMITED SCOPE:

In case the Client rejects all proposals for a new channel network, Assignment-B would be **limited** to the study of already constructed Paikhel Lift Irrigation Scheme and would continue as follows:

- 1 The consultants shall carryout detailed condition survey of all civil, electrical and mechanical infrastructure of the existing Paikhel Lift Irrigation Scheme.
- 2 The consultants shall carryout detailed Geotechnical investigations along the rout of the existing channel as well as along the possible extension as suggested.
- 3 The consultants shall suggest possible rehabilitation works, Possible extension, suitability of alignment and location with reference to Hydrology and sediment analysis of the torrential flow.
- 4 The consultants shall carryout detailed design of rehabilitation works of all civil, electrical and mechanical components of the existing channel network and shall provide the detailed construction drawings, cost estimate, BOQ and tender documents of each individual structure (Civil, Electrical, Mechanical) involved as per actual site conditions based on detail topographic and condition survey of each individual site and structure. The drawings, designs, specifications, documents, environmental and economic studies should be in accordance with the client's requirements, scope of work and strictly adhering to the rules and instructions of the Irrigation Department, Government of Punjab.
- 5 The consultants shall prepare recommendations of water allowance, irrigation intensity, and cropping pattern; prepare capacity and command statements for the watercourses and channels. Identification of crops suitable for command area; recommend efficient irrigation system models; prepare water balance; collection of agricultural data from primary and secondary resources, and estimation of present agricultural status in the command area and in the adjacent irrigated areas; formulation of agriculture parameters including land-use, cropping pattern, season of crops, quantity of inputs, cultural operations and production of outputs.
- 6 The consultants shall frequently meet with the local population in order to ascertain their demands using focused groups and incorporate their suggestions if possible.
- 7 The consultants shall prepare fresh chakbandi plans for the command area.
- 8 The Consultants shall analyze the hydraulic design of the existing infrastructure to ensure satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water.
- 9 The consultants shall prepare detailed designs and construction drawings of all structures of the project with respect to the approved feasibility study and shall submit along with detailed design calculations (both in hard and soft form along with reference material) for approval by the competent authorities. All observations in this regard shall be diligently addressed by the consultants till approval by the competent authorities.
- 10 The consultants shall carryout hydrological studies including catchment area characteristics, water availability studies, sediment inflow study of hill torrents, and water availability in Thal Canal, water demand and water requirement analysis and mathematical modelling studies etc. for existing Hydraulic structures.
- 11 The consultants shall also evaluate the likelihood of water logging in the command area.
- 12 The consultants will carryout condition survey and analyze all installed machinery as per manufactures' specifications to ascertain its workability and viability / feasibility and recommend for its further usefulness or otherwise.
- 13 The consultants shall prepare draft feasibility report of the project including detailed EIA report, economic and financial analysis, sensitivity analysis to work out the benefits available from project. The report must include all proposals to irrigate the proposed area and the decision made by the client over the proposals. The feasibility report would also include technical / engineering studies, hydraulic, hydrologic, structural, institutional, and economical analysis, environmental and social impact assessments.

- 14 The consultants will assist the client for approval of the draft feasibility report by the competent fora. Once the draft feasibility and EIA reports are approved, the consultant will submit the final version of the reports. They are bound to make amendments / modifications / upgradation of the feasibility report to incorporate the justified observations of the client till final approval of feasibility reports at the competent forum.
- 15 The consultants will engage private revenue experts to facilitate the client in Land acquisition for the project, not limited to the following:
 - a Obtain the revenue record from district administration, Demarcation of land on ground with control points and indicating extent of land to be acquired.
 - b Demarcation of land to be acquired on revenue 'LATHA' and preparation of 'field book' for acquisition of land.
 - c Preparation of case for crop / land compensation.
 - d Preparation of documents for land to be acquired.
 - e Facilitation in publication of notification in official gazette.
 - f Facilitation in mutation of project land in the name of irrigation department.
- 16 Based on the feasibility study, the consultant will frame the PC-I and submit to the client with all relevant drawings and sporting documents, Level books, bench mark register etc. duly stamped with their signatures on hard and soft form. It must include the demarcation of channel and structures with their GPS location, photographs and video clips etc.
- 17 The consultants shall prepare the rate analysis of all non-scheduled items as per procedure and criteria of Finance Department, Government of Punjab.
- 18 Consultant shall prepare technical specification manuals.
- 19 Consultant shall prepare bidding documents, including institutional and implementation arrangements. This includes, among others:
 - a Preparing the detailed design, construction drawings, bills of quantities (BOQ), technical specifications and tender documents for all aspects of the work.
 - b Preparing time bound implementation work plan and bidding documents keeping in view the possible grouping of sub projects for procurement as per PPRA rules.
- 20 The consultants shall prepare criteria of contractor pre-qualification for bid evaluation etc.
- 21 All documents be provided to the client in shape of hard copies & soft editable formats.
- 22 Consultant shall deliver all vehicles, T & P and any other articles purchased during the consultancy to the client when the duration of the consultancy is over.

2. EXTENDED SCOPE:

In case the Client accepts one or more proposals for a new channel network, Assignment-B would be **Extended** to the study of new channel network (or networks), in addition to the Limited Scope as detailed above and would continue as follows:

- 1 The consultants shall carryout detailed design of all civil, electrical and mechanical component of the proposed channel network (or networks) and shall provide the detailed construction drawings, cost estimate, BOQ and tender documents of each individual structures (Civil, Electrical, Mechanical) involved in the proposal or proposals as per actual site conditions based on detail topographic survey of each individual site and structure. The drawings, designs, specifications, documents, environmental and economic studies should be in accordance with the client's requirements, scope of work and strictly adhering to the rules and instructions of the Irrigation Department, Government of Punjab.
- 2 The consultants shall carryout detailed Geotechnical investigations along the rout of the proposed channel network (or networks).

- 3 The consultants shall carryout detail design of rehabilitation works of all civil, electrical and mechanical component of the existing channel network and shall provide the detail construction drawings, cost estimate, BOQ and tender documents of each individual structures (Civil, Electrical, Mechanical) involved as per actual site conditions based on detail topographic and condition survey of each individual site and structure. The drawings, designs, specifications, documents, environmental and economic studies should be in accordance with the client's requirements, scope of work and strictly adhering to the rules and instructions of the Irrigation Department, Government of Punjab.
- 4 The consultants shall prepare recommendations of water allowance, irrigation intensity, and cropping pattern; prepare capacity and command statements for the watercourses, channels, determination or location of each hydraulic structure including outlets, bridges, aqueduct, super passage, syphon etc. Identification of crops suitable for command area; recommend efficient irrigation system models; prepare water balance; collection of agricultural data from primary and secondary resources, and estimation of present agricultural status in the command area and in the adjacent irrigated areas; formulation of agriculture parameters including land-use, cropping pattern, season of crops, quantity of inputs, cultural operations and production of outputs.
- 5 The consultants shall frequently meet with the local population in order to ascertain their demands using focused groups and incorporate their suggestions if possible.
- 6 The consultants shall prepare the chakbandi plans for the proposed channel network or networks.
- 7 The Consultants shall analyze all hydraulic design options for ensuring satisfactory sediment transport and minimizing cost requirements without sacrificing system performance or control required for efficient and equitable distribution of irrigation water.
- 8 The consultants shall prepare detailed designs and construction drawings of all structures of the project with respect to the approved feasibility study and shall submit along with detailed design calculations (both in hard and soft form along with reference material) for approval by the competent authorities. All observations in this regard shall be diligently addressed by the consultants till approval by the competent authorities.
- 9 The Consultants shall Carryout hydrological studies including catchment area characteristics, water availability studies, sediment inflow study of hill torrents, and water availability in Thal Canal, water demand and water requirement analysis and mathematical modelling studies etc. for Hydraulic structures.
- 10 The consultants shall also evaluate the likelihood of water logging in the proposed area.
- 11 The Consultants will carryout condition survey and analyze all installed machinery as per manufactures' specifications to ascertain its workability and viability / feasibility and recommendations for its further usefulness or otherwise.
- 12 The Consultants shall prepare draft feasibility report of the project including detailed EIA report as required under Government regulations, economic and financial analysis, sensitivity analysis to work out the benefits available from project. The report must include different proposals to irrigate the area and would be submitted to client for finalization of suitable proposal. The feasibility reports would also include technical / engineering studies, hydraulic, hydrologic, structural, institutional, and economical analysis, environmental and social impact assessments.
- 13 Once the draft feasibility and EIA report are approved, the consultant will submit the final version of the reports. They are bound to make amendments / modifications / upgradation of the feasibility report to incorporate the justified observations of the client till final approval of feasibility reports at the competent forum.

- 14 The consultants will engage private revenue experts to facilitate the client in Land acquisition for the project, not limited to the following:
 - a Obtain the revenue record from district administration, Demarcation of land on ground with control points and indicating extent of land to be acquired.
 - b Demarcation of land to be acquired on revenue 'LATHA' and preparation of 'field book' for acquisition of land.
 - c Preparation of case for crop / land compensation.
 - d Preparation of documents for land to be acquired.
 - e Facilitation in publication of notification in official gazette.
 - f Facilitation in mutation of project land in the name of irrigation department.
- 15 Based on the feasibility study, the consultant will frame the PC-I and submit to the client with all relevant drawings and sporting documents, Level books, bench mark register etc. duly stamped with their signatures on hard and soft form. It must include the demarcation of channel and structures with their GPS location, photographs and video clips etc.
- 16 The consultants shall prepare the rate analysis of all non-scheduled items as per procedure and criteria of Finance Department, Government of Punjab.
- 17 Consultant shall prepare technical specification manuals.
- 18 Consultant shall prepare bidding documents, including institutional and implementation arrangements. This includes, among others:
 - a Preparing the detailed design, construction drawings, bills of quantities (BOQ), technical specifications and tender documents for all aspects of the work.
 - b Preparing time bound implementation work plan and bidding documents keeping in view the possible grouping of sub projects for procurement as per PPRA rules.
- 19 The consultants shall prepare criteria of contractor pre-qualification for bid evaluation etc.
- 20 All documents be provided to the client in shape of hard copies & soft editable formats.
- 21 Consultant shall deliver all vehicles, T & P and any other articles purchased during the consultancy to the client when the duration of the consultancy is over.

4. REPORTING (DELIVERABLES / TIMELINE):

The consultants will prepare reports as per schedule stated hereunder. Language of reporting will be English and ten (10) copies of each along with a soft copy of the key reports will be provided. Additional, reports may have to be prepared as needed by the project authorities, based on needs.

Sr. No	Activity	Months from date of award.
Assignment - A.		
1	Inception report. It includes the consultant's detailed work program.	0.5 months after award.
2	Progress report.	End of every month.
3	Hydrological Report. Including data collected and its analysis along with the methodology adopted, numerical / mathematical modeling, Remote Sensing data, GIS and computer aided modeling software used for the purpose.	1.5 Months.

4	<p>Topographic Survey. Basic purpose of the required Survey sheets is to decide the new channel network or networks. As such it must be prepared at Specified scale and contour interval clearly indicating the ridges and valleys according to prevailing coordinate system in Pakistan. It includes list of all permanent and temporary Benchmarks, Existing Paikhel Lift Channels, torrential water ways, roads, railway lines, buildings, electric poles and transmission lines, gas and telephone lines, fields, mountains, historical monuments and any other important detail.</p>	1.5 Months.
	<p>Including X-Sections of existing Paikhel Lift Irrigation Scheme, Thal Canal and natural / artificial waterways at 500 ft. interval. It also includes at least one number R.L. value per acre for the purpose of chakbandi.</p>	
5	<p>Sediment Analysis Report. Including data collected and its analysis along with the methodology adopted, numerical / mathematical modeling, Remote Sensing data, GIS and computer aided modeling software used for the purpose.</p>	1.5 Months.
6	<p>Draft Feasibility Report. It includes different feasible alternatives of project along with proposed alignment of channels, proposed structures, command area topography duly supported by contour map of command area in colors indicating CCA to be irrigated through proposed canal system and chakbandi of each proposal, hydrological / sedimentation study, concept hydraulic & structural design and drawings, cost estimates, economic and financial, environmental and social analysis, implementation plan etc.</p>	2 Months.
7	<p>Final Feasibility Report. It would be submitted after approval of the draft feasibility report by the client and must include detailed deliberation regarding all proposals and details of provisions for the adopted proposal as agreed by the client if any. merits and Demerits of every proposal should be clearly indicated. It would include the final decision of the client on the Paikhel Lift Irrigation Scheme.</p>	3 Months.
	<u>Assignment - B.</u>	
8	<p>Agricultural Study Report. It includes existing cropping pattern and prevailing watering practices in the area along with evaluation of Duty, Delta, Base period, Irrigation intensity, water allowance ...etc. for existing as well as new channel network or networks (if any). It also includes chakbandi plans.</p>	3.5 Months
9	<p>Canal System alignment and Layout Report. It includes final alignment of irrigation channel network or networks along with location of allied infrastructure, outlets, offtakes ...etc.</p>	3.5 Months

10	Hydraulic Report. It includes Hydraulic design of all existing and proposed channel network or networks.	4 Months.
11	Land Acquisition and Re-settlement Report.	4 Months.
12	Detailed Structural / Architectural Design including concept, Tender and Construction Drawings. It must include detailed design calculations and developed algorithms for computer software used for design.	5 Months.
13	Detailed Design of Pumping System. It must include detailed design calculations and developed algorithms for computer software used for design.	5 Months.
14	Detailed Engineers Cost Estimate.	5.5 Months.
15	EIA Report.	5.5 Months.
16	Draft PC - I.	5.5 Months.
17	Final PC - I.	6 Months.
18	Final Bidding Documents. It includes prequalification criteria for contractors.	6 Months.

Note:

All designs (civil, electrical & mechanical) must be supported with references material and books. The consultant shall provide copies of reference with the design report and entire data acquired through survey will be the intellectual property of the client *i.e.* Irrigation Department and consultant shall hand over the soft and hard form of the documents to the Client.

TIME DURATION OF PROPOSED CONSULTANCY:-

Time for completion of Feasibility Studies will be over the period of 06 months, which would be financed from Annual Development Program (ADP) Punjab as per allocated funds, including monitoring by P&D department by reviewing and clearing reports at inspection, mid and draft feasibility study stage.

CERTIFICATION:-

The Consultants shall certify the correctness and authenticity of collected data *i.e.* Topographic survey, Geotechnical investigation, Hydrological data and Sediment Analysis for possible further use. These data would form the base of their design and drawings.

ROLE OF CLIENT AGENCY:-

- 1 Client will provide initial data of Project to consultant and shall extend its cooperation / share its experiences for further development.
- 2 The client will supervise field data collection like geological investigation (surface & subsurface), topographic survey, material testing, and topographic survey of all project area. However, the consultants will ascertain needs/scope of field data collection of each torrents
- 3 The client shall conduct regular progress review meetings and iron out problems reported and reviewed in the monthly reports generated by Consultant. The meetings can also be called at the request of the Consultant more frequently, if required.
- 4 The Consultant will coordinate closely with the client and other concerned forums indicated by client in discharging its obligations under the contract.
- 5 The Consultant will coordinate and liaison for all the matters related to the assignment with client personnel nominated in contract as client representative or demanded by the client as project requirement.

CONSULTANTS' TEAMS

ORGANIZATION OF DESIGN TEAM:-

The Consultants will set up a main / design office at Mianwali. This will also be the principal office. The cost of renting, furnishing, equipping and maintaining the office will be included in Consultants financial proposal. The Project Manager / Team leader will be based in Mianwali with overall responsibility for Client liaison on behalf of the Consultants and will be responsible for coordinating the consulting serves. The Consultants would be responsible for establishing, equipping and maintaining the laboratory for testing the desired tests, if considered necessary by the consultants or desired by the clients. The cost of providing, equipping and maintaining the laboratory shall be included in the proposal of the Consultants for inclusion in the Consulting Services Contract.

INDICATIVE STAFFING REQUIREMENTS:-

The Consultants are expected to establish a Design Main office at Mianwali. The strength of staff would depend on extent of work and the complexity of the system on which the team is working at a given time. The Client's indicative estimation of the professional team for feasibility of remodeling / rehabilitation Paikhel Lift Irrigation Scheme elaborated in Table1. However, the prospective consultants should propose their own breakdown of staffing and level of effort staff work based on their own evaluation of the proposed services. The consultants should propose a realistic deployment schedule for all positions depending on work requirements as all positions listed in Table 1 would have inputs for different durations.

It is imperative to mention here that the semi technical level input *i.e.* surveyors, draftsmen, quantity surveyor ...etc. has not been included in summaries of person-months. The perspective consultants should include the cost of semi technical personnel in their financial proposal.

The Duties of Consultants' Key Staff required for feasibility studies as are as follows:-

TEAM LEADER:-

His duties will include but not limited to the following:-

- 1 He will review all relevant documents previously prepared on the Paikhel Lift Irrigation Scheme.
- 2 Assumes overall responsibility for management and supervision of the team for data collection / preparing inventory, identifying the needs, ranking and grouping to form projects, preparing feasibility reports for construction of detailed design & tender documents and timely consultation on design considerations with IA's;
- 3 Provide technical support and guidance in all aspects of the design effort including hydrology, flood routing, physical and mathematical hydraulic modelling, hydraulic design, sediment studies, mechanical considerations, environmental and resettlement plan etc.;
- 4 Take overall responsibility for preparation of the feasibility study and after the finalization of feasibility study report till the start of the project;
- 5 Provide overall direction to all specialists making up the consulting team and appropriately group individuals into work units responsible for a particular study.
- 6 Manage relationships and liaison with client, contractor and the agency.
- 7 Ensure timely delivery and quality control of all required outputs of feasibility studies.
- 8 Prepare detailed, time bound work plans for the design and tendering of all civil works contract packages envisaged for the works assigning various team members to each key task.
- 9 Coordinate and supervise the preparation of tender documents for detailed design and all documents required/desired by the client and construction supervision consultants.
- 10 Report on a regular basis on studies being under taken, design and/or tendering progress to IA's;
- 11 Coordinate and supervise the preparation of tender documents for project;

HYDRAULIC DESIGN ENGINEER:-

His duties will include but not limited to the following:-

- 1 Take the leadership in collecting and organizing all hydrological data and records required for updating the flood frequency analysis of the project.
- 2 Determine routs of hill torrent.
- 3 Carryout mathematical modeler in assessing water levels upstream, downstream and at the site corresponding to floods of various return intervals.
- 4 Organize and supervise topographic surveys levelling, double levelling and any other investigations required / desired to provide necessary input data for hydraulic design of structures and canal / torrents.
- 5 Use mathematical modelling results as appropriate to refine design proposals by simulating the effects of varying design parameters on hydraulic structures/canals
- 6 Analyze hydraulic design options with a view to cost effective rehabilitation.
- 7 Coordinate and supervise detailed design of all hydraulic structures including preparation of conceptual / initial drawings and specifications;
- 8 Undertake the design of rehabilitation and upgrading or replacement works including but not limited to cross / head regulators, level crossings, aqueducts, and syphon's, and bridges and falls, silt control devices for channels etc.
- 9 The conveyance system including the canals, control structures and all associated works will be designed in strict accordance with accepted fundamentals of irrigation science, hydraulics, soil mechanics and structural engineering;
- 10 Analyze all hydraulic design options for cross regulators, Silt Control systems/structure lifting machinery, Pump houses and all hydraulics and flood protection structures etc. required at site.
- 11 Coordinate and supervise the design of canal and associated structures and technical specifications.

STRUCTURAL DESIGN ENGINEER:-

His duties will include but not limited to the following:-

- 1 Supervision of follow-up physical model tests to ensure reliable output;
- 2 Use both physical and mathematical modelling results to refine both design proposals and operating rules;
- 3 Coordinate and supervise detailed design of all hydraulic aspects of the sub projects including preparation of relevant construction drawings and specifications as well as contributing as required to the preparation of the final tender documents.
- 4 Organize and undertake a critical examination targeted to establishing the overall structural and geotechnical (foundation) integrity of the structures to be rehabilitated and upgraded, identifying all remedial works required.
- 5 Organize, supervise and carry-out all investigations deemed necessary for structural aspects of all features to be included in the rehabilitation and upgrading package for each of the structure.
- 6 Analyze structural design options for all features to be rehabilitated with a view to cost-effective, but sustainable rehabilitation.
- 7 Coordinate, supervise and undertake preparation of structural design and technical specifications.
- 8 Organize and undertake a critical examination targeted to establish the overall structural integrity for major main canal structures to be maintained and/or rehabilitated identifying all remedial works required.
- 9 Organize, supervise and carry-out any additional investigations deemed necessary for structural aspects of all the structures.

MECHANICAL ENGINEER:-

His duties will include but not limited to the following:-

- 1 Organize, coordinate and carry out a detailed inspection of lift irrigation machinery already installed at each pumping station keeping in view the working of turbine pumps.
- 2 Design of pumping system for new channel network or networks.
- 3 Preparation of operation and maintenance manual for Lifting Machinery and gates of all the structures involved in the remodeling / rehabilitation of subject channel of project.
- 4 Coordinate and supervise detailed design of all mechanical and electrical aspects of the rehabilitation/replacing work required at site for the Lift Irrigation Scheme as desired by the clients.
- 5 Organize, supervise and carry-out any additional investigations deemed necessary for structural aspects of all the structures.
- 6 Design of gates and gearings.

HYDROLOGIST:-

His duties will include but not limited to the following:-

- 1 Take the leadership in collecting and organizing all hydrological data and records required for updating the flood frequency analysis of the selected streams.
- 2 Delineate the catchment area of torrent site.
- 3 Determinate catchment area characteristics.
- 4 Determinate water availability, flood frequency, peak flood discharges etc.
- 5 Using all available data, simulations and comparisons with like situations in other river basins, update and/or prepare a detailed and refined flood frequency analysis at the streams and comprehensive hydrographs of flood events for all return frequencies required by the principal hydraulic engineer and both the physical and mathematical modelers.
- 6 Carryout mathematical modeler in assessing water levels upstream, downstream and at the site corresponding to floods of various return intervals.

GEOTECHNICAL ENGINEER:-

His duties will include but not limited to the following:-

- 1 Monitor the subsurface geological investigation and provide necessary guidance in field data collection.
- 2 Formulate plans for and carry out detailed foundation investigations for each of the new works.
- 3 Supervise the work of the sub-contracted drilling, sampling and testing services to ensure compliance with best geotechnical practice.
- 4 Subsequent to the required sub-surface investigations and required laboratory testing, work with the Senior Structural Engineer in preparing detailed designs and specifications for the foundation treatment/features of the Project and any identified remedial work if required.
- 5 Assist in the preparation of the tender documents as required.
- 6 Organize, supervise and carry-out any additional investigations deemed necessary for structural aspects of all the structures.

PROCUREMENT AND CONTRACTS/ COST ENGINEER:-

His duties will include but not limited to the following:-

- 1 In consultation with IA's, develop the prequalification criteria, prepare notices of pre-qualification and prequalification documents in accordance with PPRA procedures.
- 2 Under the direction of the Project Manager/Team Leader and using input from various specialists on the team prepare the international / national bidding documents for the project, and in a format agreeable to both IA's.
- 3 Advise on the conducting of required pre-bid consultations.

GIS SPECIALIST:-

His duties will include but not limited to the following:-

- 1 Create maps and graphs, using GIS software and data collection equipment.

- 2 Perform research to obtain and expand existing datasets.
- 3 Collect and report on GIS data and determine how data sets are best utilized through GIS.
- 4 Compile geographic and demographic data from many sources.
- 5 Consult with external stakeholders to access censuses, fieldwork, satellite and aerial imagery, and maps.
- 6 Compile data for statistics to incorporate into documents and reports.
- 7 Build, manipulate, and update databases.
- 8 Enter new map data using cartographic principles.
- 9 Analyze and model relationships between geographic data sets.
- 10 Operate and maintain GIS system hardware, software, and peripherals.
- 11 Present information to clients and stakeholders in verbal or written format.

ECONOMIST:-

His duties will include but not limited to the following:-

- 1 Using input from various specialists on the team develop detailed feasibility level cost estimate for the different alternatives using different analysis techniques ensuring that all input and output can be used by government agencies in appraisal and by the Government of Punjab in PCI preparation.
- 2 From the detailed cost tables identify all costs directly related to generating “with-project” benefits.
- 3 Working with the costing engineer, identify and quantify the estimated benefits resulting from the investments including the benefits associated with reduced risk of infrastructure failure and the associated interruptions in domestic water supply as well as the raw water and treated water supply to the city area, within the relevant effective water supplies to city area and effect of population with improved, more efficient, dependable and equitable delivery of water.
- 4 Undertake detailed economic analysis of the project for Economic Analysis ensuring that it meets the viability requirements of both donor agencies and the Government of Punjab.

ELECTRICAL ENGINEER:-

His duties will include but not limited to the following:-

- 1 Organize, coordinate and carry out a detailed inspection of lift irrigation machinery already installed at each pumping station keeping in view the working of turbine pumps.
- 2 Design of power system pumping stations for new channel network or networks.
- 3 Preparation of operation and maintenance manual for all electrical installations.
- 4 Coordinate and supervise detailed design of all mechanical and electrical aspects of the rehabilitation/replacing work required at site for the Lift Irrigation Scheme as desired by the clients.
- 5 Organize, supervise and carry-out any additional investigations deemed necessary for structural aspects of all the structures.
- 6 Design of gates and gearings.

AGRONOMIST:-

His duties will include but not limited to the following:-

- 1 Comprehensive survey and study on the prevailing agricultural practices in the area.
- 2 Evaluation of water duty, delta, water allowance, irrigation intensity ...etc.

SEDIMENT MODELING SPECIALIST:-

His duties will include but not limited to the following:-

- 1 Collecting and organizing all hydrological and sediment data required for sedimentation behavior in the area
- 2 Determinate catchment area characteristics.

- 3 Using all available data, simulations and comparisons with like situations in other river basins, update and/or prepare a detailed and refined sedimentation / erosion analysis in the streams required by the principal hydraulic engineer for both the physical and mathematical modelers.
- 4 Carryout mathematical modeler in assessing water levels upstream, downstream and at the site corresponding to floods of various return intervals with respect to different sedimentation scenarios.

JUNIOR ENGINEERS:-

In general, they will assist all senior engineer in performing their role for the study.

SOCIOLOGIST:-

His duties will include but not limited to Study for Socio-economic status of the localities and their behavior against Re-settlement.

AUTO CAD OPERATOR:-

His duties will include but not limited to Assist in the preparation of the drawing and survey sheets as required.

COMPUTER OPERATOR:-

His duties will include but not limited to Assist in the carrying out all activities relating to drafting of documents on computer and running of computer models.

PATWARI:-

His duties will include but not limited to the following:-

- 1 Preparation of land acquisition documents.
- 2 Preparation of re-settlement plans and chakbandi.

GARDAWAR:-

His duties will include but not limited to the following:-

- 1 Preparation of land acquisition documents.
- 2 Preparation of re-settlement plans and chakbandi.

Sub Divisional Officer

Isakhel Sub Division
Daudkhel, Mianwali

Executive Engineer

Kalabagh Headworks Division
Daudkhel, Mianwali

TABLE 1: Consultant's Project Team

Sr. No.	Position	Qualification	Overall Experience (Years)	Job Specific Experience (Years)
1	Team Leader / Project Manager	MSc Engineering/ Master/ M.Phil. or equivalent Degree in relevant subject	22	18 Years' Experience in designing, planning and construction supervision of major irrigation sector projects.
2	Principal Hydraulic Design Engineer	MSc Engineering/ Master/ M.Phil. or equivalent Degree in relevant subject	17	15 Years' experience in design of major Hydraulic Structures.
3	Principal Structural Design Engineer	MSc Engineering/ Master/ M.Phil. or equivalent Degree in relevant subject	17	15 Years' experience in design of major Hydraulic Structures.
4	Principle Hydrologist	MSc Engineering/ Master/ M.Phil. or equivalent Degree in relevant subject	17	15 Years' Experience in planning of watershed and catchments of major rivers. Knowledge of computer aided hydrological modeling is must.
5	Senior Mechanical Engineer	BSc Engineering.	15	10 Years' experience of pumping system design.
6	Principal Geotechnical Engineer	MSc Engineering/ Master/ M.Phil. or equivalent Degree in relevant subject	17	10 Years' Experience in geotechnical investigations of hilly areas.
7	Principal Procurement and Contracts Engineer	BSc Engineering.	17	10 Years' experience of contracts administration. Knowledge of PPRA rules is must.
8	Senior GIS Specialist	Master/ M.Phil. or equivalent Degree in relevant subject	15	10 Years' Experience in the field of Hydrology and Sediment Analysis or similar fields.
9	Senior Economist	Master/ M.Phil. or equivalent Degree in relevant subject	15	10 Years' experience of economical and financial analysis of Construction Projects.
10	Senior Electrical Engineer	BSc Engineering.	15	10 Years' experience of pumping system design.
11	Senior Agronomist	Master/ M.Phil. or equivalent Degree in relevant subject	10	05 Years' experience in related field.
12	Principal Sediment Specialist	MSc Engineering/ Master/ M.Phil. or equivalent Degree in relevant subject	17	15 Years' Experience in planning of watershed and catchments of major rivers. Knowledge of computer aided hydrological modeling is must.

13	Junior Engineer	BSc Engineering.	5	02 Years' experience of design and construction of any civil engineering project.
14	Sociologist	Master/ M.Phil. or equivalent Degree in relevant subject	5	02 Years' experience in re-settlement and related field.
15	AutoCAD Operator	Draftsman 2 years' in Civil Technology with Auto cad / relevant field.	10	05 Years' experience in civil engineering projects.
16	Computer operator	One Year Diploma of Computer Operator and Auto cad Operator 2D/3D/3D max in relevant field.	10	05 Years' experience in office work.
17	Patwari	Diploma of Patwari from Irrigation / Revenue Department	20	15 Years' experience in Land Acquisition and resettlement.
18	Gardawar	Diploma of Patwari from Irrigation / Revenue Department	20	15 Years' experience in Land Acquisition and resettlement.

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