SMALL DAMS ORGANIZATION
IRRIGATION AND POWER DEPARTMENT
GOVERNMENT OF NWFP, PESHAWAR

01C

FINAL

Feasibility Report
Shah Kaleem Dam

Package -F

Volume - II

April 2009

Consulting Associates (Pvt.) Ltd. Peshawar

Ca-28/E Syed Jamal-u-Din Afghani Road, University Town,
Peshawar. Tel: 091-5701774, Fax: 091-5701775

CONSULTING ASSOCIATES

Consulting Engineers & Project Planners

CA No. 28-E, Syyed Jamal-ud-Din Afghani Road, University Town, Peshawar.
Ph: 091-5701774, Fax: 091-5701775, E-mail: consultingasso@yahoo.com

Ref. No. CA-862 Date 08-04-09

The Director
Small Dams Organization
Irrigation & Power Department
Canal Road University Town
Peshawar.

Subject: **Consultancy Services for Feasibility Study, Detailed Design and Construction Supervision of (Package – F) Shah Kaleem Dam District Nowshera.**

Dear Sir,

In pursuance to Clause 2.4.1 (Appendix B) of Special Conditions of Consultancy Agreement, we are pleased to submit herewith (3 copies) of "Draft Feasibility Report of Shah Kaleem Dam District Nowshera, each comprising of Volume I & II.

We look forward for your valuable suggestions/Comments on the report.

Sincerely Yours,

Farid Khan Wazir

Project Manager (Package – F)
Consulting associates,
Peshawar.

Copy:

1. Director General Small Dam Organization.
2. Deputy Directors Planning Small Dam Organization.

TABLE OF CONTENTS

SMALL DAMS ORGANIZATION, N.W.F.P.

SHAH KALEEM DAM PROJECT (PACKAGE-F)

FEASIBILITY STUDY REPORT

VOLUME-II

UNITS AND CONVERSIONS

Length

Units: meter: m; foot: ft: inch

Conversions:

1 m = 100 cm =3.28 ft	1 ft = 30.48 cm = 0.3048 m
1 cm = 0.39 inch	1 inch = 2.54 cm
1 km = 0.6214 mile	1 mile = 1.609 km

Area

Units: square meter; $m^{2;}$ hectare: ha; square foot: $ft^{2;\ acre}$

Conversions:

1 m^2 = 10.76 ft^2		1ft^2 = 0.093 m^2
1 ha = 10,000 m^2	2.47 acres	= 107,573 ft^2
1 acre = 0.4046 ha	4046 m^2	= 43, 52 ft^2
1 KM = 0.3861 $mile^2$		1 $mile^2$ = 2.5889 km^2

Volume

Units: cubic meter: m^3; liter: 1; cubic foot: ft^3; (US) gallon: gal; acre foot

Conversions:

1 m^3 = 10001	= 260 gal	1gal = 3.791 = 0.00379 m^3
1 Mm^3 106^6 m^3	=	811.7 acre feet

1 acre foot = 43,552 ft^3 = 1232 m^3

Time

Units: year: yr; day: d; hour: h; minute min: second: s;

Conversions:

1 yr = 365 d = 8760 h = 525,600 min = 31.563 x 10^3 s

1 d = 1440 min = 86400 s

Flow rate

Units: cubic meter per hour: m^3 / h; liter per second: 1/s; (US) gallon per minute: gpm; cubic feet per second: ft^3 /s or cusec; acre feet per year: acre feet/yr

Conversions:

1 m^3 /h = 0.277 1/s = 4.405 gpm = 0.00970 ft^3 /s or cusec

1 gpm = 0.27 m^3 /h

1 cusec = 101.9 m^3/h (appr.100 m/h) = 0.893 Mm^3 /yr
= 724.8 acre feet/ yr

UNITS

mm	:	millimeter
cm	:	centimeter
m	:	meter
km	:	kilometer
ft	:	feet
sq.m(m)	:	square meter
sq.km(km)	:	square kilometer
sq.mile	:	square mile
acre	:	acre
ha	:	hectare
cum(m)	:	cubic meter
MCM	:	million cubic meter
MAF	:	million acre feet
Kg	:	kilogram
t (ton)	:	1.000kg
Lbs/ft	:	pound per cubic feet (=16.0185 kg/m)
Sec(s)	:	second
hr	:	hour
cms	:	centimeter per second
m/s	:	meter per second
cum.s(cum/s,m/s)	:	cubic meter per second (=35.315 cfs)
susec (cfs)	:	cubic feet per second (=28.310 liters per second)
l/s	:	liter per second
Kc	:	Crop Coefficient
RD	:	Reduced Distance
WL	:	Water Level

ABBREVIATIONS

ADB	:	Asian Development Bank
ARI	:	Agricultural Research Institute
B/C (Ratio)	:	Benefit Cost Ratio
CBA	:	Cost Benefit Analysis
CEA	:	Cost Effectiveness Analysis
CF	:	Cash Flow
CAD	:	Command Area Development
CCA	:	Cultivable Command Area
EIA	:	Environmental Impact Assessment
EUP	:	Engineering University Peshawar.
EIA	:	Environmental Impact Assessment
EPA	:	Environmental Protection Agency
ETo	:	Electrical Evapotranspiration
ETpan	:	Pan Evaprtranspirtration
EC	:	Electrical Conductivity
EIRR	:	Economic Internal Rate of Return
FATA	:	Federally Administrative Tribal Area
GIS	:	Geographical Information System
GOP	:	Government of Pakistan
GCA	:	Gross Command Area
GCA	:	Gross Command Area
GDP	:	Gross Domestic Product
GVA	:	Gross Value Added
IEE	:	Initial Environmental Examination
ID	:	Irrigation Department
IRSA	:	Indus River System Authority
IBRD	:	International Bank for Reconstruction and Development (World Bank Group)
IDA	:	International Development Association (World Bank Group)
IRR	:	Internal Rate of Return
NGO	:	Non Governmental Organisation
NPV	:	Net Present Value
NWFP	:	North West Frontier Province
NGO	:	Non- Government Organization
NPV	:	Net Present Value
O&M	:	Operation and maintenance
OFWM	:	On-Farm Water Management
O&M	:	Operation & Maintenance
OMC	:	Optimum Moisture Content
PARC	:	Pakistan Agricultural Research Council
PEPA	:	Pakistan Environmental Protection Agency
RDD	:	Rural Development Department

SDO	:	Small Dams Organization
TOR	:	Terms of Reference
USAID	:	United States Agency for International Development
WHO	:	World Health Organisation
WMO	:	World Meteorological Organisation
WAPDA	:	Water and Power Development Authority

CHAPTER

08

CONSTRUCTION PLANNING

CONSTRUCTION PLANNING

Table of Contents

CHAPTER- 8
CONSTRUCTION PLANNING

8.1 General

Shah Kaleem Dam project includes the construction of main Dam, Spillway; an out let structure and the irrigation system. These components can be taken up independently at the same time splitting the activities in two construction stages, as these do not interfere with each other: and also some of the works if taken up earlier will provide additional benefits.

The construction activities have broadly been divided into the following two stages.

S.NO	Stages	Description
1	Stage-1	Excavation of the main dam trench on their side of the nullah, spillway, outlet structure and irrigation and system. Backing of the core trench, filling of upstream and downstream slopes on either sides of the main nullah, Ensuring completion of encasement, Reinforcement, and concerning of outlet structure, concerting and Reinforcement of intake structure at the end of this stages, Completion of Excavation of spillway and 65% of its Excavation and Brickwork of irrigation System.
2	Stage-2	Plugging of main nullah by construction of cofferdam 6 months, which will later on merge in the main dam as part of the shall material. Excavation of core trench in nullah section and Continuation of filling on remaining portion of Main Dam (in main nullah portion) and completion of spillway, along with the irrigation system.

The staged construction program including Nullah diversion is discussed briefly in the following paragraphs.

8.1.1 STAGE -1

During the first stages of the diversion scheme of shah kallem project we will start with the excavation of main dam core trench on either sides of the nullah.

After excavation of the core Trench, Backfilling of the core Trench with core material will be started and at the same time placement and compaction of fill material would follow immediately get started on up stream and down stream slopes of the main dam on either side of the main nullah. The flood routing studies carried out indicates that the main nullah channel can safely cater the desired (which is the maximum flood of 20 years return period)

The excavation and subsequent construction of the spillway and the outlet structure started can independently be carried out without any hindrance, on the right and left abutments respectively in view if the higher topography at these areas. The construction of irrigation system will continue in this stage also.

The construction of the outlet structure, filling of the main dam embankment to considerable height on either of the main nullah channel however should be ensured by the end of stage –1 so that is can be used for diversion purposes in the subsequent stage of construction. All other activities would be carried out in the wet period without any hindrance.

8.1.2 STAGE –2

In stage –2 of the diversion scheme, the construction activities would continue, at this stage, a coffer dam will be constructed to divert the flows of main nullah through outlet structure I-e is well above the intake level of the dam.

In this stage of the diversion scheme construction of the remaining portion of the main dam trench will be stated after completion of the cofferdam and filling and compaction of the different fill materials will be started simultaneously in the main nullah portion.

After completion of the main dam the cofferdam constructed in this stage will be merged in the main dam body as fill, material. The construction of spillway and irrigation system shall be ensured to be completed at the end of second year of the project.

CHAPTER

9

SOIL STUDIES

SOIL STUDIES

Table of Contents

CHAPTER- 9
SOIL STUDIES

9.1 BACKGROUND

The guidelines contained in the TOR concerning the subject matter stipulate as under:

"Soil survey to Asses production potential and to select as much irrigable land as is economically viable and ecologically suitable for improvement/ development".

It has served as a basis for the preparation of this study. It covers the soil characteristics and limitations for agricultural development.The report is focused to assess the potential of the soil in the command area of the dam..

The soil fertility is in fact the relationship between the soil and crop growth. A soil may be fertile for one crop and not for other. It is measured in terms of the amount of the available forms of the essential nutrient elements in the soil at any given time. Soil fertility plays an important role in crop production to fulfil the needs of our growing population ad to provide raw material for the industrial sector of the country. This can be achieved by a detail soil survey to identify the soil series and soil capability classes and sub classes. Collecting soil samples from different places of the command area will carry out the fertility evaluation of the soil.

9.2 MATERIAL AND METHODS

Soil samples from six different locations (in command area) were collected from three different depths, i.e. 0-5, 15 30 and 30-45 cm depth. The number of soil samples collection was based on the variation in Phypsographic position of the soil and soil vegetative cover. In addition to the six soil samples (collected for fertility evaluation), 20 sub samples from the profiles were collected for soil classification purpose. Soil samples collected were analyzed for soil texture, pH, electrical conductivity, lime content, organic matter, SAR, major elements N, P and K by following standards procedures for the assessment of the above parameters.

9.3 PROCEDURE FOR SOIL SAMPLING

The area, topographically a piedmont, was surveyed. Soil samples were taken from areas potentially suitable for field crops and orchard plantation keeping in

view in view the color of soil, sloppiness and presence of vegetation. The soil samples were collected with the help of auger from three depths i.e., o- 15, 15-30 and 30-45 cm, from six different locations. Five ton six sub samples were taken from each section and composite samples were prepared. About one kilogram of samples was packed in a plastic bag. The bags were numbered and brought to the soil science department, N.W.F.P Agriculture University Peshawar. Water samples from open drain, tube well and shallow water well (dug well) was also collected in clean plastic bottles. The bottles were rinsed with the water first and than filled with the sample.

KPK

9.4 HANDLING OF SOIL SAMLES:

The soil and water samples collected were brought to the laboratory and the soil samples were spread out in the plastic sheet tray for air-drying. T3eh samples were dried at room temperature for 3-4 days, grinded, sieved and stored for analysis of different soil properties.

9.5 SOIL ANALYSIS:

The processed soil samples were analyzed for physio-chemical properties. The detail is as under.

9.5.1 Soil Texture

Soil texture was determined by hydrometer method(Gee and Bouder 1986).

9.5.2 Soil pH

The pH was determined in soil saturation extract by using pH meter. The pH meter was calibrated with buffers of 4.0 and 9.25(McLean 19820).

9.5.3 Electrical Conductivity (EC)

Electrical Conductivity of the saturated extract was determined with the help of EC meter (Richards, 1954).

9.5.4 Lime Content

A 10g soil treated with 0.5N HCL and back titrated with 0.25 N NaOH, using phenolphthalein as an indicator (Richards, 1954).

9.5.5 Organic Matter

One-gram soil was treated with 10 mL of $K_2Cr_2O_7$. A 20 mL of H_2SO_4 (Conc.) was added to it and cooled, 200mL of distilled water was added, filtered and 2-3 drops of ortho-phenanthroline indicator was added to it and titrated against 0.5N $FeSO_4$. A blank titration was also run at the same time (Nelson Sommer, 1982).

9.5.6 Total Nitrogen

Total Nitrogen is determined by Kjeldahl Apparatus. In this method, 0.2g of soil sample was digested with 3ml of conc. H_2SO_4 in the presence of digestion mixture on a digestion rack for about 3 hours. The whole digest was then distilled with 4mL of 40% NaOH solution in to 5 mL of boric acid mixed indicator solution. (Bremmer and Mulvaney, 1982). The distillate was titrated against the standard 0.005M HCL and the amount of N Calculated as;

$$\%N = \frac{(\text{HCL used-Blank}) \times 0.014 \times \text{dilution factor} \times 100}{\text{Weight of soil} \times \text{volume taken}}$$

9.5.7 AB-DTPA Extractable Phosphorus

A 10 g air dried soil sample was mixed with 20 mL AB-DTPA extracting solution (pH=7.6). the soil mixture was shaken for 1 hour and filtered through Watman No 42 filter paper. The extracts were collected in the extracting bottles. Then 1mL of aliquot was mixed with 4 mL of reagent B (Ascarbic acid) and raised the volume up to 25 mL.

Standard solutions were made according to the above procedure but without samples. For the water samples, 5mL aliquot was mixed with 4 ml of reagent B {Ascorbic acid) and the volume rises to 25 mL. The P concentration WES determined by spectrophotometer using required standard solutions (Soltanpour and Schawab 1978).

9.5.8 Water soluble K and Na

The potassium and sodium in soil were determined in the extract (already prepared for pH and EC) by fiame photometer using the required standard solution {Richard, 1954).

9.5.9 Ca+Mg

Ca + Mg (meq L"1) was determined in soil saturated extract. One ml of saturated extract was taken in a 50 ml beaker. 0.5 ml (10 drops) of Ammonium Chloride-Ammonium hydroxide buffer solution was added. 3 to 4 drops of Erichrome black indicator was added. This was then titrated against 0.01 N EDTA using 10 ml micro burette. The color change was from wine red to blue (Richard 1954).

Calculations;

Ca + Mg meq L'1 = ml of EDTA used X N of EDTA X 1000

mL of extract used.

9.5.10 Water Quality

The water quality assessment for its suitability to agriculture purposes were made by collecting both surface and underground water samples and were analyzed for pH, EC, Na, K, Cap Mg and SAR,

9.6 RESULTS

The results of soil samples collected have been summarized in Tables 1 to 4 and discussed below:

9.6.1 Soil Texture:

The results of different soil separates along with soil texture are given in Table 1. Sand and silt content were the predominant soil separate while clay content was less than 20 %. Sandy loam was the major soil textural class followed by silt loam. There were abundant cobbles and boulders in the profile.

Table 1: Soil Textural classes

Sample No.	Depth	% Sand	% Silt	%Clay	Textural Class
1	0-15	32.8	57.4	9.8	Silt Loam
	15-30	24.2	65.7	10.1	Silt Loam
	30-45	22.5	59.49	18.1	Silt Loam
2	0-15	76.8	17.1	6.1	Sandy Loam
	15-30	74.8	17.1	8.1	Sandy Loam
	30-45	69.1	24.8	6.1	Sandy Loam
3	0-15	31.1	58,8	10.1	Silt Loam
	15-30	24.8	59.1	16.1	Silt Loam
	30-45	28.5	61.4	10.1	Silt Loam
4	0-15	72.8	20.8	6.4	Sandy Loam
	15-30	66.5	26.3	7.2	Sandy Loam
	30-45	66.5	28.3	5.2	Sandy Loam
5	0-15	53.1	37.4	9.5	Loam
	15-30	49.1	39.4	11.5	Silt Loam
	30-45	65.1	25.4	9.5	Sandy Loam
6	0-15	74.55	17.95	7.5	Sandy Loam
	15-30	53.1	39.4	7.5	Loam
	30-45	55.1	37.4	7.5	Sandy Loam

9.6.2 Soil pH:

The pH of the samples ranged from 7.49 to 8.41 with mean value 8.06. The result (Table 2) showed that all the samples were slight to moderately alkaline in reaction. There were less variation in soil pH with depth, being comparatively lower values on the surface and high values in subsurface soils. The reason of higher pH may be associated with sever erosion and less organic matter content and the arid environment whereby the rate of organic matter addition is higher than decomposition. Similar results were eported by Rafiq (1970), and Bhatti (1994)

9.6.3 Electrical Conductivity (EC):

The EC ranged from 0.22 to 1.45 dS m-1 with mean value of 0.66 dS m"1 which shows that salinity is in the normal range and will be no problem in the near future (Table 2). This is because of the coarser texture of soil that allows the salts to leach or washed away with the floodwaters. These results are similar to the finding of Raymond et al.

(1982).

9.6.4 Sodium Absorption ratio (SAR)

The SAR values ranged from 5.36 to 15.54 with an over all mean value of 8.94 (Table 2).'According to the criteria of Richard (1954), only sample no 5 was having high SAR and thus qualify to be a sodic soil while rest of the samples were in non sodic. The high SAR may be associated with low soluble salts content and comparatively more clay content in the profile.

9.6.5 Lime (CaCO3)

The lime content varied from 3.55 to 22.17% with mean value of 9.93% (Table 3). The lime content was high in sample 3 while rest of the samples was moderately calcareous. In sample 3 there were visible tubules of CaCOa that was in uncultivated barren soils, tubules. There was negligible variation in lime content with respect to depth,

The moderate to high calcareousness may be associated with the parent material in the area, scarcity of water and high temperature, which are conducive to calcification process,

9.6.6 Organic Matter

The organic matter content ranged from 0.21 to 1.44 with mean value of 0.97%. Organic matter content can be characterized as low (Table, 3). This may be because of scarcity of vegetation arising from unavailability of water. Apart from this, the washing away of the topsoil that normally contains organic matter may also be the reason for low organic matter content. The results are same as found by Bhatti (1994).

Table 2: Soil pH, EC and SAR

Sample No.	Depth (cm)	PH	EC dSm^{-1}	SAR
1	0-15	7.49	0.865	8.70
	15-30	7.89	0.683	9.24
	30-45	7.82	0.638	9.02
Mean X		7.73	0.729	8.987
2	0-15	8.30	0.634	7.95
	15-30	8.07	0.858	9.46
	30-45	7.82	0.788	9.12
Mean X		8.06	0.76	8.84
3	0-15	8.21	0.481	7.28
	15-30	8.27	0.458	7.61
	30-45	8.06	0.430	7.83
Mean X		8.18	0.456	7.573
4	0-15	8.05	1.450	15.54
	15-30	7.91	0.30	14,63
	30-45	7.79	0.22	9.12

Mean X		7.92 7.936	0.66 0.763	13.097
5	0-15	8.21 8.26	0.593 0.601	5.49 5.81
	15-30	8.15 7.99	0.606 0.598	8.69 9.01
	30-45	8.41 8.53	0.555 0.552	11.36 10.83
Mean X		8.26 8.29	0.585 0.40	8.51 8.55
6	0-15	8.38	0.561	8.92
	15-30	8.07	0.492	5,65
	30-45	8.21	0.586	5.36
MeanX		8.22	0.546	6.64
Grand Mean X		8.06	0.596	8.94

Copy X
Table - 3

Table 3:SelectedPhysico-chemical characteristics of Shahkaleem Command soil

Sample No.	Depth (cm)	Lime content (%)	Organic matter (%)	Total Nitrogen (%)	ABDTPA-Ext P ($mgKg^{-1}$)	K ($MgKg^{-1}$)
1	0-15	10.33 9.98	1.40 1.39	0.096 0.10	0.725-1.45	119.03
	15-30	11.56 10.96	1.30 1.87	0.07 0.06	0.225-0.45	96.63
	30-45	10.75 11.21	1.36 1.68	0.06 0.059	0.125-0.25	86.43
Mean X		10.88 10.72	1.353 1.646	0.0753 0.073	0.358	100.69
2	0-15	3.55	0.21	0.07	0.525	112.13
	15-30	4.15	0.52	0.00	0.525	88.53
	30-45	3.99	0.63	0.01	0.5	58.63
Mean X		3.896	0.453	0.027	0.516	85.76
3	0-15	22.14	0.63	0.06	0.45	114.03
	15-30	21.91	0.62	0.14	0.3	67.63
	30-45	22.17	0.73	0.08	0.2	75.53

Mean X		22.07	0.66	0.093	0.317	65.73
4	0-15	5.63	0.73	0.05	4.125	76.73
	15-30	5.39	0.88	0.06	3.625	103.33
	30-45	5.81	0.52	0.12	3.3	79.83
Mean X		5.61	0.71	0.077	3.68	86.63
5	0-15	6.98	1.00	0.15	0.825	110.33
	15-30	6.54	1.30	0.14	0.3	57.53
	30-45	6.10	1.36	0.13	0.2	128.13
Mean X		6.54	1.247	0.14	0.44	98.66
6	0-15	11.06	1.38	0.19	0.375	110.63
	15-30	10.57	1.44	0.14	0.5	97.83
	30-45	10.12	1.44	0.13	0.25	99.73
Mean X		10.58	1.42	0.15	0.375	102.73
Grand Mean X		9.93	0.97	0.095	0.95	90.03

9.6.7 Total Nitrogen

The total nitrogen ranged from 0 to 0,19% with mean value of 0.095 %. As there is inadequate organic matter in the soil, therefore, the amount of total nitrogen is low. Also since there is more runoff and leaching, the nitrogen does not stay in the soil. The soil may need N-fertilizers if grown with field crops after the establishment of irrigation system (after completion of the project)

9.6.8 Available P and K

The AB-DTPA extractable P and water soluble K ranged from 0.13 to 4.13 mg Kg'1 and 58.63 to 119.03 mg Kg"1 with an overall mean of 0.95 and 90.03 mg Kg"'1 respectively. Potassium is moderate to adequate for most of agricultural crops and none of the sample was found deficient while P content is deficient in all the samples. The adequate level of K is because of the parent material enriched with K minerals while the deficiency of P may be associated with the severe erosion of surface soils and scarcity of vegetation and low organic matter content of soil.

9.6.9 Water Sample

The results of water analysis collected from three different sources are given in Table 4. The results of water samples showed that all the samples were suitable for both irrigation and drinking purposes.

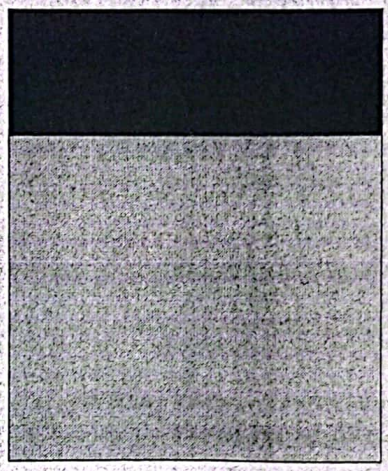
According to the criteria set by Ayers and Westcot (1985). From the values of EC and the soil texture, it cane safely be concluded that there is less likelihood of the development of salinity problems in the command area after the completion of the project.

Table 4: Selected properties of water

Sr. No.	Parameters	Dug well	Tube-well	Open Drain
1	ECdSm-1	0.628	0.689	0.302
2	Ph	7.21	7.08	7.38
3	Ca+Mg (mgKg-1)	10.94	9.06	12.97
4	KmgKg-1	24.03	33.93	19.03
5	Na mg/L-1	35.45	23.35	7.35
6	SAR	10.74	7.78	2.04

9.7 OVER VIEW OF THE STUDY

Site-specific information's regarding the nutrient status of soil and its potential for agriculture is important for planning irrigation schemes. The present investigation was carried out to know the fertility status and the land capability potential of the proposed small dam. Laboratory investigations of the soil samples collected from different location of the command area of Shah kaleem small Dam, Cherat, showed that the soil is barren due to unavailability of water and at present it is a poor grazing land. The inherited fertility with respect to major nutrient is very low. Both N and P are present in limiting concentration while K is present in moderate to adequate level. Salinity is not a problem while only one sample has high SAR. The pH of all the samples was alkaline in reaction (mean 8.06). All the soils of the study area were calcareous in nature and thus may pose potential problem in phosphorous and macronutrients availability to plants. The texture class ranged from loam, in some areas, to sandy loam. The organic matter content was less than adequate. With the sloping and .uneven terrain and the presence of abundant gravels in the soil, it is fit for orchard plantation specifically for citrus, guava and persimmon as these needs well drain soils provided water availability is insured. After establishment of irrigation system, the ysicochemical properties of the soil will be improved by the addition of organic matter through the cultivation of crop plants. Erosion is severe problem and the command area will need precise land leveling. The water quality (subsurface) of the catchments and command area is suitable for both irrigation and drinking purposes.



ANNEXURE

Annexure-1:

Sample 1:

Location:	Shahkaleem khwar
Farmer name:	Gull zaman
Cropping history:	Wheat, sorghum
Pert history:	Urea only.
Irrig:	Spring channel.
Land holding:	Cultivated 4 jareeb
	Uncultivated 25 Jareeb
Production:	70 monds (from these 8 Jareeb}
Phone number:	0932-655423

Annexure 2:

Sample 2:

Location:	Sheikh Baborbaba
Land type:	Communal
Cropping pattern:	Grazing land
Irrigation:	Nil, rainfall.
Fertilizer:	Nil

Annexure 3:

Sample 3:

Location:	Shahkaleem small dam area, East side of mountain, ~~North of Ziarat~~
Land type:	Communal land
Cropping Pattern:	Grazing land cropping history: Nil
Vegetation:	Grass, bushes {Acacia Nilotiza)

Annexure 4:

Sample 4:

Location:	Across the Shahkaleem khwar
Land type:	Communal land
Cropping Pattern:	Grazing land
Vegetation:	Scantly grasses

Annexure 5:

Sample 5:

Location:	Command area
Farmer Name:	Khaista Khan
Cropping History:	Wheat and Vegetables
Fertilizer History:	Desi
Irrigation:	Barani
Land Holding:	4.5 Jareeb

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

Table 1: Soil Textural Classes

Sample No.	Depth	% Sand	% Silt	%Clay	TEXTURAL CLASS
1	0-15	32.8	57.4	9.8	Silt Loam
	15-30	24.2	65.7	10.1	Silt Loam
	30-45	22.5	59.49	18.1	Silt Loam
2	0-15	76.8	17.1	6.1	Sandy Loam
	15-30	74.8	17.1	8.1	Sandy Loam
	30-45	69.1	24.8	6.1	Sandy Loam
3	0-15	31.1	58.8	10.1	Silt Loam
	15-30	24.8	59.1	16.1	Silt Loam
	30-45	28.5	61.4	10.1	Silt Loam
4	0-15	72.8	20.8	6.4	Sandy Loam
	15-30	66.5	26.3	7.2	Sandy Loam
	30-45	66.5	28.3	5.2	Sandy Loam
5	0-15	53.1	37.4	9.5	Loam
	15-30	49.1	39.4	11.5	Silt Loam
	30-45	65.1	25.4	9.5	Sandy Loam
6	0-15	74.55	17.95	7.5	Sandy Loam
	15-30	53.1	39.4	7.5	Loam
	30-45	55.1	37.4	7.5	Sandy Loam

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

Table 2: Soil pH, EC and SAR

Sample No.	Depth (cm)	pH	EC dSm^{-1}	SAR
1	0-15	7.49	0.865	8.70
	15-30	7.89	0.683	9.24
	30-45	7.82	0.638	9.02
Mean		**7.73**	**0.729**	**8.987**
2	0-15	8.30	0.634	7.95
	15-30	8.07	0.858	9.46
	30-45	7.82	0.788	9.12
Mean		**8.06**	**0.76**	**8.84**
3	0-15	8.21	0.481	7.28
	15-30	8.27	0.458	7.61
	30-45	8.06	0.430	7.83
Mean		**8.18**	**0.456**	**7.573**
4	0-15	8.05	1.450	15.54
	15-30	7.91	0.30	14.63
	30-45	7.79	0.22	9.12
Mean		**7.92**	**0.66**	**13.097**
5	0-15	8.21	0.593	5.49
	15-30	8.15	0.606	8.69
	30-45	8.41	0.555	11.36
Mean		**8.26**	**0.585**	**8.51**
6	0-15	8.38	0.561	8.92
	15-30	8.07	0.492	5.65
	30-45	8.21	0.586	5.36
Mean		**8.22**	**0.546**	**6.64**

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

TABLE 3: Selected Physico-chemical characteristics of Nakai Command soil

Sample No.	Depth (cm)	Lime content (%)	Organic matter (%)	Total Nitrogen (%)	ABDTPA-Ext P ($mgKg^{-1}$)	K ($mgKg^{-1}$)
1	0-15	10.33	1.40	0.096	0.73	119.03
	15-30	11.56	1.30	0.07	0.23	96.63
	30-45	10.75	1.36	0.06	0.13	86.43
Mean		**10.88**	**1.35**	**0.08**	**0.36**	**100.69**
2	0-15	3.55	0.21	0.07	0.53	112.13
	15-30	4.15	0.52	0.00	0.53	88.53
	30-45	3.99	0.63	0.01	0.50	58.63
Mean		**3.90**	**0.45**	**0.03**	**0.52**	**85.76**
3	0-15	22.14	0.63	0.06	0.45	114.03
	15-30	21.91	0.62	0.14	0.30	67.63
	30-45	22.17	0.73	0.08	0.20	75.53
Mean		**22.07**	**0.66**	**0.09**	**0.32**	**65.73**
4	0-15	5.63	0.73	0.05	4.13	76.73
	15-30	5.39	0.88	0.06	3.63	103.33
	30-45	5.81	0.52	0.12	3.3	79.83
Mean		**5.61**	**0.71**	**0.08**	**3.68**	**86.63**
5	0-15	6.98	1.00	0.15	0.83	110.33
	15-30	6.54	1.38	0.14	0.30	57.53
	30-45	6.10	1.36	0.13	0.20	128.13
Mean		**6.54**	**1.247**	**0.14**	**0.44**	**98.66**
6	0-15	11.06	1.38	0.19	0.38	110.63
	15-30	10.57	1.44	0.14	0.50	97.83
	30-45	10.12	1.44	0.13	0.25	99.73
Mean		**10.58**	**1.42**	**0.15**	**0.38**	**102.73**

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

Table 4: Selected properties of water

Sr. No.	Parameters	Dug well	Tube-well	Open Drain
1	EC dSm^{-1}	0.63	0.69	0.30
2	pH	7.21	7.08	7.38
3	Ca+Mg (mg Kg^{-1})	10.94	9.06	12.97
4	K $mgKg^{-1}$	24.03	33.93	19.03
5	Na mg/L^{-1}	35.45	23.35	7.35
6	SAR	10.74	7.78	2.04

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

PROCEDURE FOR SOIL SAMPLING:

The area, topographically a piedmont, was surveyed. Soil samples were taken from areas potentially suitable for field crops and orchard plantation, keeping in view the color of soil, sloppiness and presence of vegetation. The soil samples were collected with the help of auger from three depths i.e., 0-15, 15-30 and 30-45 cm, from six different locations. Five to six sub samples were taken from each section and composite samples were prepared. About one kilogram of sample was packed in a plastic bag. The bags were numbered and brought to the soil science department, N-W.F.P Agricultural University Peshawar. Water samples from open drain, tube well and shallow water well (dug well) was also collected in clean plastic bottles. The bottles were rinsed with the water first and than filled with the sample.

HANDLING OF SOIL SAMLES:

The soil and water samples collected were brought to the laboratory and the soil samples were spread out in the plastic sheet tray for air drying. The samples were dried at room temperature for 3-4 days, grinded, sieved and stored for analysis of different soil properties.

SOIL ANALYSIS:

The processed soil samples were analyzed for physio-chemical properties. The detail is as under:

1. **SOIL TEXTURE:**

Soil texture was determined by hydrometer method (Gee and Bouder 1986).

2. **SOIL pH:**

The pH was determined in soil saturation extract by using pH meter. The pH meter was calibrated with buffers of 4.0 and 9.25 (Mclean 1982).

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

---

3. ELECTRICAL CUNDUCTIVITY (EC):

Electrical Conductivity of the saturated extract was determined with the help of EC meter (Richards, 1954).

4. LIME CONTENT:

A 10 g soil was treated with 0.5N HCl and back titrated with 0.25 N NaOH, using phenolphthalein as an indicator (Richards, 1954).

5. ORGANIC MATTER:

One gram soil was treated with 10 mL of 1N $K_2Cr_2O_7$. A 20 mL of H_2SO_4 (Conc.) was added to it and cooled, 200mL of distilled water was added, filtered and 2-3 drops of ortho-phenanthroline indicator was added to it and titrated against 0.5N $FeSO_4$. A blank titration was also run at the same time (Nelson and Sommer, 1982).

TOTAL NITROGEN:

Total Nitrogen was determined by Kjeldahl Apparatus. In this method, 0.2g of soil sample was digested with 3ml of conc. H_2SO_4 in the presence of digestion mixture on a digestion rack for about 3 hours. The whole digest was then distilled with 4 mL of 40% NaOH solution into 5 mL of boric acid mixed indicator solution. (Bremmer and Mulvaney, 1982). The distillate was titrated against the standard 0.005M HCl and the amount of N calculated as:

$$\% N = \frac{(HCl\ used - Blank) \times 0.014 \times 0.005 \times dilution\ factor}{Weight\ of\ soil \times volume\ taken} \times 100$$

7. AB-DTPA Extractable Phosphorus:

A 10 g air dried soil sample was mixed with 20 mL AB-DTPA extracting solution (pH=7.6). The soil mixture was shaken for 1 hour and filtered through Watman No 42 filter paper. The extracts

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

Samples were collected in the extracting bottles. Then 1mL of aliquot was mixed with 4 mL of reagent B (Ascarbic acid) and raised the volume up to 25mL. Standard solutions were made according to the above procedure but without samples. For the water samples, 5 mL aliquot was mixed with 4 mL of reagent B (Ascorbic acid) and the volume raised to 25 mL. The P concentration was determined by spectrophotometer using required standard solutions (Soltanpour and Schawab 1978).

8. Water soluble K and Na:

The potassium and sodium in soil were determined in the extract (already prepared for pH and EC) by flame photometer using the required standard solution (Richard, 1954).

Calcium Plus Magnesium (Ca+Mg):

Ca + Mg (meq L^{-1}) was determined in soil saturated extract. One ml of saturated extract was taken in a 50 ml beaker. 0.5 ml (10 drops) of Ammonium Chloride-Ammonium hydroxide buffer solution was added. 3 to 4 drops of Erichrome black indicator was added. This was then titrated against 0.01 N EDTA using 10 ml micro burette. The color change was from wine red to blue (Richard 1954).

Calculations;

$$\text{Ca + Mg meq } L^{-1} = \frac{\text{ml of EDTA used X N of EDTA X 1000}}{\text{mL of extract used}}$$

Water Quality

The water quality assessment for its suitability to agriculture purposes were made by collecting both surface and underground water samples and were analyzed for pH, EC, Na, K, Ca, Mg and SAR.

DEPARTMENT OF SOIL & ENVIRONMENTAL SCIENCES

FACULTY OF CROP PRODUCTION SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR, PAKISTAN

Mr Farid Khan Wazir
Project Manager
Email. Consultingassot@yahoo.com

Off. 091-5701774

Date. 16 / 02 /2009

References

Black, C.A. 1965, Methods of soil analysis. Part 2. Amer. Soc. Agron. Inc. Madison, Winsconsin. U.S.A.

Bremmer, J. M., and C. S. Mulvaney. 1982. Nitrogen-total. In A.L. Page., R.H. Miller, and D. R. Keeney. Methods of soil analysis. Part 2. 2nd _ed. Agronomy, 9: 595-621.

Gee, G. W. and Bouder, J.W. 1986. Particle size analysis. P. 383-411. In Klute (ed) Methods of soil analysis. Part 1. Physical and minrlogical methods. 2nd Ed. Agron. Monogr. ASA and SSSA, Madison, WI.

Mclean, E. O. 1982. Soil pH and lime requirement. In A.L. Page., R.H. Miller., and D. R. Keeney (ed.) Methods of soil analysis Part 2, 2nd ed. Agronomy. 9: 199-208.

Nelson, D. W., and L. E. Sommers. 1982. Total carbon, organic carbon and organic matter, In A. L. Page., R. h. Miller and D. R. Keeney (ed.) Methods of soil analysis Part 2, 2nd ed. Agronomy. 9: 547-577.

Raymond, A. G., W. G. Marshall, and H. W. Smith. 1982. Characteristics of soils of the arid zone of Washington. Soil Sci. Soc. Amer. Proc. 21(20: 644-649.

Richard, L.A. 1954. Diagnosis of saline and alkali soil. USDA hand Book 60, USA.

Soltanpour. P.N. and A. P. Schwab. 1978. A new soil test for simultaneous extraction of macro and micro nutrients in alkaline soil common. Soil. Sci. Plant Anal. 8: 195-207.

CHAPTER

10

AGRICULTURE

AGRICULTURE

Table of Contents

CHAPTER – 10
AGRICULTURE

10.1 Agriculture

10.1.1 Introduction

The North West Frontier Province covers 25.1 million acres of which 16.6 per cent and about 8.1 per cent is irrigated area. The Province is not self sufficient for staple food. Government of NWFP in order to increase the agricultural production of the Province and to improve the socio-economic condition of the people, has been making continuous efforts to further utilize the irrigation potential of the perennial and non-perennial nullahs (small rivers) during flood flows. In this regards a number of small dams are planned for implementation on various sites. One such site has been selected on Shah Kaleem Nullah (locally named as Pitao Khwar) namely Shah Kaleem Dam for which preparation of feasibility studies has been required.

The agriculture studies and estimation of Crop Water Requirements have been carried out for Shah Kaleem Dam in Nowshera District. The command area to be developed is presently un-irrigated with below subsistence of rain fed agriculture. Much of the land is plane and fertile but remains barren most of the time for want of irrigation water.

Regular and dependable irrigation water availability with the construction of Shah Kaleem dam will greatly increase cropping intensity and production in the currently un-irrigated command area. Due to timely and regulated water supplies there will be substantial improvement in agriculture production. To avoid seepage losses and leakages from the system, the lining of watercourses is recommended to improve irrigation efficiency and save precious irrigation water.

Provision of irrigation water with the construction of dam, will transform the below subsistence level rain fed farming lands into productive irrigated agriculture. There will be appreciable socio-economic development with implementation of the project. However, without project, the existing agriculture situation will remain unchanged. The assessment of current agricultural production and the future agriculture development with project conditions is detailed in the subsequent sections of this Chapter.

10.1.2 Approach and Methodology

For the purpose of feasibility studies evaluation of incremental production is carried out in case the project is implemented. To estimate the incremental production three conditions of agriculture has been studied namely

- Present Agriculture
- Agricultural Development 'without' Project

- Agricultural Development 'with' Project

10.1.3 Agronomic Field Survey

For obtaining primary data on existing agriculture, a well-designed questionnaire was prepared regarding cropping patterns, crop yields, crop inputs and cultural practices in the project areas. Farmers from project villages were randomly selected and interviewed to evaluate existing agriculture situation in the command area. In addition some farmers from small dams situated in adjoining irrigated areas were randomly selected and interviewed to establish future cropping pattern, crop yields and cultural practices "with" project development by consultants.

The data collected during interviews of the respondents were considered reliable and to supplement the field survey published data has also been collected from the secondary sources. However, additional primary data have been collected to reconfirm certain facts and figures through personal communications and discussion with the agriculture specialists in the nProject area. Agriculture research stations were visited to collect the information on potential yields, recommended agricultural practices and farm inputs i.e. seed, fertilizer, plant protection measures etc and to estimate potential benefits. Also the primary data, collected from the project area regarding land use and farm practices, not available from secondary sources have been found very useful in the evaluation of existing agriculture in these areas.

The data of agronomic field survey, data sources, the results achieved and the planning of the future agriculture development is given in the following sections.

10.1.4 Data Sources

To establish the agriculture studies following secondary and primary data sources were utilized.

- Economic Policy and Prospects Group, Development Economics Vice Presidency World Bank, Washington dc., U.S.A.
- Pakistan Economic Survey 2005-06 and 2006-07, Ministry of Finance, Government of Pakistan.
- Irrigation and Drainage Paper # 56 guidelines for computing crop water requirement (CWR), Food and Agriculture Organization of the United Nations (FAO) Rome, Italy.
- Irrigation and Drainage Paper FAO # 29 Water Quality for Agriculture.
- Agricultural Census 2000, Procedure and Data Tables, Statistics Division, Government of Pakistan.
- Bureau of Statistics, Planning and Development Department, Government of NWF, Peshawar.

- Director General, Agriculture Department (Extension wing), Government of NWFP, Peshawar.
- NWFP Development Statistics, Bureau of Statistics Government of NWFP Peshawar.
- Small Dams Organization, Irrigation and Power Department, Govt. of NWFP, Peshawar.
- District Coordination Officer Agriculture (DCO), District Nowshera, NWFP.
- Pakistan Meteorological Department, Lahore
- Executive District Officer (EDO) Agriculture Extension.
- Farmers of the project command area.
- Farmers of adjoining irrigated areas.

10.1.5 Present Agriculture

Agriculture development status of an area is manifested by its land use, cropping pattern, cropping intensities, level of crop yields. Information on these parameters was obtained from the local revenue records of project villages, questionnaires and published data regarding Nowshera district in which the command area of the project falls. The agriculture institutions in the area were consulted to get needed information. Data on land use, cropping pattern and crop intensities were collected from the local revenue and agriculture departments.

10.1.6 Land Use Statistics

Land use data are required to examine the existing agriculture development status in the Project area. These data also provide information regarding the future potential for land development. Existing Land use statistics for proposed command area of the project are prescribed in Table -10.1.

The command area of the Shah Kaleem Dam is located in Shidu village of Nowshera tehsils. Land use records of these villages were taken from the concerned Revenue offices and processed statistically to extract required information. The data from the soil studies were also incorporated to finalize the Table on land use statistics. According to the data in Table - 10.1, the gross area is 720 acres having 600 acres as culturable area (CCA). Although 80% area is cultivated, only 40% is cropped. The culturable waste is 120 acres (20%). These data show agricultural activity, but there is major constraint of irrigation water for increasing cropped area and productivity.

10.1.7 Farm Size

The farm size has a major impact on the agriculture development of an area, because large farms have comparatively higher absorptive capacity for development than smaller farms. Therefore, data collection and appraisal regarding farm sizes and their distribution in the command area is necessary to evolve a practicable strategy which suits the socio-economic conditions of the farming community in the area. The published data regarding farm structure for Nowshera District have been obtained from the Agriculture Census Report 2000 and are discussed in the following paragraphs.

The number of farms by size of farm for the Shah Kaleem Dam command area has been computed. Farms have been classified into four categories i.e., (i) under 5 acres, (ii) 5 to 12.5 acres, (iii) 12.5 to 25 acres and (iv) above 25 acres. The percentage of number of farms and the farm area in each category is also computed and discussed for command area as follows.

The distribution of farms and farm area by the size of farms for the proposed gross command area of 720 acres of the Dam has been worked out and shown in Table – 10.2. There are 239 farms with an average farm size of 3.2 acres, which is classified as small farm size. According to distribution by size, the number of farms comes to 193, 38, 6 and 1 in the above mentioned farm size categories i, ii, iii & iv respectively. It may be noted that 81 % of the farms include in the very small farm size of less than 5 acres and occupy 42 % of the farmland, while 16 % farms are small (5 to 12.5 acres), which consist about 37% farmland and medium sized farms (12.5 to 25 acres) are only 2.5 % with 15 % of the farmland. In general it may be concluded that the farm size is small and the farmer have low potential response to rapid development. The policies must be designed to suit small size farmers for quick progress.

10.1.8 Existing Cropping Pattern And Intensities

The cropping pattern and intensities of an area are an index of its agriculture development status. Therefore, to compare the existing cropping pattern and intensities in the command area, data on area under different crops was obtained from the concerned Revenue and Agriculture Offices.

To supplement the published data an agronomic survey was conducted by the Consultants to appraise the present agriculture in the area. The present cropping intensities in the command area are described in the subsequent paragraphs.

Presently un-irrigated agriculture is practiced in the area. The cropping pattern and intensities were computed on the basis of average area under each crop as percent of the command area 600 acres. The results are shown in Table 10.3. It may be noted that on the average 50% of the area is annually cropped comprising 20% in

Kharif and 30% in Rabi. During Kharif most of the area is cropped under maize being used as food for human consumption and fodder for animals to sustain summer and winter period. The major crop of Rabi is Wheat which occupies 30% of cultivated area.

10.1.10 Crop Yields And Production

The data on crop yields for an area are required to compute crop production by multiplication with the cropped area. The published data from the Agriculture Statistics NWFP was supplemented with primary data collected through agronomic field survey, local revenue records and consultation with the local Agriculture Officers for the estimation of crop yields and production.

The average crop yields are extremely low due to inadequate and erratic rainfall in the unleveled fields of the command area. The existing yields computed from the published and primary information collected through the agronomic field surveys are discussed in the following paragraphs.

The average yields of the crops grown in the area have been computed from the crop yields for un-irrigated areas of Nowshera district, published in the Agricultural Statistics NWFP, 2006-07. These crop yields have been rationalized through agronomic field survey by Consultants, discussion with the local Agriculture Officer and Agriculture Scientists of Nowshera. Based on the yield adopted for the un-irrigated area, existing crop production has been computed and displayed in Table 10.4. It may be noted that from a CCA of 600 acres only 147 tones production including 68 tones of maize and 79 tones of wheat are received annually. The yield as such is low by all standards.

10.1.11 Farm Inputs

The aforesaid agronomic survey was conducted to obtain information regarding the use of crop inputs in the command area of the project. Little application of chemical fertilizers and pesticides by the farmers has been reported in the irrigated crops but not applied in the rainfed areas. The other inputs such as seed rates, tillage and labour use for the project area are tabulated in Table 10.5.

10.1.12 Agriculture Extension

The agricultural extension services are inadequately available in Nowshera and such services have no apparent impact on production improvement as reported by the farmers in the un-irrigated of the district and also because most of the demonstrations made by the agriculture extension failed due to scanty inconvenient rains.

10.2 Future Agriculture Development "Without" Project

The present condition of low yields and crop failures in the area from inadequate and erratic rainfall is not going to improve without provision of regular irrigation. The improvement of cropping pattern and intensities in the Command is also not possible without supply of surface irrigation supply. Advance technology may slightly improve yield level, but that is not in the scope of this project. Therefore, the existing level of agricultural production in the project areas is not going to improve without the project. However, it is expected that the existing level of farming and production would continue. Therefore, the existing cropped area, yield, production and inputs have been assumed unchanged under "without" Project conditions for project evaluation.

10.3 Future Agriculture Development "With" Project

10.3.1 General

As earlier discussed there are un-irrigated and rainfed areas in command area of the project. The provision of irrigation water will transform the rainfed below subsistence level farming into sustainable productive agriculture. This will also bring socio-economic changes and prosperity in the area. Availability of irrigation water in command area will reactivate the farmers and large extent of abandoned cultivated land will be cropped. This will result in increased production and consequently the farm income. The Improvement in irrigation efficiency will reinforce enhance production.

The allocation of volume of water for irrigation and the resultant improvement in the cropping pattern, intensities and productivity in the command area has been detailed in the following sections.

10.3.2 Proposed Cropping Pattern and Intensities

With the provision of irrigation water, there will be substantial improvement in cropping pattern and considerable increase in cropping intensities of the currently un-irrigated area. The proposed cropping pattern and intensities under 'with' project condition are given Table 10.6. The development of cropping intensities is detailed in Table – 10.7. The cropping pattern and intensities proportionate to the water availability for the area is discussed subsequently:

Annually 582 acre foot (AF) of irrigation water has been estimated available for the proposed command area of 600 acres. Keeping in view the water availability, the crop water requirement, the irrigation efficiency, the agro-climate, soil crop suitability and socio-economic conditions in the project area, an appropriate cropping pattern has been forecasted at a cropping intensity of 100% and detailed in the same Table (Table 10.6).

The salient features of the cropping pattern and intensities include Maize 25% of CCA followed by Kharif Fodders 8%, Sugarcane 5% and K. Vegetables 5%. During Rabi Wheat occupies 40% of CCA, R. Vegetables 8%, Orchards 2%. The total Kharif intensity comes to 45 % and total Rabi intensity comes to 55 %, which aggregate to 100 percent as annual cropping intensity. The Kharif Rabi ratio comes to 1:1.22. The cropping pattern is quite similar to what is already being grown in the irrigated areas in the neighborhood of the project area. It is expected that the local agriculture extension network would be reinforced to facilitate the transition from rainfed to irrigated agriculture technology.

Although, there is un-irrigated farming at about 50 % intensity, still it may take quite some time to convert the rainfed un-even farms into irrigable leveled fields connected with the water distribution system. It is expected that the area development to achieve the ultimate intensity of 100 % will be completed in 3 years after the commencement of this project. The gradual area build up by the development years in the command area is shown in the Table 10.8.

10.3.3 Justification for Selection of Crops & Intensities

In case of presently un-irrigated command area, there will be enormous increase in cropping intensity and substantial improvement in the cropping pattern. The crops included in the proposed cropping pattern have been selected in view of the fact that the agro-climatic and soil conditions are favorable for growing of these crops. The farmers are already familiar with these crops and the Department of Agriculture will also be providing extension services for the expansion of these crops and introduction of modern agricultural technology.

i) Maize

- Maize being major kharif crop of the area. Fodder is used as animal food, while grain is consumed both by local population and animals.
- Maize is already largely cultivated in the irrigated as well as un-irrigated fields in the area.
- The soils are suitable for Maize growing.
- The required water for Maize will be made available through the implementation of the project.

ii) Kharif Vegetables

- The soils are well suited for Kharif Vegetables cultivation.
- The crop water requirements of Kharif Vegetables will be fulfilled with the implementation of the project.
- The gross margins of the Kharif Vegetables are quite high, These will serve as cash crop for the farmers.

- The marketable surplus will easily be marketed as the necessary infrastructure for marketing is already available in the project area.

iii) Sugarcane

- Sugarcane is already successfully being grown on irrigated lands of the adjoining area and marketing facilities are available in the area.
- The soils are well suited for Sugarcane cultivation.
- The crop water requirements of Sugarcane will be fulfilled with the implementation of the project.
- The gross margins of the Sugarcane is quite high, it will serve as cash crop for the farmers.

iv) Kharif Fodder

- In the irrigated areas of the region, fodders are grown for the livestock consumption throughout the year.
- In the un-irrigated about half of the Kharif fodder is harvest fresh and remaining part harvest dry and stored for cattle consumption during shortage periods.
- Area under Kharif fodders is expected to increase.
- Kharif fodders include sorghum and millets mainly.

v) Wheat

- Wheat being staple food of the local population in the project area is already extensively cultivated on large area both on un-irrigated as well as irrigated lands.
- The soils are suitable for wheat crop growing.
- The required water will be made available from the dam.
- Wheat is a cash crop for the farmers and surplus is easily marketed as the Government and brokers purchases wheat from the area.
- Wheat straw holds major share in dry animal food especially during winter season.

vi) Rabi Vegetables

- The soils are well suited for Rabi Vegetables cultivation.
- The crop water requirements of Rabi Vegetables will be fulfilled with the implementation of the project.
- The gross margins of the Rabi Vegetables are quite high, These will serve as cash crops for the farmers.
- The marketable surplus will easily be marketed as the necessary infrastructure for marketing is already available in the project area.

vii) Orchards

- The soils are well suited for orchards cultivation.
- The crop water requirements of orchards will be fulfilled with the implementation of the project.
- The gross margins of the orchards are high , it will serve as cash crop for the farmers.
- The marketable surplus will easily be marketed as the necessary infrastructure for marketing is already available in the project area.

10.3.4 Crop Yields

The yield projections for the Project area have been made keeping in view the current irrigated crop yields in the district Nowshera, the yields projected in feasibility reports of proposed dams located in the region and findings of the agronomic fields survey 2009 by Consultants. The yield potential reported by the Agricultural Research Institute in the project area and in the neighborhood and crop production literature of the Department of Agriculture NWFP was also taken into consideration. For the sake of comparison, yield from different sources and yields projected are presented in Table 10.9. The adopted yields are within limits of the potential and easily achievable. Technical and agriculture factors affecting annual growth rate and yield development have been considered in projecting the yields. The yield projections are on the following basic assumptions.

- According to the findings of the soil studies, the Project soils possess production potential for the proposed crops and the required area would be available for the projected intensities.
- Adequate and regular irrigation water supplies would be made available to meet the crop water requirement in full.
- Agro-climatic conditions are suitable for successful growing and achieving proposed yields.
- Crop production technology and required inputs will be available in the region.
- Network of agricultural extension services would be strong enough for transfer of technology and making inputs timely available with ease.

Experience from other similar projects indicates that the ultimate yields are reasonable and can be achieved in the field. In view of the agriculture development policies, the proposed yields will be achieved in a period of three years in the new areas being brought under irrigation gradually after the commencement of the project. Temporal crop yield projections under "with" project conditions for command areas are given in Table 10.10.

10.3.5 Agricultural Production

The agricultural production estimated for "with" Project conditions along development years is listed in Table – 10.11. The incremental crop production expected from the new areas brought under irrigation with project is summarized in Table – 10.12.

It may be noted that with project there would be enormous incremental production of cereals, vegetables, fruits, sugarcane and fodders totaling to 1766 tones which is almost 12 times the existing production from these un-irrigated areas, It may also be noted that an area of 600 acres of rain fed land would be converted to irrigated farmland due to the agricultural development "with project". This production will improve the socio-economic status of the farming community in the area and will also provide job opportunities to skilled and unskilled labor force in the area. There will be substantial economic activity and improvement in the living standards of the populace of the project area.

10.3.6 Agricultural Inputs

Use of farm inputs at the given rates is essential to achieve the expected yields. The rates per acre of inputs i.e., seed, fertilizer, tillage operations, labour and plant protection have been formulated according to proposed yield levels in consideration to recommendations of the Department of Agriculture, NWFP. The local agriculture extension specialists were consulted in this regard. Agronomic field survey was also conducted to obtain primary information regarding yields per acre and inputs used by the farmers in the project area and adjacent irrigated area. The input rates adopted for project area are proportionate to the projected yields. The quantities of inputs required for project areas are computed and discussed in the following sections.

i) Seeds and Planting Material

Certified seed of improved varieties is necessary to achieve optimum productivity. The use of recommended seed rates is also very important to establish the desired plant population in the field. The Department of Agriculture should therefore, ensure the use of infestation free pure seed rates of high yielding varieties for productivity enhancement. The estimated seed rates per acre for the proposed crops are given in Table – 10.13 for the project area. And the total seed requirement along years of development have been computed and listed in Table – 10.14.

ii) Fertilizers

Chemical fertilizer is the most effective input to increase crop yields and production. Its application at the right time and with optimum combination of required nutrients is essential to obtain high production. To maintain the proper percentage of organic matter in the soil, farm yard manure (FYM) especially for new high yielding varieties and vegetables crops is also necessary. It provides micronutrients that are lacking in

the commercially available NPK fertilizers and facilitate availability of nutrients to plant. FYM also improves CN ratio in the soil and enhances water holding capacity of soil. FYM lowers pH of soil and enhance soil fertility.

iii) Chemical Fertilizers - NPK

Nowadays Chemical fertilizers become indispensable for achieving productive potential of a crop. The recommended doses of elemental Nitrogen, Phosphorus and Potassium have been collected from various sources of literature. Special consideration was given to the recommendations by the Department of Agriculture NWFP while making projection of yield and inputs. The rates of nutrients are estimated proportionate to the projected yield levels.

Nitrogen (N) is part of Chlorophyll molecule, amino acids, proteins, nucleic acids and pigments. Normal metabolic process can only continue in the presence of an optimum level of nitrogen. Leaves, being metabolically most active contain the highest level of Nitrogen followed by roots, stem and fruit. Nitrogen is most needed during the blooming period to mobilize the process of flower opening, fruit setting and fruit development. Addition of Nitrogen enhances vegetative growth and deficiency leads to low production, stunted growth and small yellow leaves.

Heavy application of N promotes luxuriant growth in some plants while in other like citrus it some times causes high production of small, low market value fruit. Delayed ripening and poor post harvest life is also reported in other crops. With some leafy vegetables where succulence is important, heavy application of Nitrogen enhances the value of crop per acre.

Phosphorous (P) is a major essential plant nutrient and is extremely important in plant metabolism. Phosphorous level is higher in seed and lower in leaves and roots. It stimulates root growth and early maturity. It improves quality of produce and offers disease resistance and prevents lodging in cereals. Deficiency of Phosphorous causes reduction in plant growth and ultimately yields especially those of cereals crops.

Potassium (K) is considered essential in photosynthesis, sugar translocation, Nitrogen metabolism and protein synthesis, enzyme activation, stomata movement, water retention and promotion of growth of tissues. Potassium is known as quality element and high level of K improves the physical quality and nutritional value of grains, fruit, vegetables and forages. K develops resistance to crop pests and diseases.

NPK Nutrients Requirements: The rate of Nitrogen, Phosphorous, and Potassium (NPK) according to the recommendation of the Department of Agriculture for various

crops corresponding to their yields and year of development has been computed and presented in Table – 10.15. The total requirement of Nitrogen, Phosphorous and Potassium (N-P-K) along years of project development for command area has been computed and presented in Table – 10.16. It is estimated that a total of 33.4 tones of N-P-K nutrients will be annually required from the year of full production. Nutrients requirements for command area are given below:

Summary of NPK Nutrients Requirement with Project

Names of Nutrient	Quantity in Tonnes
Nitrogen-N	22.0
Phosphorous-P	10.3
Potassium-K	1.1
Total	33.4

iv) Plant Protection

The plant protection measures are essential to save the crops from the damage of insect pests and diseases, particularly those crops that are easily susceptible, like vegetables and cash crops. As the proposed cropping pattern constitutes vegetables and cash crops, provision of adequate and timely spraying is necessary for achieving target production. With the increased use of fertilizers, the crops are likely to become succulent and more susceptible to insects pests and diseases. The population of insects and diseases would increase considerably due to favorable environments for their multiplication. Cultural practices like crop rotations, adjustment of sowing time, use of healthy seed and resistant varieties can go a long way in minimizing the crop losses from insect pests and diseases. Undoubtedly, the application of pesticides / fungicides to control insects / diseases is the most effective remedial measure. As such, the percent of cropped area to be covered with plant protection measures by development years, proportionate to production potential has been shown in Table – 10.17. The cropped area to be treated with plant protection measures has been estimated and given in Table – 10.18 including the number of sprays to be applied with project for each crop.

v) Tillage and Labor Requirements

The number of ploughing and planking for preparatory tillage and seed bed preparation of various crops "with" Project by the years of development are calculated for the estimation of gross margins. These tillage operations are based on

the Agronomic field survey and consultations with the officers of the Agriculture Department at Nowshera and Peshawar.

The number of ploughings projected with project are detailed in Table – 10.19.The labor requirements in terms of man-days for various farm operations such as sowing, tillage operation, fertilizer and pesticide application, irrigation, harvesting and threshing etc are based on the Agronomic field survey, discussions held with the personnel of the Agriculture Department and professional experience of the agronomist for similar projects in NWFP. Labour requirements per acre for all crops are given in Table 10.20

10.4 Crop Water Requirements

10.4.1 Background

In early 1970's, FAO developed a practical procedure to estimate crop water requirements, which has become a widely accepted standard, in particular for irrigation studies. Since the publication of FAO Irrigation and Drainage Paper No. 24, new concepts and advances in research have revealed shortcomings in the methodology and made a review and revision necessary.

A panel of experts consisting of Derek Clarke, Martin Smith and Khalid EL Askari organized by FAO, recommended the adoption of Penman-Monteith combination method as a new standard for reference evapotranspiration and advised on procedures for calculation of the various parameters.

The FAO Penman-Monteith equation is recommended as the standard method for estimating reference crop evapotranspiration. The new method has been proved to have a global validity as a standardized reference for grass evapotranspiration and has found recognition both by the International Commission for Irrigation and Drainage and by the World Meteorological Organization.

10.4.2 Climatic Data

Climatic data at least for the last 10 years of the project area are required to compute crop water requirement. Peshawar Meteorological station is situated in the vicinity of the command area of the Shah Kaleem Dam. Daily Maximum, Minimum Temperatures and humidity data was taken from the Surface Water Hydrology Project (SWHP), WAPDA which records meteorological data in their observatory at Peshawar. The other climatic parameters i.e. Precipitation and wind speed required for computation of crop water requirements were synthesized from met data of Peshawar Met Station obtained from the Metrological department Peshawar. The

climatologic data used for computation of crop water requirement in this study are presented in Table – 10.21.

10.4.3 Methodology For Crop Water Requirements

Revised procedures have been developed by FAO in cooperation with an international working group of high level experts to estimate Crop Evapotranspiration based on Penman-Monteith approach

i) Penman Monteith Approach

Penman Montieth Computer Programme "CROPWAT" 1991 and "CropWat 4 Windows Version 4.3" October, 2000 edition have been used to compute reference evapotranspiration (ETo) from the collected climatic data. The daily, monthly and annual ETo values are given in Table – 10.22 and 10.23. The maximum potential evapotranspiration is during the month of June, which is 189 mm/month closely followed by the months of May & July with 177 & 161 mm/month respectively. The minimum potential evapotranspiration is during the months of December and January, which are 37 mm and 43 mm respectively. The total annual ETo is estimated as 1307 mm/ year.

ii) Crop Consumptive Use

Crop consumptive use, is defined as "the depth of water needed to meet the water losses through evapotranspiration (ETc) of a disease free crop growing in large fields under non-restricting soil conditions including soil water, fertility and achieving full production potential under the given environment". ET crop has been computed by multiplying ETo with crop coefficient (Kc).

iii) Growing Season of Different Crops

Crop evapotranspiration varies with the types of crops and the climatic conditions, i.e. rainfall, wind speed, humidity, temperature and sun shine hours etc. In order to estimate crop water requirements, type of crops, time of sowing, harvesting and the length of growing period are essential. The data about the sowing and harvesting of different crops has been collected from publications of the Agricultural Research Institute Peshawar, NWFP and verified with field visit and interviews with farmers in the Project areas. The crop growing season and stages data are reflected in crop coefficient (Kc) data given in the following section.

iv) Crop Coefficient

The effect of crop characteristics on crop water requirement is given by the crop coefficient (Kc), which represents the relation-ship between the reference evapotranspiration (ETo) and crop evapotranspiration (ETc).

The crop evapotranspiration:

$$ETc = Kc \times ETo.$$

The crop coefficients of the proposed crops to be grown in the Project area are adopted from F.A.O. Paper 24 and Paper 56. The monthly crop coefficient developed for different crops in the Project area are presented in the Table – 10.24.

v) Monthly Crop Consumptive Use (ETc)

The monthly consumptive use of a crop has been calculated by multiplying crop coefficient of the particular crop with the potential evapotranspiration during that period. The monthly ETc of the concerned crops are presented in Table – 10.25.

vi) Effective Rainfall

Effective rainfall is that portion of rainfall, which directly meets the crop water requirements and has been calculated by the formula of United States Bureau of Reclamation using "CROPWAT 4 Windows 4.3" Computer Program developed by FAO. The effective precipitation for different months is computed and is given in the same table. It may be noted that because of low rainfall the percentage of affectivity is very high. The monthly rainfall is also listed at the bottom row of the same table for subtraction from the ETc requirements to determine the net water required for consumption by the crop.

vii) Net Consumptive Use

The net consumptive use is the depth of irrigation water, exclusive of effective rainfall; carry over soil moisture etc. required consumptively for crop production. It is the quantity of irrigation water required to bring the soil moisture level in the effective root zone to the field capacity. The net consumptive use in Project irrigation scheme is the total consumptive use (mm) reduced by effective rainfall (mm). The net monthly and seasonal consumptive use of each proposed crop is given Table – 10.26.

10.4.4 Proposed Cropping Patterns

The Shah Kaleem Dam envisages providing irrigation water to convert the un-irrigated farmlands into irrigated ones and improve water availability to bring up the cropping intensity at least to the level of 120%. Lining of new canal and distribution system will improve irrigation efficiency in its command and as a result increase agricultural production. The strategy of agriculture development, proposed cropping pattern and intensities, the crop water requirement and gross irrigation requirements for project command is worked out and described in the following sections.

10.4.5 Strategy of Development with Project

The command area is a small expense of land with a cultivable command area of 600 acres, where rain fed agriculture is currently practiced. Due to inadequate and erratic rainfall the cropping intensity is very low. From the field visits of the command area it has been concluded that for the last 3 years average annual cropping

intensity comes to 50 % consisting 20 % in Kharif and 30 % in Rabi. It is planned to provide irrigation water to this area through the Shah Kaleem Dam.

The agro-ecology, soil suitability, existing cropping pattern and intensities in and around the project area, value of crops, crop water requirements has been matched with the quantum of available water from the project to evolve a suitable cropping pattern & intensity for future agriculture development in the area. An annual cropping intensity of 100 % comprised of Kharif 45 % and Rabi 55 % has been developed. The details of cropping pattern and intensities and crop water requirements of each crop by months are tabulated in Table – 10.27. The gross and net irrigation requirements per annum work out to be 582 AF and 553 AF respectively at an irrigation efficiency of 81 %. The Hydrological studies suggest the required amount of irrigation water would be available for the identified command area.

10.4.6 Net Irrigation Requirement for the Project

The net consumptive use of each crop at the proposed intensity in acre-feet is also given for the project area on annual basis. The volume of irrigation water required at head works depends on the water distribution efficiency of irrigation system in the Project area.

10.4.7 Irrigation Efficiencies

Not all the water diverted at the source reaches the crop root zone for consumptive use by the crops. There are several types of water losses on the way from Head Works to crop root zone affecting the efficiency of the Irrigation system. It is proposed that canals and watercourses are to be lined. Therefore, based on technical consultations with irrigation experts, information from similar projects in the neighborhood, FAO Papers No. 24 and personal experience the following conveyance efficiencies are estimated:

Field application efficiencies in the currently un-irrigated areas due to different soil types and greater extent of light soils would be different. Therefore, based on technical consultations with the soil studies and FAO Bulletin # 42, FAO Papers No. 24 and information from similar projects in the neighborhood, field application efficiencies have been computed and then multiplied with the conveyance applications to arrive at the irrigation efficiency for project area. They are listed below:

- Field Application Efficiency = 85%
- Water course Efficiency = 95%
- Canal Efficiency = 100%
- Project Irrigation Efficiency = 0.85x0.95x1.00= 81%

81% irrigation Efficiency computed for the project area has been used for calculating the gross irrigation water requirement at the Head works. It is assumed that due to the small area the canal losses will be minimum.

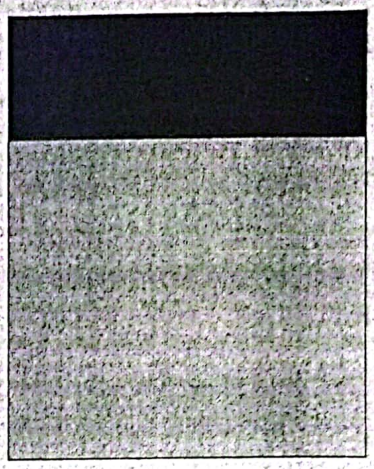
10.4.8 Gross Irrigation Requirement

To meet net consumptive use requirements of the crops at the root zone, provision for the losses of water on the way is made to determine the volume of water required at the Head Works.

The gross irrigation requirement for the Project at source is computed as follows.

$$\text{Gross Irrigation Requirement} = \frac{\text{Net Crop Water Requirement}}{\text{Project Irrigation Efficiency}}$$

The gross irrigation requirements worked out with the related irrigation efficiency for the project area has been summarized in Table- 10.28 along with the net and gross irrigation requirements of the project for monthly periods. The maximum water required 105 AF is during the month of May. This is due to high intensity of sugarcane and vegetables. The minimum requirement is in the month of January.



TABLES

Table - 10.1
Existing Land Use of Shah Kaleem Dam

Category of Land	CCA (Acres) = 600	
	Acres	% of Culturable Command Area
Gross Area	720	
Culturable Area (CA)	600	100
Cultivated Area	480	80.0
Current Fallow		
Area Sown More than Once		
Kharif	120	20.0
Rabi	180	30.0
Total Crop Matured	300	50.0
Forest		
Culturalable Waste	120	20.0
Not Available For Cultivation	120	20.0
Total Un-Cultivated	240	40.0
Rainfed	600	100.0
Total	**600**	**100.0**

Table- 10.2

Existing Number and Area of Farms by Size of Farms in Shah Kaleem Dam

Gross Command Area = 720 Acres

Sr. No.	Size of Farms	Number of Farms		Farm Area		Average Size of Farm
	(Acres)	Total	Percent	Acres	Percent	Acres
1	1 to under 5	193	81.00	305	42.34	1.6
2	5 to under 12.5	38	16.00	266	36.92	7.0
3	12.5 to under 25	6	2.50	105	14.55	17.6
4	25 & above	1	0.50	45	6.19	37.4
5	All Farms	239	100	720	100	3.02

SOURCE: Agricultural Census 2000 North Westren Frontier Province (NWFP),Government of Pakistan, Statistics Division, Agricultural Census Organization.

Table - 10.3

Existing Cropping Pattern and Intensities in Shah Kaleem Dam

Sr. No.	CROPS	CCA (Acres) Un-Irrigated Area Cropping Intensity %	600 Cropped Area (Acres)
	Kharif-		
1	Maize	20.0	120.0
2	Kharif Fodders	0.0	0.0
3	K. Vegetables	0.0	0.0
4	Sugarcane	0.0	0.0
	Total Kharif	**20.0**	**120.0**
	Rabi-		
5	Wheat	30.0	180.0
6	Rabi Vegetables	0.0	0.0
7	Orchards	0.0	0.0
	Total Rabi	**30.0**	**180.0**
	Annual Total	**50.0**	**300.0**

Source: Agricultural Statistics NWFP- Averages yields of Mohamand Agency.
Agronomic Field Survey

Table - 10.4
Existing Crop Yields and Production in Shah Kaleem Dam

Sr. No.	CROPS	Cropped Area (Acres)	CCA (Acres) = Crop Yields* Kg/Acre	600 Production Metric Tonnes
	Kharif-			
1	Maize	120	564	68
2	Kharif Fodders	0	0	0.0
3	K. Vegetables	0	0	0
4	Sugarcane	0	0	0.0
	Kharif Total	**120**	**564**	**68**
	Rabi-			
5	Wheat	180	440	79
6	Rabi Vegetables	0	0	0
7	Orchards	0	0	0
	Rabi Total	**180**	**440**	**79**
	Annual Total	**300**		**147**

Source: Agricultural Statistics NWFP-
Averages yields of Mohamand Agency.
Agronomic Field Survey.

Table - 10.5

Existing Use of Farm Inputs in the Proposed Shah Kaleem Dam

Sr. No.	CROPS	Seeds Kg/Acre	No. Of Ploughings Rs/Acre	FYM (Kg)	Fertilizers (Nutrients) Kg/acre			Plan Protection		Labour Man Days		
					N	P	K	% area Sprayed	No. of Sprays	Total	Family	Hired
	Kharif-											
1	Maize	12	2.0	0				0	0	6	4	2
2	Kharif Fodders											
3	K. Vegetables											
4	Sugarcane											
	Rabi-											
5	Wheat	40	1.5	0				0	0	4	4	0
6	Rabi Vegetables											
7	Orchards											

Source: Agronomic Field Survey by Consultants.2009.

Table - 10.6

Cropping Patteren & Intensities Proposed With Project for Shah Kaleem Dam

Sr. No		CCA (Acres) =	600
	Crops	Intensities	Area Cropped
		%	Acres
1	Maize	25.0	150
2	Kharif Fodders	5.0	
3	K. Vegetables	8.0	48.0
4	Sugarcane	5.0	
	Kharif Total	**45.0**	**210.0**
5	Wheat	40.0	240.0
6	Rabi Vegetables	8.0	48.0
7	Orchards	2.0	12.0
	Rabi Total	**55.0**	**300.0**
	Annual Total	**100**	**510.0**

Note:Perennial Crops Are Counted Twice to Compute the Annual Cropping Intensity.

TABLE - 10.7

Development Of Intensities With Project - Shah Kaleem Dam

CCA = 600 Acres

S. No.	Crops	Base	Year of Development		
			1	2	3
1	Maize	20.0	23.3	24.3	25.0
2	Kharif Fodders	0.0	3.3	4.3	5.0
3	K. Vegetables	0.0	5.2	6.8	8.0
4	Sugarcane	0.0	3.3	4.3	5.0
5	Wheat	30.0	36.5	38.5	40.0
6	Rabi Vegetables	0.0	5.2	6.8	8.0
7	Orchards	0.0	1.3	1.7	2.0
	Total	**50.0**	**82.5**	**92.5**	**100.0**

TABLE- 10.8

Area Build Up "With" Project - Shah Kaleem Dam

(Area in Acres)

S. No.	Crops	Base	Year of Development		
			1	2	3
1	Maize	120	140	146	150
2	Kharif Fodders	0	20	26	30
3	K. Vegetables	0	31	41	48
4	Sugarcane	0	20	26	30
5	Wheat	180	219	231	240
6	Rabi Vegetables	0	31	41	48
7	Orchards	0	8	10	12
	Total	**300**	**476**	**530**	**570**

Table - 10.9

Crop Yields From Different Sources

Yields in Kg/Acre

Sr. No.	Crops	Average Yields in the Region (Irrigated) 2003-04	Research Station Yields	KTD Feasibility	Munda Dam NWFP	Gomal Zam Dam Feasibility	CRBC Stage III Feasibility	Agronomic Field Survey	Adopted for the Project
1	Maize	795	1500	844		789	1185	1320	936
2	Kharif Fodders	8903		7362	18000	2286	29100		9000
3	K. Vegetables	4503		3786	10000	5160	10926	3840	5787
4	Sugarcane	20640							22000
5	Wheat	683	1700	768	1350	1103	1606	880	946
6	Rabi Vegetables	5203	6000	6330	5000	4755	10117		5500
7	Orchards	6070		9654		5880			6100

Source:
1. Agricultural Statistics and NWFP, 1999-2000 & 2003 - 2004. Department of Agriculture NWFP Peshawar
2. Station Director, Agricultural Research Station, Sarai Nurang,Bannu: Yields obtained at the Experimental Station.*
3. Feasibility Study Kurram Tangi Dam Project. Report-2003-2004
4. Munda Dam Feasibility Study 1990. NWFP
5. Gomal Zam Dam Feasibility Study 1995.
6. Chashma Right Bank Canal CRBC 1990
7. Agronomic Field Survey 2009.

TABLE - 10.10

Crop Yields Projected For "With" Project - Shah Kaleem Dam

(Kgs./Acres)

S. No.	Crops	Base	Year of Development		
			1	2	3
1	Maize	564	787	880	936
2	Kharif Fodders	0	5400	7650	9000
3	K. Vegetables	0	3472	4919	5787
4	Sugarcane	0	13200	18700	22000
5	Wheat	440	744	870	946
6	Rabi Vegetables	0	3300	4675	5500
7	Orchards	0	3660	5185	6100

TABLE - 10.11
Crop Production Projected For "With" Project
Shah Kaleem Dam

(Tonnes)

S. No.	Crops	Base	Year of Development		
			1	2	3
1	Maize	68	110	128	140
2	Kharif Fodders	0	105	195	270
3	K. Vegetables	0	108	201	278
4	Sugarcane	0	257	477	660
5	Wheat	79	163	201	227
6	Rabi Vegetables	0	103	191	264
7	Orchards	0	29	53	73

Table - 10.12
Incremental Production "With" Project - Shah Kaleem Dam

Sr. No.	CROPS	Production in Tonnes		
		Without Project	"With" Project	Incremental
1	Maize	68	140	73
2	Kharif Fodders	0	270	270
3	K. Vegetables	0	278	278
4	Sugarcane	0	660	660
5	Wheat	79	227	148
6	Rabi Vegetables	0	264	264
7	Orchards	0	73	73
	Total	**147**	**1912**	**1766**

'SUMMARY OF PRODUCTION

Sr. No.	CROPS	Production in Tonnes		
		Without Project	"With" Project	Incremental
1	CEREALS	147	367	221
2	FODDERS	0	270	270
3	VEGETABLES	0	542	542
4	SUGARCANE	0	660	660
5	ORCHARDS	0	73	73
	Total	**147**	**1912**	**1766**

Table - 10.13
Farm Inputs Proposed "With" Project For Shah Kaleem Dam

Sr. No.	CROPS	Seeds Kg/Acre	No. Of Ploughings Rs/Acre	FYM (Kg)	Fertilizers (Nutrients) Kg/acre			Plan Protection		Labour Man Days		
					N	P	K	% area Sprayed	No. of Sprays	Total	Family	Hired
	Kharif-											
1	Maize	12	3	300	23	11	0	24	1	22	15	7
2	Kharif Fodders	30	3	300	22	0	0	0	0	15	11	5
3	K. Vegetables	12	4	500	56	21	10	50	1	40	24	16
4	Sugarcane	4000	6.00	0	63	32	0	40	1+1*	35	21	14
	Rabi-											
5	Wheat	50	4	300	43	22	0	33	1+1**	20	13	7
6	Rabi Vegetables	2.5	4	500	43	19	9	28	1	30	18	12
7	Orchards	100	2	500	80	40	15	30	1	32	19	13

* 9 Kg padan granular and 1 spray

** Wheat: Seed Treatment and 1 Herbicide spray

TABLE - 10.14

Projected Seed Requirements "With" Project -Shah Kaleem Dam

(Kgs)

S. No.	Crops	Base	Year of Development			Unit
			1	2	3	
1	Maize	1.4	1.7	1.7	1.8	Tonnes
2	Kharif Fodders	0.0	0.6	0.8	0.9	Tonnes
3	K. Vegetables	0.0	0.4	0.5	0.6	Tonnes
4	Sugarcane	0.0	78.0	102.0	120.0	Tonnes
5	Wheat	9.0	11.0	11.6	12.0	Tonnes
6	Rabi Vegetables	0.0	0.08	0.10	0.12	Tonnes
7	Orchards	0.0	780.0	1020.0	1200.0	Plants

NOTE: * *Total Number of Seedlings Ultimately Required for Orchard .

TABLE - 10.15

Fertilizer Rates Per Acre "With" Project - Shah Kaleem Command Area

S. No.	Crops	Base			Year of Development								
					1			2			3		
		N	P	K	N	P	K	N	P	K	N	P	K
1	Maize	0	0	0	19	9	0	22	10	0	23	11	0
2	Kharif Fodders	0	0	0	13	0	0	19	0	0	22	0	0
3	K. Vegetables	0	0	0	34	13	6	48	18	9	56	21	10
4	Sugarcane	0	0	0	38	19	0	54	27	0	63	32	0
5	Wheat	20	10	0	34	17	0	40	20	0	43	22	0
6	Rabi Vegetables	0	0	0	26	11	5	37	16	8	43	19	9
7	Orchards	0	0	0	48	24	9	68	34	13	80	40	15
0													

TABLE - 10.16

Fertilizer Requirements "With" Project - Shah Kaleem Command Area

S. No.	Crops	Base			Year of Development								
					1			2			3		
		N	P	K	N	P	K	N	P	K	N	P	K
1	Maize	0.0	0.0	0.0	2.7	1.3	0.0	3.1	1.5	0.0	3.5	1.7	0.0
2	Kharif Fodders	0.0	0.0	0.0	0.3	0.0	0.0	0.5	0.0	0.0	0.7	0.0	0.0
3	K. Vegetables	0.0	0.0	0.0	1.0	0.4	0.2	1.9	0.7	0.3	2.7	1.0	0.5
4	Sugarcane	0.0	0.0	0.0	0.7	0.4	0.0	1.4	0.7	0.0	1.9	1.0	0.0
5	Wheat	3.6	1.8	0.0	7.4	3.8	0.0	9.1	4.7	0.0	10.3	5.3	0.0
6	Rabi Vegetables	0.0	0.0	0.0	0.8	0.4	0.2	1.5	0.7	0.3	2.1	0.9	0.4
7	Orchards	0.0	0.0	0.0	0.4	0.2	0.1	0.7	0.3	0.1	1.0	0.5	0.2
	Totals	3.6	1.8	0.0	13.3	6.4	0.4	18.3	8.6	0.8	22.0	10.3	1.1

TABLE - 10.17
Percent of Cropped Area Treated "With" Pesticide
Shah Kaleem Dam

S. No.	Crops	Base	Year of Development			Sprays
			1	2	3	
1	Maize	0	20	23	24	1
2	Kharif Fodders	0	0	0	0	0
3	K. Vegetables	0	30	43	50	1
4	Sugarcane	0	24	34	40	1+1*
5	Wheat	0	26	30	33	1+1**
6	Rabi Vegetables	0	17	24	28	1
7	Orchards	0	18	26	30	1

* 9 Kg padan granular and 1 spray

** Wheat: Seed Treatment and 1 Herbicide spray

TABLE - 10.18
Cropped Area Treated With Pesticide "With" Project
Shah Kaleem Dam

(Acres)

S. No.	Crops	Base	Year of Development			Number of Sprays
			1	2	3	
1	Maize	0	28	33	36	1
2	Kharif Fodders	0	0	0	0	0
3	K. Vegetables	0	9	17	24	1
4	Sugarcane	0	5	9	12	1+1*
5	Wheat	0	57	70	79	1+1**
6	Rabi Vegetables	0	5	10	13	1
7	Orchards	0	1	3	4	1

TABLE - 10.19
Number of Ploughings Required "With" Project - Shah Kaleem Dam

S. No.	Crops	Base	Year of Development		
			1	2	3
1	Maize	2.0	2.5	2.8	3.0
2	Kharif Fodders	0.0	1.8	2.6	3.0
3	K. Vegetables	0.0	2.4	3.4	4.0
4	Sugarcane	0.0	1.5	2.1	2.5
5	Wheat	2.0	3.1	3.7	4.0
6	Rabi Vegetables	0.0	2.4	3.4	4.0
7	Orchards	0.0	1.2	1.7	2.0

Values Are Number of Ploughings Per Acre Including Planking

TABLE - 10.20

Labour Requirements "With" Project - Shah Kaleem Dam

Mandays/Acre

S. No.	Crops	Base	Year of Development			Family	Hired
			1	2	3 *	%	%
1	Maize	13.3	18.5	20.7	22.0	70	30
2	Kharif Fodders	0.0	9.0	12.8	15.0	70	30
3	K. Vegetables	0.0	24.0	34.0	40.0	60	40
4	Sugarcane	0.0	21.0	29.8	35.0	70	60
5	Wheat	9.3	15.7	18.4	20.0	65	35
6	Rabi Vegetables	0.0	18.0	25.5	30.0	60	40
7	Orchards	0.0	19.2	27.2	32.0	60	40

Table: 10.21
Climate Normals of Peshawar

Meteostation : Peshawar **Country:** Pakistan

Altitude: 521m **Coordinates:** 33.34 North 71.27 East

Month	MaxTem °C	MinTem °C	Humid. %	Wind Km / Day	Sunshine Hours	Radiation MJ / m^2 / Day	Eto - PenMon mm / Day
April	30	17	55	93	8.2	20.6	5.7
May	36	21	42	112	9.5	23.9	7.2
June	40	26	39	111	9.1	23.7	7.2
July	38	27	58	113	8.3	22.3	6.3
August	36	26	67	103	8.5	21.5	5.5
September	35	22	60	79	8.8	19.7	4.8
October	31	16	56	55	8.9	16.8	3.9
November	26	10	60	54	8.1	13.1	2.7
December	20	5	64	52	6.5	10.3	1.8
January	18	4	59	64	6.7	11.2	1.7
February	19	6	58	74	7.1	13.8	2.7
March	24	11	60	89	6.9	16.4	3.8
Year	29	15.9	56.5	83.3	8.1	17.8	4.4

** Pakistan Meteorological Department, Peshawar Station.

Table - 10.22

Evapotranspiration and Effective Precipitation - Shah Kaleem Dam Project

Months	Eto		Precipitation mm/month	
	mm/day	mm/month	Actual	Effective
April	4.4	132	72	63.7
May	5.7	177	20.3	19.6
June	6.3	189	29.1	27.7
July	5.2	161	57.5	52.2
August	4.9	152	64.1	57.5
September	4.2	126	45	41.8
October	2.8	87	47.9	44.2
November	1.7	51	20.4	19.7
December	1.2	37	15.2	14.8
January	1.4	43	51.6	47.3
February	2.0	56	75.8	66.6
March	3.1	96	61.8	55.7
Annual		**1307**	**560.7**	**510.8**

ETo computed with Penman Monteith method using computer program.Cropwat by FAO

Effective Precipitation Computed by USBR method using computer program Cropwat by FAO

TABLE - 10.23

REFERENCE CROP EVAPOTRANSPIRATION (ETo) FOR Shah Kaleem DAM

Months	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	Annual
ETO mm/day	4.4	5.7	6.3	5.2	4.9	4.2	2.8	1.7	1.2	1.4	2.0	3.1	
ETO mm/month	132	177	189	161	152	126	87	51	37	43	56	96	1307

TABLE - 10.24
CROP CO-EFFICIENTS (Kcs)
Noshera District

MONTHS	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
CROPS												
Maize			0.19	0.63	0.82	0.72	0.20					
Maize				0.19	0.63	0.82	0.72	0.20				
Maize			0.19	0.63	0.82	0.72	0.20					
Sorghum			0.14	0.38	0.80	0.97	0.68	0.08				
Kharif Fodders	0.49	0.68	0.84	0.84	0.84	0.73	0.32					
Kharif Fodders	0.68	0.84	0.84	0.84	0.73	0.32						0.49
Tomato	0.75	1.12	0.60								0.35	0.67
Melons	1.00	0.95									0.35	0.80
Lady's Finger	0.49	0.68	0.84	0.84	0.84	0.73	0.32					
Lady's Finger	0.68	0.84	0.84	0.84	0.73	0.32						0.49
Cotton		0.39	0.93	1.12	0.85	0.63	0.42					
Rice		0.04	0.21	1.03	1.40	1.13	0.55	0.16				
Sugarcane	0.99	1.14	1.19	1.19	1.19	1.19	0.89	0.46			0.37	0.60
Kharif Pulses				0.30	0.62	0.90	0.85					
K. Oilseeds			0.30	0.62	0.90	0.85						
Tumeric	0.47	0.78	0.90	1.05	1.05	1.00	0.90	0.77				
Wheat	0.56							0.35	0.52	0.85	1.10	1.10
Wheat	1.10	0.56							0.35	0.52	0.85	1.10
Wheat	0.56							0.35	0.52	0.85	1.10	1.10
Gram								0.25	0.51	0.94	0.92	0.29
Rabi Oilseeds	0.23						0.28	0.49	0.81	1.00	0.88	0.43
Potato							0.55	0.98	1.00	0.60		
R. Vegetables	0.42					0.14	0.45	0.80	0.93	0.98	0.88	0.76
Cauliflower							0.74	0.90	1.05			
Onion	0.92	0.75								0.56	0.73	1.00
Guava	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.70	0.70	0.80	1.10
Dates	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.75	0.75
Citrus	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.70	0.70	0.80	1.10
Rabi Others	0.42					0.14	0.45	0.80	0.93	0.98	0.88	0.76
Rabi Fodders	0.42					0.14	0.45	0.80	0.93	0.98	0.88	0.76

TABLE - 10.25
CONSUMPTIVE USE OF CROPS
Noshera District

	100								MONTHS				
CROPS	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	TOTAL
Maize	0.0	100.0	35.9	101.6	124.6	90.7	17.4	0.0	0.0	0.0	0.0	0.0	470
Maize	0.0	0.0	100.0	30.6	95.7	103.3	62.5	10.2	0.0	0.0	0.0	0.0	402
Maize	0.0	100.0	35.9	101.6	124.6	90.7	17.4	0.0	0.0	0.0	0.0	0.0	470
Sorghum	0.0	100.0	26.5	61.3	121.5	122.2	59.0	4.1	0.0	0.0	0.0	0.0	495
Kharif Fodders	64.7	120.2	158.8	135.4	127.6	92.0	27.8	0.0	0.0	0.0	0.0	100.0	826
Kharif Fodders	89.8	148.4	158.8	135.4	110.9	40.3	0.0	0.0	0.0	0.0	100.0	47.1	831
Tomato	99.0	197.9	113.4	0.0	0.0	0.0	0.0	0.0	0.0	100.0	19.6	64.4	594
Melons	132.0	167.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	19.6	76.9	496
Lady's Finger	64.7	120.2	158.8	135.4	127.6	92.0	27.8	0.0	0.0	0.0	0.0	100.0	826
Lady's Finger	89.8	148.4	158.8	135.4	110.9	40.3	0.0	0.0	0.0	0.0	100.0	47.1	831
Cotton	100.0	68.9	175.8	180.5	129.1	79.4	36.5	0.0	0.0	0.0	0.0	0.0	770
Rice	0.0	7.1	39.7	166.0	212.7	142.4	47.7	8.2	0.0	0.0	0.0	0.0	624
Sugarcane	130.7	201.4	224.9	191.8	180.8	149.9	77.3	23.5	0.0	100.0	20.7	57.7	1359
Kharif Pulses	0.0	0.0	100.0	48.4	94.2	113.4	73.8	0.0	0.0	0.0	0.0	0.0	430
K. Oilseeds	0.0	100.0	56.7	99.9	136.7	107.1	0.0	0.0	0.0	0.0	0.0	0.0	500
Tumeric	62.0	137.8	170.1	169.3	159.5	126.0	78.1	39.3	0.0	0.0	0.0	100.0	1042
Wheat	73.9	0.0	0.0	0.0	0.0	0.0	100.0	17.9	19.3	36.9	61.6	105.7	415
Wheat	145.2	99.0	0.0	0.0	0.0	0.0	0.0	100.0	13.0	22.6	47.6	105.7	533
Wheat	73.9	0.0	0.0	0.0	0.0	0.0	100.0	17.9	19.3	36.9	61.6	105.7	415
Gram	0.0	0.0	0.0	0.0	0.0	0.0	100.0	12.8	19.0	40.8	51.5	27.9	252
Rabi Oilseeds	30.4	0.0	0.0	0.0	0.0	100.0	24.3	25.0	30.1	43.4	49.3	41.3	344
Potato	0.0	0.0	0.0	0.0	0.0	100.0	47.7	50.0	37.2	26.0	0.0	0.0	261
R. Vegetables	55.4	0.0	0.0	0.0	100.0	17.6	39.1	40.8	34.6	42.5	49.3	73.0	452
Cauliflower	0.0	0.0	0.0	0.0	0.0	100.0	64.2	45.9	39.1	0.0	0.0	0.0	249
Onion	121.4	132.5	0.0	0.0	0.0	0.0	0.0	0.0	100.0	24.3	40.9	96.1	515
Guava	145.2	194.4	207.9	177.3	167.1	138.6	95.5	56.1	26.0	30.4	44.8	105.7	1389
Dates	99.0	132.5	141.8	120.9	113.9	94.5	65.1	38.3	26.0	30.4	42.0	72.1	976
Citrus	145.2	194.4	207.9	177.3	167.1	138.6	95.5	56.1	26.0	30.4	44.8	105.7	1389
Rabi Others	55.4	0.0	0.0	0.0	100.0	17.6	39.1	40.8	34.6	42.5	49.3	73.0	452
Rabi Fodders	55.4	0.0	0.0	0.0	100.0	17.6	39.1	40.8	34.6	42.5	49.3	73.0	452
Eff.ppt* (mm)	63.7	19.6	27.7	52.2	57.5	41.8	44.2	19.7	14.8	47.3	66.6	55.7	511

TABLE - 10.26
NET CONSUMPTIVE USE OF CROPS
Noshera District

								MONTHS					
CROPS	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	TOTAL
Maize	0.0	80.4	8.2	49.4	67.1	48.9	0.0	0.0	0.0	0.0	0.0	0.0	254
Maize	0.0	0.0	72.3	0.0	38.2	61.5	18.3	0.0	0.0	0.0	0.0	0.0	190
Maize	0.0	80.4	8.2	49.4	67.1	48.9	0.0	0.0	0.0	0.0	0.0	0.0	254
Sorghum	0.0	80.4	0.0	9.1	64.0	80.4	14.8	0.0	0.0	0.0	0.0	0.0	249
Kharif Fodders	1.0	100.6	131.1	83.2	70.1	50.2	0.0	0.0	0.0	0.0	0.0	44.3	480
Kharif Fodders	26.1	128.8	131.1	83.2	53.4	0.0	0.0	0.0	0.0	0.0	33.4	0.0	456
Tomato	35.3	178.3	85.7	0.0	0.0	0.0	0.0	0.0	0.0	52.7	0.0	8.7	361
Melons	68.3	148.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.7	0.0	21.2	290
Lady's Finger	1.0	100.6	131.1	83.2	70.1	50.2	0.0	0.0	0.0	0.0	0.0	44.3	480
Lady's Finger	26.1	128.8	131.1	83.2	53.4	0.0	0.0	0.0	0.0	0.0	33.4	0.0	456
Cotton	36.3	49.3	148.1	128.3	71.6	37.6	0.0	0.0	0.0	0.0	0.0	0.0	471
Rice	0.0	0.0	12.0	113.8	155.2	100.6	3.5	0.0	0.0	0.0	0.0	0.0	385
Sugarcane	67.0	181.8	197.2	139.6	123.3	108.1	33.1	3.8	0.0	52.7	0.0	2.0	909
Kharif Pulses	0.0	0.0	72.3	0.0	36.7	71.6	29.6	0.0	0.0	0.0	0.0	0.0	210
K. Oilseeds	0.0	80.4	29.0	47.7	79.2	65.3	0.0	0.0	0.0	0.0	0.0	0.0	302
Tumeric	0.0	118.2	142.4	117.1	102.0	84.2	33.9	19.6	0.0	0.0	0.0	44.3	662
Wheat	10.2	0.0	0.0	0.0	0.0	0.0	55.8	0.0	4.5	0.0	0.0	50.0	121
Wheat	81.5	79.4	0.0	0.0	0.0	0.0	0.0	80.3	0.0	0.0	0.0	50.0	291
Wheat	10.2	0.0	0.0	0.0	0.0	0.0	55.8	0.0	4.5	0.0	0.0	50.0	121
Gram	0.0	0.0	0.0	0.0	0.0	0.0	55.8	0.0	4.2	0.0	0.0	0.0	60
Rabi Oilseeds	0.0	0.0	0.0	0.0	0.0	58.2	0.0	5.3	15.3	0.0	0.0	0.0	79
Potato	0.0	0.0	0.0	0.0	0.0	58.2	3.5	30.3	22.4	0.0	0.0	0.0	114
R. Vegetables	0.0	0.0	0.0	0.0	42.5	0.0	0.0	21.1	19.8	0.0	0.0	17.3	101
Cauliflower	0.0	0.0	0.0	0.0	0.0	58.2	20.0	26.2	24.3	0.0	0.0	0.0	129
Onion	57.7	112.9	0.0	0.0	0.0	0.0	0.0	0.0	85.2	0.0	0.0	40.4	296
Guava	81.5	174.8	180.2	125.1	109.6	96.8	51.3	36.4	11.2	0.0	0.0	50.0	917
Dates	35.3	112.9	114.1	68.7	56.4	52.7	20.9	18.6	11.2	0.0	0.0	16.4	507
Citrus	81.5	174.8	180.2	125.1	109.6	96.8	51.3	36.4	11.2	0.0	0.0	50.0	917
Rabi Others	0.0	0.0	0.0	0.0	42.5	0.0	0.0	21.1	19.8	0.0	0.0	17.3	101
Rabi Fodders	0.0	0.0	0.0	0.0	42.5	0.0	0.0	21.1	19.8	0.0	0.0	17.3	101

TABLE - 10.27
CROP WATER REQUIREMENTS - Shah Kaleem DAM

CCA= 600 Acres — Crop Water Requirement in Acre Feet

CROPS	INTENSITY	AREA CROPPED	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
	(%)	(Acres)	1	2	3	4	5	6	7	8	9	10	11	12	(AF)
Maize	9.0	54	0.0	14.2	1.5	8.7	11.9	8.7	0.0	0.0	0.0	0.0	0.0	0.0	45
Maize	8.0	48	0.0	0.0	11.4	0.0	6.0	9.7	2.9	0.0	0.0	0.0	0.0	0.0	30
Maize	8.0	48	0.0	12.7	1.3	7.8	10.6	7.7	0.0	0.0	0.0	0.0	0.0	0.0	40
Kharif Fodders	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Kharif Fodders	5.0	30	2.6	12.7	12.9	8.2	5.3	0.0	0.0	0.0	0.0	0.0	3.3	0.0	45
K. Vegetables	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
K. Vegetables	8.0	48	4.1	20.3	20.6	13.1	8.4	0.0	0.0	0.0	0.0	0.0	5.3	0.0	72
Sugarcane	5.0	30	6.6	17.9	19.4	13.7	12.1	10.6	3.3	0.4	0.0	5.2	0.0	0.2	89
Kharif Pulses	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
K. Oilseeds	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Wheat	40.0	240	8.0	0.0	0.0	0.0	0.0	0.0	43.9	0.0	3.6	0.0	0.0	39.4	95
Wheat	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Wheat	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Oilseed	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
R. Vegetables	8.0	48	0.0	0.0	0.0	0.0	0.0	9.2	0.6	4.8	3.5	0.0	0.0	0.0	18
R. Vege (Onion)	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Fodder	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Orchards (Plums)	2.0	12	3.2	6.9	7.1	4.9	4.3	3.8	2.0	1.4	0.4	0.0	0.0	2.0	36
			Kharif Intensity % =			**45.0**	Rabi Intensity % =			**55.0**					
TOTALS	100	600	24.5	84.7	74.2	56.5	58.6	49.7	52.6	6.6	7.5	5.2	8.5	41.5	470
Field Water Requirements		85%	28.8	99.6	87.3	66.4	68.9	58.4	61.9	7.7	8.9	6.1	10.1	48.9	553
Water Course Requirements		95%	30.4	104.8	91.9	69.9	72.5	61.5	65.2	8.1	9.3	6.4	10.6	51.4	582
Diversion Requirements		100%	30.4	104.8	91.9	69.9	72.5	61.5	65.2	8.1	9.3	6.4	10.6	51.4	582
Flow Available (cfs)			0.51	1.70	1.54	1.14	1.18	1.03	1.06	0.14	0.15	0.10	0.19	0.84	0.80
Shortage/Surplus (%)															

Table - 10.28
Gross Irrigation Requirements of Shah Kaleem Dam

INTENSITY	(%)	100	Gross Irrigation Requirement at Head Works	
Command Area	(Acres)	600		
Cropped Area	(Acres)	600		
Months			**(AFT)**	**cfs**
APR			30.36	0.51
MAY			104.83	1.70
JUN			91.86	1.54
JUL			69.94	1.14
AUG			72.53	1.18
SEP			61.52	1.03
Kharif Total			**431.04**	**1.18**
OCT			65.20	1.06
NOV			8.14	0.14
DEC			9.35	0.15
JAN			6.42	0.10
FEB			10.58	0.19
MAR			51.44	0.84
Rabi Total			**151.13**	**0.41**
ANNUAL			**582.18**	**0.80**

CHAPTER

11

ENVIRONMENTAL ASSESSMENT

ENVIRONMENTAL ASSESSMENT

Table of Contents

CHAPTER – 11

ENVIRONMENTAL ASSESSMENT

11.1 General

Shah Kaleem dam is proposed to be constructed in the mountainous part of NWFP. In this part there are small valleys incised by small and big torrent streams. The available pieces of land are under rain fed (barani) cultivation but their full potential is not being realized because of rain not always falling at the required time and in the required quantity. Improved yields can be had by bringing these lands under irrigation by using runoff from rainfall. This is proposed to be achieved by creating water storage of rainfall runoff by construction of dams on streams at appropriate locations. To make use of this potential for agricultural development, Small Dams Organization of the Irrigation and Power Department selected a dam site in district Nowshera. In compliance with the provisions of Pakistan Environmental Protection Act 1997 and in fulfilment of the requirements of Consultancy Agreement, this Report presents Initial Environmental Examination (IEE) of Shah Kaleem Dam Project.

11.2 Shah Kaleem Dam Project

Located on Pitao Khwar in district Nowshera, Shah kaleem Dam Project besides providing flood control, will irrigate lands .The stream bed elevation is 1125.3 ft. above mean sea level. It will have gross storage of 646 acre ft. Based on 60% reduction of gross storage, the life of the dam is estimated at 60 years. The 300 ft. wide ogee type spillway will be located on the left hand side of the dam designed for a surcharge of 8.9 ft.

11.3 Legal Framework

Pakistan Environmental Act 1997 under Section 12 requires preparation and submission of environmental impact assessment (EIA) reports by proponents of all development projects and obtains approval from the relevant government agency before commencement of construction or operation.

Pakistan Environmental Protection Agency issued August 2000 "Policy and procedures for filing, review and approval of environmental assessment." This policy document includes schedules A, B and C defining development projects in terms of requirements for Initial Environmental Examination and Environmental Impact Assessment. Included in the list of projects under schedule B are dams with storage volume less than 40,565 acre ft., irrigation schemes serving less than 37,065 acres and small scale irrigation systems. Shah Kaleem Dam Project, therefore, falls under schedule B. Accordingly, Initial Environmental Examination Report for Shahkaleem Dam Project has been prepared for submission to and approval of the provincial

Environmental Protection Agency Peshawar.

11.4 Environmental Baseline

11.4.1 Physiography

Physiographically the proposed Shah kaleem Dam site area is situated where the mountains are medium high and become high at east. Flood plains of Nowshera are presnt in the north east.river Kabul runs parallel to these plains. The irrigated area is composed of Quaternary deposits. Climatically the area lies in the region characterized by cold in the winter and very hot in the summer.

11.4.2 Geology

The Shah Kaleem dam is located in mountainous region belonging to Attock- Cherat Ranges. The rocks exposed in the area range from Paleozoic to Cenozoic ages. The solid rocks of mountains are mainly composed of Slates, Phyllite, Argillites, Limestone, Quartz tic Slates and Quartzite.

11.4.3 Land Use

The land areas of the project lie on right and left side of Pitao Khwar. At present arable farming is practiced in Nowshera District due to scarcity of water; rainfed agriculture, irrigation by using wells and flood-water cultivation resulting in low yields. Some tracts of land are used for grazing, though perpetual grazing has resulted in very poor condition of grazing lands and even complete elimination of palatable plant species. An existing system of Tube well irrigation is also practiced in the project area.

11.4.4 Water Resources

Besides wells, number of springs and streams flow throughout the district providing clean water for drinking and irrigation. The hydrological conditions are good with respect to runoff generation. The average annual rainfall at the catchment is about 17.6 inches. Mean annual runoff is 1320 acre-ft. Water quality is fit for irrigated agriculture. It can be rendered fit even for drinking purposes after necessary treatment.

11.4.5 Flora and Fauna

The flora of the project area is conspicuous by deciduas forest, bushes and shrubs. There are no endangered species of wild life animals including those of birds.

11.4.6 Socio – Economic Environment

There are four villages considered under the influence of Shah Kaleem Dam Project. The population of these villages is 9500. Facilities in terms of potable water are limited whereas access to electricity is 90%.Health facilities are poor. At present 1 BHU and a private hospital exist in the project area. Regional economy is largely dependent on agriculture with small number of industrial units.

11.5 Impact Assessment

Assessment of impact of each project component on the physical, biological and socio-economic environment has been undertaken in respect of project construction and much longer period of project operation using impact matrixes based On Asian Development Bank Guidelines.

11.5.1 Construction Phase Impacts

Project impacts during construction phase are negative but short lived and site specific. Environmentally, they are significant in terms of land use effect, which would result in acquisition of 4.6 acres of cultivated land, demolition/relocation of, 1 no. of well, 1 no. of Tube well, and relocation of electric poles. These entire infrastructures would be submerged by the creation of dam reservoir. The project construction will offer benefits in terms of employment opportunities to local population.

11.5.2 Operation Phase Impacts

Significant environmental impacts during operation stage of the project are positive. During project operation benefits will accrue in terms of agricultural expansion, employment opportunities for locals and overall improvement in economy of the project area.

11.6 Mitigation Measures

Shah Kaleem Dam is environment friendly as it will cause minimal environment impacts during construction and operation stages of the project. Mitigation measures have been identified wherever required. In particular, compensatory tentative amount of Rs.4.21 million would be provided for land, wells, Electric Poles and access road to be overtaken for project implementation.

11.7 Environmental Management and Monitoring Plan

The initial environmental examination of the project indicates no significant environmental impacts (SEI's) except for acquisition of cultivated land, loss of built up property, cutting of trees, relocation of electric poles, relocation of one School and a graveyard during the construction phase of the project. It is important that an environmental management programme (EMP) is pursued during construction and operation phase of the project. This will involve development of guidelines for monitoring environmental parameters related to land acquisition, built up property, relocation of utility services/infrastructure, cultural property, water resources particularly their quality and quantity and meteorology particularly rain fall record through installation of rain gauges. The monitoring work may be undertaken by the concerned authorities in the vicinity of dam site.

CHAPTER

12

COST ESTIMATES

COST ESTIMATES

Table of Contents

CHAPTER – 12
COST ESTIMATES

12.1 Project Cost

Based upon the preliminary designs and drawings prepared for Shah kaleem Dam on Pitao khawar in district Nowshera under Small Dams, in NWFP, the project components, quantities and cost estimate of project components involved have been worked out as shown in tables as Annexures.

The rates used in working out the cost are based on NWFP Schedule of rates - 2008 with suitable premium added to rates wherever the rates are not workable. The final rates were compared with the rates on the project tendered or completed recently in the vicinity of the dam. Moreover in adapting the schedule of rates, escalation at the rate of 6% per annum has been applied to bring the rates to date. Factors effecting the increase in rates due to increase in cost of construction material, skilled and unskilled labour, basic and operational cost of construction plant and machinery have been accounted for in reaching the most realistic rates as used therein. In addition to all the above mentioned factors, due consideration has been given to the location of the dam which is located in a remote area.

Allowances for physical contingencies, engineering and administration have been included in the total project cost.

12.2 Scope of the Cost Estimate

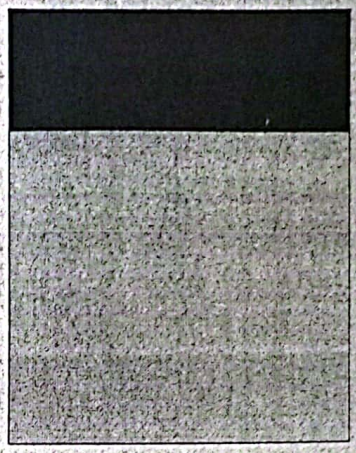
The project comprises of the following components on the basis of which the cost estimate has been prepared:

- Dam Embankment
- Spillway
- Outlet works
- Irrigation system including stepped falls, aqueducts, x-drainage and outlets structures and water courses.

12.2.1 Dam Embankment and Appurtenant Structures

Cost estimate for these structures have been prepared on the basis of project located in the vicinity of dam, with due adjustment for applicability to the dam site.

Total cost estimate for the dam construction has been shown in Annexure-(1).



MEASUREMENT SHEET

SHAH KALEEM DAM PROJECT
DISTRICT NOWSHERA

Summary of Cost

S No.	Description		Amount Rs.(Million)
A	**WORKS**		
	i.	Dam Embankment	62.46
	ii.	Spillway	34.94
	iii.	Intake & Outlets Structure	3.13
	iv.	Irrigation System	11.91
		Sub Total	**112.44**
B	**PRELIMINARIES**		
	i	Environmental related cost	2.46
	ii.	Provission for access road	1.00
	iii.	Provision for Drinking water supply system	0.50
	iv.	Provision for Command Area Development including Construction of Water Courses	0.25
	.	**Sub Total**	**4.21**
C.	**GENERAL**		
	i	Contingency /project staff, inauguration, pol and maintenance of vehicles, Office Furniture and Stationary @ 3% on Rs. 112.44 Millions.	3.37
		Sub Total	**3.37**
	Grand Total A+B+C		**120.02**

→ Detail Design = 1.44 m.

→ Construction Supervision @ per actual ~~cost~~ cost. 17.43

3.37 +
17.43
20.80 × .7 = 14.56

4.21
1.44
5.65
50% 2.825

120.02
1.44
17.43
138.89

SHAH KALEEM DAM PROJECT

DISTRICT NOWSHERA

BILL OF QUANTITIES

Bill No. 1: Embankment Dam

Item	Description	Unit	Quantity	Rate (Rs)	Amount (Rs)
1.1	Bailling out of water by pumps	M^3	13,495	4.65	62,751.75
1.2	Care and handling of water during construciton	L.S			350,000.00
1.3	Clearing and Stripping of Embankment foundation	M^2	3,456.95	22.67	78,369.06
1.4	Excavation under the dam toe i/c disposal of excavated material to any lead/lift				
i)	In shingle/gravel - formation	M^3	20,990.18	216.76	4,549,830.79
ii)	In Rock	M^3	6,542.00	412.92	2,701,322.64
1.5	Excavation for toe drain in main dam, including disposal of excavated material to designated area	M^3	4,146.14	216.76	898,717.96
1.6	Excavation in rock for grout curtain cap in main dam including disposal of excavated material to designated area	M^3	383.92	412.92	158,526.86
1.7	Loading, haulage and placing of Rock for up and downstream slope protection of embankment.	M^3	38,765.18	487.21	18,886,783.35
1.8	Loading, haulage and placing of Gravel for up and downstream slope of embankment.	M^3	17,652.10	422.63	7,460,307.02
1.9	Loading, haulage, placing and compacting clayey silt in the core of dam.	M^3	33,239.12	401.00	13,328,885.91
1.10	Providing, placing and compacting fine filter at up and downstream of clayey silt	M^3	16,909.03	365.00	6,171,796.59
1.11	Loading, haulage, and placing rip-rap on upstream slope of dam embankment.	M^3	6,539.43	860.00	5,623,912.99
1.12	Drilling of 2" Dia bore hole for Grout Curtain.	M	255.00	3,335.00	850,425.00
1.13	Providing And Filling Cement Slurry / Bentonite grout curtain through bore hore including pressure test.	Bag	465.00	1,050.00	488,250.00
1.14	Providing and install required instrumentation i.e. stand pipe piezometer.	Nos.	13.00	40,000.00	520,000.00
1.15	Providing and fixing boundary piller including paint etc.	Nos.	150.00	550.00	82,500.00
1.16	P&F Barbed wire fencing with 4 Horizantal & 2 cross wire with PCC 1:4:8 base 12"x12"x21"	M	600.00	334.00	200,400.00
1.17	P&F Surface Marker	Nos.	10.00	5,000.00	50,000.00
				Sub Total	**62,462,779.91**

SHAH KALEEM DAM PROJECT
DISTRICT NOWSHERA
BILL OF QUANTITIES
Bill No. 2: Spillway & Spill Channel

m	Description	Unit	Quantity	Rate (Rs)	Amount (Rs)
1	Bulk excavation of Approach Channel for Spillway and exit channel including dressing, disposal of excavated material any lead/lift to areas.				
	In Shingle/Gravel	M^3	12,400.00	187.20	2,321,280.00
)	In Rock	M^3	30,108.79	412.92	12,432,521.57
2	Provide and lay lean concrete, 10 cm of 1200 psi i/c curing and finishing	M^3	759.30	2,967.22	2,253,009.66
3	Provide place and compact plain cement concrete 3000 psi in spillway floor and stepped weir section.	M^3	2,007.95	3,550.92	7,130,083.76
4	Providing, place and compact RCC 3000 psi in Ogee, baffle/chute blocks, foundation slab and retaining walls i/c formwork all	M^3	675.00	5,342.06	3,605,890.50
5	Providing, fabrication and fixing in position of mild steel deformed bar reinforcement of 60,000 psi yield strength for RCC including cutting, bending, laying and securing in position, making joint and fastenings, including cost of binding wires, chairs, supports, labour charges and also including removal of rust, oil and other deleterious materials etc. from bars (Temperature Steel)	Tonne	54.50	117,265.90	6,390,991.55
6	Provide and Place stone pitching in approach and down stream of stilling basin	M^3	679.60	1,182.61	803,705.45
				Sub Total	**34,937,482.48**

SHAH KALEEM DAM PROJECT
DISTRICT NOWSHERA
BILL OF QUANTITIES
Bill No. 3: Intake/Outlet Works

Item	Description	Unit	Quantity	Rate (Rs)	Amount (Rs)
3.1	Excavation for Intake/Outlet structures and in trench for laying of pipe etc. including disposal of excavated material				
i)	In Rock	M^3	154.95	412.76	63,957.16
ii)	In Shingle/ Gravel	M^3	878.05	216.76	190,326.12
3.2	Providing, placing and compacting lean concrete 1200 psi including curing and finishing.	M^3	14.48	2,967.22	42,959.41
3.3	Providing, placing and compacting plain concrete 3000 PSI including curing and finishing intake/outlet structures etc.	M^3	189.13	3,550.92	671,585.50
3.4	Providing, placing and compacting RCC 3000 PSI including curing and finishing intake/outlet structures etc.	M^3	63.00	5,342.06	336,549.78
3.5	Providing, fabrication and fixing in position of mild steel deformed bar reinforcement of 60,000 PSI yield strength for RCC including cutting, bending, laying and securing in position, making joints and fastenings, including cost of binding wires, chairs and support and labour charges.	Tonne	5.04	117,265.90	591,020.14
3.6	Supplying and placing of 2.0 Feet Internal Dia RCC pressure pipe of ASTM C-76-79, Class II for intake/outlet	RM	84.50	3,250.00	274,625.00
3.7	Supply and fix trashrack for intake as per drawing, specification and direction of the Engineer Incharge.	M^2	14.00	4,000.00	56,000.00
3.8	Providing and placing gate valve at outlet of conduit with all accessories.	Nos.	1.00	650,000.00	650,000.00
3.9	Providing and placing 2' dia butterfly valve with all accessories.	Nos.	1.00	250,000.00	250,000.00
				Sub Total	**3,127,023.11**

SHAH KALEEM DAM PROJECT
DISTRICT NOWSHERA
BILL OF QUANTITIES
Bill No. 4: Irrigation System

Item	Description	Unit	Quantity	Rate (Rs)	Amount (Rs)
4.1	Earth Excavation in Irrigation Channels and disposal upto 25 m and dressing in ordinary soil	M^3	2,587.66	128.09	331,453.37
4.2	Excavation in Rock Dressing and Disposal upto 50m Medium Hard Rock requiring occational blasting.	M^3	1,899.35	341.67	648,950.91
4.3	Provide and place 4" thick PCC lining in channel (1:2:4).				
i)	In Bed	M^3	422.71	4,226.92	1,786,761.35
ii)	on walls	M^3	980.68	4,226.92	4,145,255.91
4.4	Supply and Fabricate Ms Reinforcement for cement concrete deformed bar G-60	Tonne	16.41	117,265.90	1,924,333.42
4.5	Rcc in Roof, Slab, Beam, Column and other structural members insitu or Precast 1:2:4.	M^3	205.11	5,342.06	1,095,709.93
4.6	Supplying, placing and compacting of lean concrete of 1200 Psi.	M^3	138.68	2,967.22	411,494.07
4.7	Cascade of Falls	Rft	125.00	1,940.00	242,500.00
4.8	Construction of Acqaduct Structures	Nos	3.00	55,000.00	165,000.00
4.9	Construction of Road Culverts and Drainage Culverts	Nos	3.00	95,000.00	285,000.00
4.10	Irrigation Outlets	Nos	3.00	42,000.00	126,000.00
4.11	Water shed / Storm water crossing	Nos	6.00	125,000.00	750,000.00
				Sub-Total	**11,912,458.96**

CHAPTER

13

ECONOMICAL AND FINANCIAL STUDIES

ECONOMIC AND FINANCIAL STUDIES

Table of Contents

CHAPTER – 13

ECONOMIC AND FINANCIAL STUDIES

13.1 General

The various types of analyses of the development projects are carried out to conclude whether they are beneficial for the economy, executing agencies and the individual stakeholders of the project. There are three major analyses mainly Project Analysis, Economic Analysis, and Financial Analysis, which are carried out to judge the viability of the projects. The Economic analysis of an activity is carried out to develop a comparison to assist in concluding whether an investment in that particular activity is in the best interest of the Nation. In the Project Analyses the judgement is derived whether it is beneficial for the implementing and executing agency, whereas the Financial Analysis serves as the bases for benefits accruing from the implementation of the projects for the individuals and communities participating in the development of the economy. Here the process includes the identification and measurement of total benefits accruing and totalling of all costs required for completion and proper functioning of the project. An income accruing to community or Nation because of the project is considered a project benefit. The various types of prices are applied to work out the Project Costs and Benefits.

13.2 Background

North West Frontier Province covers 25.1 million acres as Farm area of which 16.6 per cent cultivated and about 8.1 per cent is irrigated area. The Government of NWFP in order to increase the agricultural production of the province and to improve the socio-economic conditions of the people, has been making continuous efforts to further utilize the irrigation potential of the perennial and non-perennial nullahs (small rivers) during flood flows. In this regards a number of small dams are planned for implementation on various sites. One such site has been selected on Shah Kaleem Nullah (locally named as Pitao Khwar) namely Shah Kaleem Dam for which preparation of feasibility studies has been required.

Shah Kaleem Dam is an irrigation project, which will irrigate 600 acres of land besides fish production in the reservoir. The dam site is proposed on said Pitao Khwar and is located Shidu village in Noshera District.

The project is envisaged to increase the cropping intensities of the existing rainfed area by construction of water reservoir and new irrigation system for the provision of dependable irrigation supply.

For the purpose of detailed feasibility study, following two types of analyses have been carried out.

13.2.1 Economic Analysis

The capital and O&M costs have been converted into Economic costs of the project to accomplish the economic analysis of the project. For the purpose of economic analysis, a standard conversion factor of 0.92 has been applied to the remaining project cost to convert it into economic cost. Under this analysis the economic farm-gate prices of non-traded goods have been used, whereas for the traded commodities border prices have been applied. While the escalation and interest during construction has not been accounted for to work out the economic cost.

13.2.2 Financial Analysis

Financial analysis has been carried out on the basis of financial costs of the project, which has been achieved by the addition of escalation and interest during construction in the base cost of the project. The project benefits have been computed on the basis of financial prices of all the inputs and outputs of the project area.

13.3 Parameters for the Analyses

The approach and methodology of analyses are given in the following sections.

13.3.1 Project Datum

All costs and benefits attributed to the project are expressed in constant March 2009 price level. No allowance for inflation during and after the construction period of the project has been taken into account in the analyses.

13.3.2 Exchange Rate

In view of the existence of a freely floating exchange rate in Pakistan, the calculation of a shadow price is not considered necessary as would be the case if the exchange rate was not floating. This, however, does not imply that the balance of payments is considered to be in equilibrium or that such distortion as import and export taxes do not exist. Nominal Exchange rate as prevailing in March, 2009 has been taken as Rs. 80.00 per US Dollar.

13.3.3 Discount Rate

The selection of an appropriate discount rate for 'Cash Flow' analysis is a matter of considerable importance. A low discount rate exaggerates the desire or postpones the future benefits thereby giving performance to long gestation projects. Moreover, a low rate would make the marginal projects look profitable with a high rate of return. The choice of social discounts rate has been the subject of considerable debate and

the theoretical work involved is highly sophisticated and cumbersome in practical application. In general, the appropriate social discount rate would depend on the economic conditions of the economy. The discount rate in developing countries is higher than the same in capital rich countries because in case of the former, people have a low level of consumption, which implies preference to present over future consumption. Moreover, in developing countries the marginal rate of return on capital is high owing to the shortage of investment funds.

In Pakistan, the marginal productivity of capital is believed to lie around 10-12 percent. The low rate of opportunity costs as compared to 16% cut off rate, used by Planning Commission is based on (i) fluctuation in discount rate declared by State Bank of Pakistan during the last 5 year (ii) projects in backward regions are accepted even with low returns for regional development. Therefore the discount rate of 10% has been used in this study. This discount rate has already been applied and approved by the Planning & Development Organization of Government of Pakistan and Provincial Government.

13.3.4 Sensitivity Analysis

Sensitivity analysis has been under taken to assess the impacts of possible decreases, delays/negative effects on benefits because project benefits are function of many variables like irrigation, other farm inputs, credit and agriculture technology etc. Similarly many an elements of risks and uncertainties are encountered at the construction and operation stages, which are likely to occur in this project as well. These elements result in increased project costs. For analyzing the impact of such risks and uncertainties, four possibly applicable scenarios have been recognized as under:

1) Base Case.
2) An increase of 10% in costs.
3) A decrease of 10% in benefits.
4) Decrease in benefits & increase in costs by 10% occurring simultaneously.

13.3.5 Life of the Project

Project life or service life of the project is dependent upon the useful life of its diverse components. The service life of civil works ranges from 70 to 80 years. The useful life of the mechanical component would be much less and different for various types of equipment. It is assumed that such components will be replaced as and when required along with their repair and maintenance practice during the useful life of the civil works. As a common practice for such projects, the project life is assumed to be

40 years. The evaluation period excludes the period of two year for the construction of the Project.

13.3.6 Other Assumptions

i) Construction period of the project is considered as two year.

ii) Full agricultural development directly resulting from the project for arable crops is expected to be achieved in third year with gradual yield build up in each successive year. The detail of development strategy has been given in Chapter 8 on Agriculture.

13.4 Benefits

The project mainly aims at social uplift of the area and warrants to be evaluate from that point of view. This project comprised of those gains to the economy that can be measured in monetary terms as well as those benefits which, though socially desirable and of great value, cannot be quantified and expressed in monetary terms. Benefits could be broadly grouped into two categories namely (i) Direct or primary benefits and (ii) indirect or secondary benefits. In addition to the indirect benefits accruing from the Project the benefits that are quantifiable are given as under:

Direct Benefits

Increase in crop production by construction of Shah Kaleem Dam through dependable irrigation supply.

Increase in Crop production due to conversion of existing rainfed agriculture into irrigated agriculture.

Water utilization for drinking purpose by local community.

Benefits from fisheries development.

Indirect Benefits

Indirect or the secondary benefits would include facility of sweat/cleandrinking water, creation of employment opportunity and improved standard of living of the people. Increase agricultural production made possible by the project would result in enhanced earnings / savings of the farmers. Thus it has multiple effects on socio-economic development of the region. Development of forestry, cottage industry and other opportunities would open up with construction of the proposed project. These benefits have neither been quantified nor considered in the present analysis. Most of the indirect benefits are difficult to quantify in monetary terms but should not be ignored while making decision for the implementation of the Project.

13.4.1 Agriculture Benefits in the Project Area

The projection for crops acreage and yields for "With" and "Without" project situation have been shown in Chapter-10. To derive the agriculture benefits for input and output relationship of all crops for present, "Without" Project and "With" project situations have been based on feasibility study of the Project and secondary data collected by agronomist for similar other projects in NWFP. These physical input and output relationship of crops have been multiplied by respective prices to obtain gross value of production. Costs of production and net value of production per acre for future "Without" and "With" Project situations have been calculated. The per acre gross production values, farm cost and net value of various crops are shown in Annexure. Crop budget for "Without" Project situation have been defined as existing technology and "With" Project as improved technology.

Returns from livestock have been calculated in the analysis using adjusted average wholesale prices of fodder. Per acre gross value of production, cost of production and net value of production have been multiplied by crop acreage in respective year and Project situations, to derive the incremental benefits for the Project.

13.4.2 Benefits from Fisheries

Benefits from fisheries have been worked out by taking into account the main features of the dam for fish production, like Dam area, depth of water and existing fish species etc.

13.4.3 Benefits from Drinking Water

Project benefits from drinking water have been evaluated on the basis of sale of water. The rate has been taken from the vicinity of the project.

13.4.4 Land Values

Values for land adjacent to the reservoir are reported to be higher than for lands at some distance from the reservoir. People are willing to pay more for land near water, no doubt valuing the aesthetic features of the project. Under the principal that benefits to whosoever they accrue may be attributed to the project, the increase in land values near the lake contribute to the economic rate of return for the project. However this benefit has not been accounted for the analysis.

13.5 Cost

13.5.1 Capital Costs

These are investments made for completion of the project works, which comprise dam embankment, spillway, outlet structures, command area development, river diversion during construction, land acquisition etc. The capital costs include component of price contingencies 0.5%, escalation (6.0%), interest during construction (9.96%) and other transfer payments.

13.5.2 Operation, Maintenance and Replacement Cost

The operation, maintenance and replacement costs of Project consists of (a) Administration expenses, salaries and allowance of the staff, rent, stationery etc., (b) operation and maintenance of the project works and facilities, (c) running & maintenance of vehicles (P.O.L & repair etc.) (d) Misc. / unforeseen expenses.

The detail of the each type of analysis with the assumptions is given in the following sections separately.

13.6 Economic Analysis

The capital and O&M costs have been converted into Economic costs of the project to accomplish the economic analysis of the project. For the purpose of economic analysis a standard conversion factor of 0.92 has been applied to the remaining project cost to convert it into economic cost, while the escalation and interest during construction has not been accounted for to work out the economic cost. Under this analysis the economic farm-gate prices of non-traded goods have been used, whereas for the traded commodities border prices have been applied. The economic prices are measured as net of all subsidies and price supports to reflect the true societal costs of outputs and inputs. World prices adjusted to local conditions are thus often used to reflect true economic values. The commodities are classified into traded and non-traded goods. The traded commodities are those goods, which are either imported or exported to foreign countries, where as non-traded commodities which are sold or purchased with in the country.

13.7 Parameters for the Economic Analysis

The approach, methodology and results of economic analysis are given in the following sections.

13.7.1 Standard Conversion Factor

The most general conversion factor used in economic analysis is the Standard

Conversion Factor (SCF), which represents the ratio of prices of all goods within the economy to their international prices. The SCF is mainly influenced by the trade policies of the Government. It is approximated by the weighted average of import and export tariffs, with subsidies excluded. The weights used are based on the magnitude of imports and exports in the total trade during the recent years.

Table 13.1 gives the yearly data used in calculation of the Standard Conversion Factor for the fiscal years 2003-04 to 2007-08. An average of five years is taken to allow for annual fluctuations in trade, taxes and subsides. Taxes on exports are levied on a range of items including raw cotton, rice, hides and skins. Rebates of excise duties and sales tax are allowed on certain domestically produced goods used in the production of exports. Standard Conversion Factor is calculated based on these data.

The value of SCF works out as 0.92. This, however, only takes into account distortions to domestic prices of traded goods caused by tariffs. It may be noted that such factors, as trade margins and labour input particularly in non-tradable or services also tend to distort the ratio. The same conversion factor is adopted by the Word Bank, Asian Development Bank, WAPDA and other planning agencies. As the labour rates in the peak seasons i.e. harvesting period of the crops are the highest during the year and the labour rates are lowest in the slack season of the year. In certain periods of the year the demand of the labour comes to even negligible.

13.7.2 Derivation of Economic Prices

To derive economic prices of agricultural commodities and input in broader terms these have been classified into traded and non-traded commodities and inputs. Wheat, Maize and Chemical Fertilizers have been assumed as traded commodities and their economic prices i.e. import parity prices of Wheat and Maize have been derived. Economic (import parity) prices have also been derived for fertilizers, namely: Urea, DAP and Potassium Chloride. Remaining commodities in the cropping pattern are non-traded commodities. Average market prices of these commodities for the year 2008-09 have been adjusted to farm gate accounting for marketing and transport charges. The adjusted farm gate prices have been converted to economic prices by multiplying these by SCF of 0.92. Labour has been shadow priced by converting financial prices of labour prevailing in the area using conversion factor of 0.7 To convert financial rate of tractor in to economic rate, a conversion factor of 0.92 has been used.

The derivation of economic prices is given in Table 13.2 to 13.6.

13.7.3 Agriculture Benefits in the Project Area

The additional benefits from agriculture are the difference between the total benefits

With Project less the benefits Without Project. The benefits from agriculture are the aggregate of the gross margins applied to the area cropped under each crop. The crop budgets presented in economic terms for the present and future situation by index years is given in Appendix-A.

Use of Water rates, land rent and other taxes are excluded in economic analysis. Economic returns from livestock have been calculated in the analysis using adjusted average wholesale prices of fodder. Per acre gross value of production, cost of production and net value of production have been multiplied by crop acreage in respective year and Project situations, to derive the incremental benefits for the entire Project. Projected agricultural benefits and incremental agricultural benefits for the entire Project come to Rs. 14.584 million and Rs.11.768 million respectively.

The details are given in Tables 13.7 to 13.8.

13.7.4 Benefits from Fisheries

Benefits from fisheries have been worked out by taking into account the main features of the dam for fish production, like: Dam area, depth of water and existing fish species etc. The benefits worked out for fisheries development in the dam are as Rs. 0.973 million. The assumptions in calculating fisheries benefits are given in Table 13.9.

13.7.5 Benefits from Drinking Water

Economic benefits from drinking water have been worked out as Rs. 3.659 million.

13.7.6 Economic Cost

The economic costs include all cost except interest during construction and escalation. However, there are taxes, duties (paid on materials used in engineering works pose a complex situation, as project works require many types of materials and machines on construction material) and economic premium on highly skilled labour. To overcome these distortions conversion factor as explained in previous section has been used to convert local component of capital and O&M costs to Economic Costs. Foreign component has been assumed nil as all the construction material is produced locally and available in the local markets. The economic cost amounts to Rs. 120.020 million (Table 13.10).

13.7.7 Operation, Maintenance and Replacement Cost

The annual OM&R economic costs worked out to be Rs. 0.600 million.

13.7.8 Economic Internal Rate of Return

Economic cash flow of benefits and cost as computed in the light of assumptions adopted for the project are shown in Table 13.11 A, B, C & D. Economic indicators namely (a) EIRR, (b) B.C ratio and NPV @ 10% are calculated from the cash flow which yields value of 11.5 %, 1.15 :1 and Rs. 16.6 million respectively.

13.7.9 Sensitivity Analysis

Sensitivity analysis has been carried by calculating EIRR, NPV and B.C ratio in respect of each scenario, which are depicted in the same tables. EIRR results of various scenarios are summarized as under:

Sr. No.	Scenarios	EIRR (%)
1	Base case	11.5
2	An increase in costs by 10%	10.5
3	Decrease in benefits by 10%	10.4
4	Decrease in benefits and increase in cost by 10%	9.4

13.8 Conclusion

The results of the Economic analysis reveal that the proposed dam is feasible as EIRR is above the opportunity cost of the capital assumed for the Project, B.C ratio exceeds unity and NPV is positive. So the project is recommended for implementation.

13.9 Financial Analysis

13.9.1 General

The financial analysis is undertaken to ascertain the expected returns on investment and assess the financial viability of the project. For a project to be financially viable, it is necessary that gains generated (expected returns) exceed the cost of goods and services used in the form of project investment costs. At least, these gains must match or yield higher returns as compared to an alternative investment plan.

The primary objective of undertaking this kind of analysis is to determine whether the contribution of this particular project in the shape of added value of benefits is adequate enough to justify the use of scarce resources needed for construction and

operation of the project in the form of project investment cost. As financial analysis is basically carried out from the viewpoint of project owner rather than the economy as a whole, it specifically aims:

- To determine the costs and returns of the project under reasonable financing plan.
- To establish a framework demonstrating the financial viability of the project during financial negotiations for project financing and capital investment.
- To assess repayment capability of the project.

13.10 Approaches to Financial Analysis

Financial analysis of the Project has been undertaken firstly to calculate Financial Internal Rate of Return (FIRR) and secondly to estimate project funding requirements over the construction period. Broadly speaking, FIRR is based on market prices converted to farm gate prices of output and inputs. Project costs also take into account taxes, duties, escalation and interest during construction.

13.10.1Financial Prices (Market Prices)

In the absence of any regulated market in the vicinity of the project area the farmers sell their products locally or in Noshera District. The prices in the future adopted for the financial analysis are based on the whole sale prices in Noshera District which are collected from the markets, farmers and by the consultants own economic survey.

An average transport cost is deducted from the wholesale prices in order to get farm gate prices of 2008-09.

Average monthly figure for year 2008-09 have been adopted for the wholesale prices, in addition the resulting figures have some times been slightly corrected according to prices collected during the farm survey. Market prices for agricultural inputs utilized in the crop budget have been collected from three different sources and compared: surveyed farmers, suppliers in the area and extension services.

No anticipation of future marketing prices has been made for market prices because the main objective of the financial analysis is to evaluate the impact of the project on the farmers and on institutions involved and each of them could evaluate the benefits they could expect from the project using the effective current prices. The Table 13.12 shows the economic and financial farm gate prices adopted for the financial analysis.

13.10.2 Benefits from Agriculture

The additional benefits from agriculture are the difference between the total benefits

"With" project less the benefits "With out" project. The benefits from agriculture are the aggregate of the gross margins applied to the area cropped under each crop. The crop budgets presented in financial terms for the present and future situation by index years is given in Appendix-B

The total agriculture benefits and the incremental agricultural benefits are represented in Table 13.13 and Table 13.14. It may be added that procedure is same as adopted for computation of economic benefits explained earlier except the application of financial prices for completion of financial benefits.

13.10.3 Benefits from Fisheries

The benefits from fisheries development in the dam has been worked out as Rs. 1.081 million.

13.10.4 Other Unquantifiable Benefits

The enhanced agriculture production would encourage localized development of agro-based activities. The people would also get employment through trading. The project would increase the business activity of the area thereby providing increased employment and investment opportunities. This would provide incentive to the work force to live near their homes. Availability of food supply would provide healthy and better living conditions to the local residents.

In brief, it is envisaged that the project will help to achieve some improvements in health and general standard of living of the people of the project area and also usher in an era of continuous prosperity as well as economic emancipation in utilization of indigenous resources of land, labour and capital.

13.10.5 Financial Cost

The project base cost is almost local currency component. The local currency cost is required for payment of land, compensation, construction, tools and supplies, inland transportation, insurance. The financial cost of the project includes escalation at the rate of 6.0% and interest during construction at the rate of 9.96%. The total financial cost and its periodic phasing is shown in Table 13.15

13.10.6 Escalation

Escalation for the whole Project at the rate of 6.0% has been worked out to Rs. 4.32 million.

13.10.7 Interest During Construction

At this stage, funding of the Project is not committed and hence the applicable borrowing rates for loan components are not known. However, a rate of 9.96% for local borrowing has been adopted as is advised by implementing agencies. Interest During Construction (IDC) for the whole Project at these rates worked out to Rs. 11.212 million.

13.10.8 Operation, Maintenance and Replacement

The annual OM&R costs worked out to be Rs. 0.678 million.

13.10.9 Cash Inflows and Outflows

For the purpose of computing FIRR, cash inflows and outflows related to the Project have been computed over the analysis period. Project Cash Inflows comprise of Crop Revenues (CR). CR has been based on crop budgets per acre for various crops in the command area using domestic prices of outputs and inputs and are shown in Appendix - B.

13.10.10 Financial Internal Rate of Return

Streams of Cash inflows and Cash Outflows and Net Inflows over the analysis period are detailed in Tables 13.16 - A, B, C and D. The FIRR is estimated as 7.2 %. The benefit Cost Ratio and Net Present Value comes to 0.73:1 and Rs. -32.6 million respectively.

13.10.11 Unit Cost

On the basis of the Project cost allocated to water, the cost per acre-foot of additional stored water is worked out as below:

Project Implementation Cost	Rs. 135.553 million
CCA	600 acres
Available water per annum at head	582 Aft
Cost per Acre ft. of water	Rs. 233

13.10.6 Escalation

Escalation for the whole Project at the rate of 6.0% has been worked out to Rs. 4.32 million.

13.10.7 Interest During Construction

At this stage, funding of the Project is not committed and hence the applicable borrowing rates for loan components are not known. However, a rate of 9.96% for local borrowing has been adopted as is advised by implementing agencies. Interest During Construction (IDC) for the whole Project at these rates worked out to Rs. 11.212 million.

13.10.8 Operation, Maintenance and Replacement

The annual OM&R costs worked out to be Rs. 0.678 million.

13.10.9 Cash Inflows and Outflows

For the purpose of computing FIRR, cash inflows and outflows related to the Project have been computed over the analysis period. Project Cash Inflows comprise of Crop Revenues (CR). CR has been based on crop budgets per acre for various crops in the command area using domestic prices of outputs and inputs and are shown in Appendix - B.

13.10.10 Financial Internal Rate of Return

Streams of Cash inflows and Cash Outflows and Net Inflows over the analysis period are detailed in Tables 13.16 - A, B, C and D. The FIRR is estimated as 7.2 %. The benefit Cost Ratio and Net Present Value comes to 0.73:1 and Rs. -32.6 million respectively.

13.10.11 Unit Cost

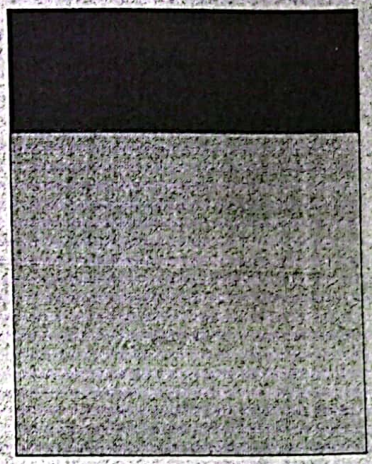
On the basis of the Project cost allocated to water, the cost per acre-foot of additional stored water is worked out as below:

Project Implementation Cost	Rs. 135.553 million
CCA	600 acres
Available water per annum at head	582 Aft
Cost per Acre ft. of water	Rs. 233

	Thousand
Cost per Acre of CCA	Rs. 226 Thousand
Annual Benefits per acre of CCA	Rs. 24 Thousand

11 Conclusion

All the results show that the returns to the economy after the implementation of the project would be satisfactory. Sensitivity analysis also proves that the project is viable for all the constraints. It may, thus, be safely deduced that the project is feasible, sound and viable, and no risk is involved in making the investment for the project. The project is recommended for implementation.



TABLES

Table – 13.1

Derivation of Standard Conversion Factor

Description	2003-04	2004-05	2005-06	2006-07	2007-08	Average
Total Import (M)*	897825	1223079	1711158	1851806	1979103	1532594
Total Exports (X)*	709036	854088	984841	1029312	940484	903552
Imports Duties*	90940	117243	138200	132200	154000	126516.6
Sales Tax on Imports*	220607	235533	294600	309228	375000	286993.6
Subsidies on Imports*	62500	57800	86300	74010	373300	130782
Exports Duties (Tx)*	45823	58670	55000	71575	98000	65814
SCF**	**0.89**	**0.90**	**0.90**	**0.91**	**0.98**	**0.92**

SCF = (M+X)/(M+Tm)+(X-Tx)

M= CIF value of imports

X= FOB value of exports

Tm=Net value of taxes on imports

Tx= Net value of taxes on exports

Tm =	282728
M + X =	*2436146*
M + Tm =	*1815322*
X - Tx =	*837739*
(M+Tm)+(X-Tx) =	*2653061*
S C F =	***0.92***

* Source: Economic Survey 2006-07.

** Source: Ministry of Finance, Islamabad.

Note: Import subsidy includes subsidies on Wheat and Sugar.

Table - 13.2

Import Parity Price of Maiz

1 US$ =PAK Rs. 80

Sr. #	Description	Unit	Economic
1	World Bank Commodity Price	U.S $/MT	168.40
2	Quality Adjustment Factor	Factor	0.9
3	Adjusted to Pakistani Standard	U.S $/MT	154.09
4	Freight and Marine Insurance from Canadian port to Karachi	U.S $	33.00
5	c.i.f. Price at Karachi	U.S $/MT	187.09
6	c.i.f. Price at Karachi	RS/MT	14,966.88
7	Transportation and Handling Charges from Karachi to Jhal Magsi	Rs/MT	920.00
8	Equivalent Value at Jhal Magsi	Rs/MT	15,886.88
9	Transportation Charges from Jhal Magsi to Project Area	Rs/MT	55.20
10	Value at project area	Rs/MT	15,942.08
11	Farmgate Price of Maize	Rs/MT	15,997.28
		Rs/Kg	16.00

Source: 1) World Bank Development Prospects- Commodity Price Data Pinksheet- Oct-Dec 2008. Maize (US), no. 2, yellow, f.o.b. US Gulf ports

2) Consultant's Economic Survey 2009

Table - 13.3

Import Parity Price of Wheat

1 US$ =PAK Rs. 80

Sr. #	Description	Unit	Economic
1	World Bank Commodity Price	U.S $/MT	390.20
2	Quality Adjustment Factor		0.9
3	Adjusted to Pakistani Standard	U.S $/MT	357.03
4	Freight and Marine Insurance from Canadian port to Karachi	U.S $	33.00
5	c.i.f. Price at Karachi	U.S $/MT	390.03
6	c.i.f. Price at Karachi	RS/MT	31,202.64
7	Transportation and Handling Charges from Karachi to Jhal Magsi	Rs/MT	920.00
8	Equivalent Value at Jhal Magsi	Rs/MT	32,122.64
9	Transportation Charges from Jhal Magsi to Project Area	Rs/MT	55.20
10	Value at project area	Rs/MT	32,177.84
10	Farmgate Price of Wheat	Rs/MT	32,233.04
		Rs/Kg	32.23

Source 1) World Bank Development Prospects - Commodity Price Data Pinksheet - July-September 2008. Wheat (Canadian), no. 1, Western Red Spring (CWRS), in store, St. Lawrence, export price

2) Consultant's Economic Survey 2009

Table - 13.4

Import Parity Price of Urea

1 US$ = PAK Rs. 80

Sr. #	Description	Unit	Economic
1	World Bank Commodity Price	US $/ MT	293.40
2	Freight and Marine Insurance to Karachi	US $/ MT	38.50
3	c.i.f. Price at Karachi	US $/MT	331.90
4	c.i.f. Price at Karachi	Rs/MT	26,552.00
5	Transportation and Handling Charges from Karachi to Jhal Magsi	Rs/MT	920.00
6	Equivalent Value at Jhal Magsi	Rs/MT	27,472.00
7	Transportation Charges from Jhal Magsi to Project Area	Rs/MT	55.20
8	Value at project area	Rs/MT	27,527.20
9	Equivalent Farmgate Price	Rs/MT	27,582.40
10	Farmgate Price per bag (One bag of 50 Kg)	Rs/bag	1,379.12
11	Farmgate Price of Nitrogen	Rs/P Kg	60.0

Source: 1) World Bank Development Prospects - Commodity Price Data Pinksheet - Oct-Dec 2008. Urea f.o.b. Eastern Europe onwards f.o.b. blacksea.

2) Consultant's Economic Survey 2009

Table - 13.5

Import Parity Price of DAP (Phosphate)

1 US$ = PAK Rs. 80

Sr. #	Description	Unit	Economic
1	World Bank Commodity Price	US $/ MT	665.00
2	Freight and Marine Insurance to Karachi	US $/ MT	38.50
3	c.i.f. Price at Karachi	US $/MT	703.50
4	c.i.f. Price at Karachi	Rs/MT	56,280.00
5	Transportation and Handling Charges from Karachi to Jhal Magsi	Rs/MT	920.00
6	Equivalent Value at Jhal Magsi	Rs/MT	57,200.00
7	Transportation Charges from Jhal Magsi to Project Area	Rs/MT	55.20
8	Value at project area	Rs/MT	57,255.20
9	Equivalent Farmgate Price	Rs/MT	57,310.40
10	Farmgate Price per bag (One bag of 50 Kg)	Rs/bag	2,865.52
11	Less Value of Nitrogen @ 9 kg per bag	Rs/bag	539.66
12	Farmgate Price of P_2O_5	Rs/P Kg	101.1

Source: 1) World Bank Development Prospects - Commodity Price Data Pinksheet - Oct-Dec 2008. DAP (diammonium phosphate), standard size, bulk, spot, f.o.b. US Gulf.

2) Consultant's Economic Survey 2009

Table - 13.6

Import Parity Price of Potash (Potassium)

1 US$ = PAK Rs. 80

Sr. #	Description	Unit	Economic
1	World Bank Commodity Price	US $/ MT	766.70
2	Freight and Marine Insurance to Karachi	US $/ MT	38.50
3	c.i.f. Price at Karachi	US $/MT	805.20
4	c.i.f. Price at Karachi	Rs/MT	64,416.00
5	Transportation and Handling Charges from Karachi to Jhal Magsi	Rs/MT	920.00
6	Equivalent Value at Jhal Magsi	Rs/MT	65,336.00
7	Transportation Charges from Jhal Magsi to Project Area	Rs/MT	55.20
8	Value at project area	Rs/MT	65,391.20
9	Equivalent Farmgate Price	Rs/MT	65,446.40
10	Farmgate Price per bag (One bag of 50 Kg)	Rs/bag	3,272.32
11	Farmgate Price of K	Rs/K Kg	130.9

Source: 1) World Bank Development Prospects - Commodity Price Data Pinksheet - Oct-Dec 2008. Potassium chloride (muriate of potash), standard grade, spot, f.o.b Vancouver.

2) Consultant's Economic Survey 2009

Table: 13.7

TOTAL VALUE OF PRODUCTION - Shah Kaleem DAM (Million Rs.)

Sr. No.	Crops	Years of development			
		Base	Year 1	Year 2	Year 3
1	Maize	1.035	1.397	1.632	1.792
	K. Fodder	0.000	0.236	0.441	0.612
2	K. Vegetables	0.000	1.172	2.211	3.082
	Sugarcane	0.000	0.204	0.457	0.716
3	Wheat	1.781	3.796	4.732	5.371
5	R. Vegetables	0.000	0.728	1.358	1.884
6	Orchards	0.000	0.437	0.811	1.127
	N. V. P OF CROPS	2.815	7.532	10.831	13.457
	N. V. P OF ORCHARDS		13.893	14.267	14.584

Table: 13.8

ECONOMIC BENEFITS

S.No.	Years	Projected	Incremental
0	Base Year	2.815	
1	2009	7.532	4.717
2	2010	10.831	8.016
3	2011	13.457	10.641
4	2012	13.457	10.641
5	2013	13.457	10.641
6	2014	13.893	11.078
7	2015	14.267	11.452
8	2016	14.330	11.515
9	2017	14.394	11.578
10	2018	14.457	11.642
11	2019	14.520	11.705
12	2020	14.584	11.768

Table: 13.9
FISHERIES BENEFITS ECONOMIC

S. No.	Description	Unit	Qty
1	Reservoir Area	Acre	30
2	Depth	m	35.0
3	Volume	AF	1023
4	Run off	AF	3057
5	Fertility	Moderate	
6	Fish Fingerling stocking Rate	Per Acre	650
7	Total Seed Stocking	No.	19500
8	Mortality	%	30%
9	Growth @ 1Kg / per Year	Kg	14625
10	Fishing Efforts	%	70%
11	Estimated Catch / ter	Kg	10237.5
12	Average Rate (Market Price)	Rs. / Kg	95
13	Total Value	Mill. Rs.	0.973

Source Directorate of Fisheries WAPDA
Publications of Fisheries Department
Consultants Economic Survey

Table - 13.10

SHAH KALEEM DAM PROJECT

DISTRICT NOWSHEHRA

Summary of Cost

Sr. No.		Description	Amount Rs. (Million)
A	WORKS		
	i.	Dam Embankment	62.46
	ii.	Spillway	34.94
	iii.	Intake & Outlets Structure	3.13
	iv.	Irrigation System	11.91
		Sub Total	**112.44**
B	PRELIMINARIES		
	i	Environmental related cost	2.46
	ii.	Provission for access road	1.00
	iii.	Provision for Drinking water supply system	0.50
	iv.	Provision for Command Area Development including Construction of Water Courses	0.25
		Sub Total	**4.21**
C.	GENERAL		
	i	Contingency /project staff, inauguration, pol and maintenance of vehicles, Office Furniture and Stationary @ 3% on Rs. 112.44 Millions.	3.37
		Sub Total	**3.37**
Grand Total A+B+C			**120.02**
		Grand Total (A+B+C)	**120.020**
D.	**Escalation (6%)**		**4.32**
E.	**IDC (local 11%)**		**11.212**
		Total Implementation Cost	**135.553**

Table: 13.11 A

Shah Kaleem DAM PROJECT

Derivation of Benefit Cost Ratio, Net Present Worth and IRR

Construction Period = 2 Years

Project Year	Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)		Net Present Worth of Cash Flow (Million Rupees)
					Costs	Benefits	10%
1	0.000	48.008	-48.008	0.909	43.640	0.000	-43.640
2	0.000	72.012	-72.012	0.826	59.480	0.000	-59.480
3	9.349	0.000	9.349	0.751	0.000	7.020	7.020
4	12.648	0.600	12.048	0.683	0.410	8.640	8.230
5	15.273	0.600	14.673	0.621	0.370	9.480	9.110
6	15.273	0.600	14.673	0.564	0.340	8.610	8.270
7	15.273	0.600	14.673	0.513	0.310	7.830	7.520
8	15.709	0.600	15.109	0.467	0.280	7.340	7.060
9	16.083	0.600	15.483	0.424	0.250	6.820	6.570
10	16.147	0.600	15.547	0.386	0.230	6.230	6.000
11	16.210	0.600	15.610	0.350	0.210	5.670	5.460
12	16.273	0.600	15.673	0.319	0.190	5.190	5.000
13	16.337	0.600	15.737	0.290	0.170	4.740	4.570
14	16.400	0.600	15.800	0.263	0.160	4.310	4.150
15	16.400	0.600	15.800	0.239	0.140	3.920	3.780
16	16.400	0.600	15.800	0.218	0.130	3.580	3.450
17	16.400	0.600	15.800	0.198	0.120	3.250	3.130
18	16.400	0.600	15.800	0.180	0.110	2.950	2.840
19	16.400	0.600	15.800	0.164	0.100	2.690	2.590
20	16.400	0.600	15.800	0.149	0.090	2.440	2.350
21	16.400	0.600	15.800	0.135	0.080	2.210	2.130
22	16.400	0.600	15.800	0.123	0.070	2.020	1.950
23	16.400	0.600	15.800	0.112	0.070	1.840	1.770
24	18.040	0.600	17.440	0.102	0.060	1.840	1.780
25	18.040	0.600	17.440	0.092	0.060	1.660	1.600
26	18.040	0.600	17.440	0.084	0.050	1.520	1.470
27	18.040	0.600	17.440	0.076	0.050	1.370	1.320
28	18.040	0.600	17.440	0.069	0.040	1.240	1.200
29	18.040	0.600	17.440	0.063	0.040	1.140	1.100
30	18.040	0.600	17.440	0.057	0.030	1.030	1.000
31	18.040	0.600	17.440	0.052	0.030	0.940	0.910
32	18.040	0.600	17.440	0.047	0.030	0.850	0.820
33	18.040	0.600	17.440	0.043	0.030	0.780	0.750
34	19.844	0.600	19.244	0.039	0.020	0.770	0.750
35	19.844	0.600	19.244	0.036	0.020	0.710	0.690
36	19.844	0.600	19.244	0.032	0.020	0.640	0.620
37	19.844	0.600	19.244	0.029	0.020	0.580	0.560
38	19.844	0.600	19.244	0.027	0.020	0.540	0.520
39	19.844	0.600	19.244	0.024	0.010	0.480	0.470
40	19.844	0.600	19.244	0.022	0.010	0.440	0.430
41	19.844	0.600	19.244	0.020	0.010	0.400	0.390
42	19.844	0.600	19.244	0.018	0.010	0.360	0.350
Sum	687.569	143.424	544.145		107.510	124.070	16.560

B/C	1.15
NPW	16.6
IRR	11.5%

Table: 13.11 B
Shah Kaleem DAM PROJECT
COST INCREASE OF 10%

Construction Period = 2 Years

Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)	
				Costs	Benefits
0.000	52.809	-52.809	0.909	48.000	0.000
0.000	79.213	-79.213	0.826	65.430	0.000
9.349	0.000	9.349	0.751	0.000	7.020
12.648	0.660	11.988	0.683	0.450	8.640
15.273	0.660	14.613	0.621	0.410	9.480
15.273	0.660	14.613	0.564	0.370	8.610
15.273	0.660	14.613	0.513	0.340	7.830
15.709	0.660	15.049	0.467	0.310	7.340
16.083	0.660	15.423	0.424	0.280	6.820
16.147	0.660	15.487	0.386	0.250	6.230
16.210	0.660	15.550	0.350	0.230	5.670
16.273	0.660	15.613	0.319	0.210	5.190
16.337	0.660	15.677	0.290	0.190	4.740
16.400	0.660	15.740	0.263	0.170	4.310
16.400	0.660	15.740	0.239	0.160	3.920
16.400	0.660	15.740	0.218	0.140	3.580
16.400	0.660	15.740	0.198	0.130	3.250
16.400	0.660	15.740	0.180	0.120	2.950
16.400	0.660	15.740	0.164	0.110	2.690
16.400	0.660	15.740	0.149	0.100	2.440
16.400	0.660	15.740	0.135	0.090	2.210
16.400	0.660	15.740	0.123	0.080	2.020
16.400	0.660	15.740	0.112	0.070	1.840
18.040	0.660	17.380	0.102	0.070	1.840
18.040	0.660	17.380	0.092	0.060	1.660
18.040	0.660	17.380	0.084	0.060	1.520
18.040	0.660	17.380	0.076	0.050	1.370
18.040	0.660	17.380	0.069	0.050	1.240
18.040	0.660	17.380	0.063	0.040	1.140
18.040	0.660	17.380	0.057	0.040	1.030
18.040	0.660	17.380	0.052	0.030	0.940
18.040	0.660	17.380	0.047	0.030	0.850
18.040	0.660	17.380	0.043	0.030	0.780
19.844	0.660	19.184	0.039	0.030	0.770
19.844	0.660	19.184	0.036	0.020	0.710
19.844	0.660	19.184	0.032	0.020	0.640
19.844	0.660	19.184	0.029	0.020	0.580
19.844	0.660	19.184	0.027	0.020	0.540
19.844	0.660	19.184	0.024	0.020	0.480
19.844	0.660	19.184	0.022	0.010	0.440
19.844	0.660	19.184	0.020	0.010	0.400
19.844	0.660	19.184	0.018	0.010	0.360
687.57	157.77	529.80		118.26	124.07

B/C	1.0
NPW	5.8
IRR	10.5%

Table: 13.11 C
Shah Kaleem DAM PROJECT
REDUCTION IN BENEFITS OF 10%

Construction Period = 2 Years

Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)	
				Costs	Benefits
0.000	48.008	-48.008	0.909	43.640	0.000
0.000	72.012	-72.012	0.826	59.480	0.000
8.414	0.000	8.414	0.751	0.000	6.320
11.383	0.600	10.783	0.683	0.410	7.770
13.746	0.600	13.145	0.621	0.370	8.540
13.746	0.600	13.145	0.564	0.340	7.750
13.746	0.600	13.145	0.513	0.310	7.050
14.138	0.600	13.538	0.467	0.280	6.600
14.475	0.600	13.875	0.424	0.250	6.140
14.532	0.600	13.932	0.386	0.230	5.610
14.589	0.600	13.989	0.350	0.210	5.110
14.646	0.600	14.046	0.319	0.190	4.670
14.703	0.600	14.103	0.290	0.170	4.260
14.760	0.600	14.160	0.263	0.160	3.880
14.760	0.600	14.160	0.239	0.140	3.530
14.760	0.600	14.160	0.218	0.130	3.220
14.760	0.600	14.160	0.198	0.120	2.920
14.760	0.600	14.160	0.180	0.110	2.660
14.760	0.600	14.160	0.164	0.100	2.420
14.760	0.600	14.160	0.149	0.090	2.200
14.760	0.600	14.160	0.135	0.080	1.990
14.760	0.600	14.160	0.123	0.070	1.820
14.760	0.600	14.160	0.112	0.070	1.650
16.236	0.600	15.636	0.102	0.060	1.660
16.236	0.600	15.636	0.092	0.060	1.490
16.236	0.600	15.636	0.084	0.050	1.360
16.236	0.600	15.636	0.076	0.050	1.230
16.236	0.600	15.636	0.069	0.040	1.120
16.236	0.600	15.636	0.063	0.040	1.020
16.236	0.600	15.636	0.057	0.030	0.930
16.236	0.600	15.636	0.052	0.030	0.840
16.236	0.600	15.636	0.047	0.030	0.760
16.236	0.600	15.636	0.043	0.030	0.700
17.860	0.600	17.259	0.039	0.020	0.700
17.860	0.600	17.259	0.036	0.020	0.640
17.860	0.600	17.259	0.032	0.020	0.570
17.860	0.600	17.259	0.029	0.020	0.520
17.860	0.600	17.259	0.027	0.020	0.480
17.860	0.600	17.259	0.024	0.010	0.430
17.860	0.600	17.259	0.022	0.010	0.390
17.860	0.600	17.259	0.020	0.010	0.360
17.860	0.600	17.259	0.018	0.010	0.320
618.81	143.42	475.39		107.51	111.63

B/C	1.0
NPW	4.1
IRR	10.4%

Table: 13.11 D

Shah Kaleem DAM PROJECT

COST INCREASE AND REDUCTION OF BENEFITS

Construction Period = 2 Years

Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)	
				Costs	Benefits
0.000	52.809	-52.809	0.909	48.000	0.000
0.000	79.213	-79.213	0.826	65.430	0.000
8.414	0.000	8.414	0.751	0.000	6.320
11.383	0.660	10.723	0.683	0.450	7.770
13.746	0.660	13.085	0.621	0.410	8.540
13.746	0.660	13.085	0.564	0.370	7.750
13.746	0.660	13.085	0.513	0.340	7.050
14.138	0.660	13.478	0.467	0.310	6.600
14.475	0.660	13.815	0.424	0.280	6.140
14.532	0.660	13.872	0.386	0.250	5.610
14.589	0.660	13.929	0.350	0.230	5.110
14.646	0.660	13.986	0.319	0.210	4.670
14.703	0.660	14.043	0.290	0.190	4.260
14.760	0.660	14.100	0.263	0.170	3.880
14.760	0.660	14.100	0.239	0.160	3.530
14.760	0.660	14.100	0.218	0.140	3.220
14.760	0.660	14.100	0.198	0.130	2.920
14.760	0.660	14.100	0.180	0.120	2.660
14.760	0.660	14.100	0.164	0.110	2.420
14.760	0.660	14.100	0.149	0.100	2.200
14.760	0.660	14.100	0.135	0.090	1.990
14.760	0.660	14.100	0.123	0.080	1.820
14.760	0.660	14.100	0.112	0.070	1.650
16.236	0.660	15.576	0.102	0.070	1.660
16.236	0.660	15.576	0.092	0.060	1.490
16.236	0.660	15.576	0.084	0.060	1.360
16.236	0.660	15.576	0.076	0.050	1.230
16.236	0.660	15.576	0.069	0.050	1.120
16.236	0.660	15.576	0.063	0.040	1.020
16.236	0.660	15.576	0.057	0.040	0.930
16.236	0.660	15.576	0.052	0.030	0.840
16.236	0.660	15.576	0.047	0.030	0.760
16.236	0.660	15.576	0.043	0.030	0.700
17.860	0.660	17.199	0.039	0.030	0.700
17.860	0.660	17.199	0.036	0.020	0.640
17.860	0.660	17.199	0.032	0.020	0.570
17.860	0.660	17.199	0.029	0.020	0.520
17.860	0.660	17.199	0.027	0.020	0.480
17.860	0.660	17.199	0.024	0.020	0.430
17.860	0.660	17.199	0.022	0.010	0.390
17.860	0.660	17.199	0.020	0.010	0.360
17.860	0.660	17.199	0.018	0.010	0.320
618.81	157.77	461.05		118.26	111.63

B/C	0.9
NPW	-6.6
IRR	9.4%

Table: 13.12

Economic & Financial Prices

Output

(Rupees)

S.No.		Unit	Economic	Financial	S.No.
	Kharif				
	Maize	Kg	16.00	12.70	
	Maize Stalks	Kg	1.84	2.00	
	K.Fodder	Kg	2.76	3.00	
	K. Vegetables	Kg	13.80	15.00	
	K.Pulses	Kg	33.88	36.83	
	K.Oilseeds	Kg	49.54	53.85	
	By Product	Kg	0.89	0.97	
	Sugarcane	Kg	1.84	2.00	
	By Product	Kg	0.46	0.50	
	Rabi				
	Wheat	Kg	32.23	23.75	
	Wheat Straw	Kg	1.84	2.00	
	Onion	Kg	9.20	10.00	
	R. Vegetables	Kg	9.20	10.00	
	Orchards	Kg	18.40	20.00	

Inputs (Seed)

(Rupees)

		Unit	Economic	Financial	S.No.
	Kharif				
	Maize	Kg	12.0	13.00	
	K.Fodder	Kg	11.0	12.00	
	K. Vegetables	Kg	184.0	200.00	
	K.Pulses	Kg	36.8	40.00	
	K.Oilseeds	Kg	50.6	55.00	
	Sugarcane		1.8	2.00	
	Rabi				
	Wheat	Kg	23.0	25.00	
	R. Vegetables	Kg	184.0	200.00	
	Onion	Kg	322.0	350.00	
	Orchards	Plant	18.40	20.00	
	Fertilizers				
	Nitrogen	Kg	60.0	30.43	
	Phosphate	Kg	101.1	108.70	
	Potash	Kg	130.9	30.00	
	FYM	Kg	0.2	0.22	
	Chemicals				
	Pesticides	Per Spray	299.0	325.00	
	Granules	Application	414.0	450.00	
	Sprays	Per Spray	322.0	350.00	

Table: 13.12
Economic & Financial Prices

Farm Labour				
Hired	Per Day	140.0	200.00	
Family	Per Day	140.0	200.00	
Tractor Hours	Per Hour	368.0	400.00	
Ploughing & Planking	Per Plough	207.0	225.00	
Miscellaneous				
Wheat harvesting	Per Day	210.0	300.00	
Cane harvesting	Per Day	210.0	300.00	
Wheat threshing	Per Hour	276.0	300.00	
Marketing Charges				
Packing Charges				
Jute Bag	Per Bag	49.5	55.00	
Wooden Crate	Per Crate	9.9	11.00	
Fruit Basket	Per Basket	19.8	22.00	
Vegetable Basket	Per Basket	19.8	22.00	
Transportation				
Haripur - Karachi	100Kg	189.0	210.00	
Karachi - Haripur	100Kg	252.0	280.00	
Loading/unloading	100Kg	5.4	6.00	
Project Area-Haripur	100Kg	13.5	15.00	
Haripur-Project Area	100Kg	13.5	15.00	
Marketing	100Kg	13.5	15.00	

Source: Consultant's Economic Survey, 2009+A73:A108.

Table: 13.13

TOTAL VALUE OF PRODUCTION -Shah Kaleem Dam (Million Rs.)

S.No.	Crops	Years of development			
		Base	Year 1	Year 2	Year 3
1	Maize	0.731	0.975	1.141	1.253
2	K. Fodder	0.000	0.257	0.480	0.667
3	K. Vegetables	0.000	1.297	2.445	3.407
4	Sugarcane	0.000	0.228	0.509	0.795
5	Wheat	1.089	2.385	2.995	3.411
6	R.Vegitable	0.000	0.811	1.513	2.100
7.000	Orchards	0.000	0.488	0.907	1.261
	N. V. P OF CROPS	1.820	5.953	9.083	11.633
	N. V. P OF ORCHARDS		12.121	12.540	12.894

Table: 13.14

FINANCIAL BENEFITS

S.No.	Years	Projected	Incremental
0	Base Year	1.820	
1	2009	5.953	4.133
2	2010	9.083	7.263
3	2011	11.633	9.813
4	2012	11.633	9.813
5	2013	11.633	9.813
6	2014	12.121	10.301
7	2015	12.540	10.719
8	2016	12.610	10.790
9	2017	12.681	10.861
10	2018	12.752	10.932
11	2019	12.823	11.003
12	2020	12.894	11.073

Table: 13.15

Shah Kaleem DAM PROJECT

ANNUAL PHASING - Total Project Cost

Million Rs.

Sr. #	Items	YEARS		Total
		2009	2010	
		40%	60%	
A.	**Base Cost**	**48.008**	**72.012**	**120.020**
B.	Escalation (6% on civil works)	0.000	4.321	4.321
	Total Cost	**48.008**	**76.333**	**4.321**
C.	IDC (Interest During Construction) (11%)	2.391	8.821	11.212
	Grand Total (Total Implementation Cost)	**50.399**	**85.154**	**135.553**

Table: 13.16 A

Shah Kaleem DAM PROJECT

Derivation of Benefit Cost Ratio, Net Present Worth and FIRR

Construction Period = 2 Years

Project Year	Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)		Net Present Worth of Cash Flow (Million Rupees)
					Costs	Benefits	10%
1	0.000	54.221	-54.221	0.909	49.290	0.000	-49.290
2	0.000	81.332	-81.332	0.826	67.180	0.000	-67.180
3	5.214	0.000	5.214	0.751	0.000	3.920	3.920
4	8.344	0.678	7.666	0.683	0.460	5.700	5.240
5	10.893	0.678	10.215	0.621	0.420	6.760	6.340
6	10.893	0.678	10.215	0.564	0.380	6.140	5.760
7	10.893	0.678	10.215	0.513	0.350	5.590	5.240
8	11.382	0.678	10.704	0.467	0.320	5.320	5.000
9	11.800	0.678	11.122	0.424	0.290	5.000	4.710
10	11.871	0.678	11.193	0.386	0.260	4.580	4.320
11	11.942	0.678	11.264	0.350	0.240	4.180	3.940
12	12.012	0.678	11.335	0.319	0.220	3.830	3.610
13	12.083	0.678	11.406	0.290	0.200	3.500	3.300
14	12.154	0.678	11.476	0.263	0.180	3.200	3.020
15	12.154	0.678	11.476	0.239	0.160	2.900	2.740
16	12.154	0.678	11.476	0.218	0.150	2.650	2.500
17	12.154	0.678	11.476	0.198	0.130	2.410	2.280
18	12.154	0.678	11.476	0.180	0.120	2.190	2.070
19	12.154	0.678	11.476	0.164	0.110	1.990	1.880
20	12.154	0.678	11.476	0.149	0.100	1.810	1.710
21	12.154	0.678	11.476	0.135	0.090	1.640	1.550
22	12.154	0.678	11.476	0.123	0.080	1.490	1.410
23	12.154	0.678	11.476	0.112	0.080	1.360	1.280
24	13.261	0.678	12.584	0.102	0.070	1.350	1.280
25	13.261	0.678	12.584	0.092	0.060	1.220	1.160
26	13.261	0.678	12.584	0.084	0.060	1.110	1.050
27	13.261	0.678	12.584	0.076	0.050	1.010	0.960
28	13.261	0.678	12.584	0.069	0.050	0.920	0.870
29	13.261	0.678	12.584	0.063	0.040	0.840	0.800
30	13.261	0.678	12.584	0.057	0.040	0.760	0.720
31	13.261	0.678	12.584	0.052	0.040	0.690	0.650
32	13.261	0.678	12.584	0.047	0.030	0.620	0.590
33	13.261	0.678	12.584	0.043	0.030	0.570	0.540
34	14.480	0.678	13.802	0.039	0.030	0.560	0.530
35	14.480	0.678	13.802	0.036	0.020	0.520	0.500
36	14.480	0.678	13.802	0.032	0.020	0.460	0.440
37	14.480	0.678	13.802	0.029	0.020	0.420	0.400
38	14.480	0.678	13.802	0.027	0.020	0.390	0.370
39	14.480	0.678	13.802	0.024	0.020	0.350	0.330
40	14.480	0.678	13.802	0.022	0.010	0.320	0.310
41	14.480	0.678	13.802	0.020	0.010	0.290	0.280
42	14.480	0.678	13.802	0.018	0.010	0.260	0.250
Sum	501.799	161.985	339.813		121.440	88.820	-32.620

B/C	0.73
NPW	-32.6
FIRR	7.2%

Table: 13.16 B
Shah Kaleem DAM PROJECT
COST INCREASE OF 10%

Construction Period = 2 Years

Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)	
				Costs	Benefits
0.00	59.64	-59.64	0.91	54.22	0.00
0.00	89.46	-89.46	0.83	73.90	0.00
5.21	0.00	5.21	0.75	0.00	3.92
8.34	0.75	7.60	0.68	0.51	5.70
10.89	0.75	10.15	0.62	0.46	6.76
10.89	0.75	10.15	0.56	0.42	6.14
10.89	0.75	10.15	0.51	0.38	5.59
11.38	0.75	10.64	0.47	0.35	5.32
11.80	0.75	11.05	0.42	0.32	5.00
11.87	0.75	11.13	0.39	0.29	4.58
11.94	0.75	11.20	0.35	0.26	4.18
12.01	0.75	11.27	0.32	0.24	3.83
12.08	0.75	11.34	0.29	0.22	3.50
12.15	0.75	11.41	0.26	0.20	3.20
12.15	0.75	11.41	0.24	0.18	2.90
12.15	0.75	11.41	0.22	0.16	2.65
12.15	0.75	11.41	0.20	0.15	2.41
12.15	0.75	11.41	0.18	0.13	2.19
12.15	0.75	11.41	0.16	0.12	1.99
12.15	0.75	11.41	0.15	0.11	1.81
12.15	0.75	11.41	0.14	0.10	1.64
12.15	0.75	11.41	0.12	0.09	1.49
12.15	0.75	11.41	0.11	0.08	1.36
13.26	0.75	12.52	0.10	0.08	1.35
13.26	0.75	12.52	0.09	0.07	1.22
13.26	0.75	12.52	0.08	0.06	1.11
13.26	0.75	12.52	0.08	0.06	1.01
13.26	0.75	12.52	0.07	0.05	0.92
13.26	0.75	12.52	0.06	0.05	0.84
13.26	0.75	12.52	0.06	0.04	0.76
13.26	0.75	12.52	0.05	0.04	0.69
13.26	0.75	12.52	0.05	0.04	0.62
13.26	0.75	12.52	0.04	0.03	0.57
14.48	0.75	13.73	0.04	0.03	0.56
14.48	0.75	13.73	0.04	0.03	0.52
14.48	0.75	13.73	0.03	0.02	0.46
14.48	0.75	13.73	0.03	0.02	0.42
14.48	0.75	13.73	0.03	0.02	0.39
14.48	0.75	13.73	0.02	0.02	0.35
14.48	0.75	13.73	0.02	0.02	0.32
14.48	0.75	13.73	0.02	0.01	0.29
14.48	0.75	13.73	0.02	0.01	0.26
501.80	178.18	323.61		133.59	88.82

B/C	0.7
NPW	-44.8
EIRR	6.5%

Table: 13.16 C
Shah Kaleem DAM PROJECT
REDUCTION IN BENEFITS OF 10%

Construction Period = 2 Years

Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)	
				Costs	Benefits
0.00	54.22	-54.22	0.91	49.29	0.00
0.00	81.33	-81.33	0.83	67.18	0.00
4.69	0.00	4.69	0.75	0.00	3.52
7.51	0.68	6.83	0.68	0.46	5.13
9.80	0.68	9.13	0.62	0.42	6.09
9.80	0.68	9.13	0.56	0.38	5.53
9.80	0.68	9.13	0.51	0.35	5.03
10.24	0.68	9.57	0.47	0.32	4.78
10.62	0.68	9.94	0.42	0.29	4.50
10.68	0.68	10.01	0.39	0.26	4.12
10.75	0.68	10.07	0.35	0.24	3.76
10.81	0.68	10.13	0.32	0.22	3.45
10.87	0.68	10.20	0.29	0.20	3.15
10.94	0.68	10.26	0.26	0.18	2.88
10.94	0.68	10.26	0.24	0.16	2.61
10.94	0.68	10.26	0.22	0.15	2.38
10.94	0.68	10.26	0.20	0.13	2.17
10.94	0.68	10.26	0.18	0.12	1.97
10.94	0.68	10.26	0.16	0.11	1.79
10.94	0.68	10.26	0.15	0.10	1.63
10.94	0.68	10.26	0.14	0.09	1.48
10.94	0.68	10.26	0.12	0.08	1.35
10.94	0.68	10.26	0.11	0.08	1.23
11.94	0.68	11.26	0.10	0.07	1.22
11.94	0.68	11.26	0.09	0.06	1.10
11.94	0.68	11.26	0.08	0.06	1.00
11.94	0.68	11.26	0.08	0.05	0.91
11.94	0.68	11.26	0.07	0.05	0.82
11.94	0.68	11.26	0.06	0.04	0.75
11.94	0.68	11.26	0.06	0.04	0.68
11.94	0.68	11.26	0.05	0.04	0.62
11.94	0.68	11.26	0.05	0.03	0.56
11.94	0.68	11.26	0.04	0.03	0.51
11.94	0.68	11.26	0.04	0.03	0.51
13.03	0.68	12.35	0.04	0.02	0.47
13.03	0.68	12.35	0.03	0.02	0.42
13.03	0.68	12.35	0.03	0.02	0.38
13.03	0.68	12.35	0.03	0.02	0.35
13.03	0.68	12.35	0.02	0.02	0.31
13.03	0.68	12.35	0.02	0.01	0.29
13.03	0.68	12.35	0.02	0.01	0.26
13.03	0.68	12.35	0.02	0.01	0.23
451.62	161.99	289.63		121.44	79.94

B/C	0.7
NPW	-41.5
EIRR	6.4%

Table: 13.16 D

Shah Kaleem DAM PROJECT

COST INCREASE AND REDUCTION OF BENEFITS

Construction Period = 2 Years

Project Benefits (Million Rupees)	Project Cost (Million Rupees)	Cash Flow (Million Rupees)	D.F @ 10%	Present Worth (Million Rupees)	
				Costs	Benefits
0.00	59.64	-59.64	0.91	54.220	0.000
0.00	89.46	-89.46	0.83	73.900	0.000
4.69	0.00	4.69	0.75	0.000	3.520
7.51	0.75	6.76	0.68	0.510	5.130
9.80	0.75	9.06	0.62	0.46	6.09
9.80	0.75	9.06	0.56	0.42	5.53
9.80	0.75	9.06	0.51	0.38	5.03
10.24	0.75	9.50	0.47	0.35	4.78
10.62	0.75	9.87	0.42	0.32	4.50
10.68	0.75	9.94	0.39	0.29	4.12
10.75	0.75	10.00	0.35	0.26	3.76
10.81	0.75	10.07	0.32	0.24	3.45
10.87	0.75	10.13	0.29	0.22	3.15
10.94	0.75	10.19	0.26	0.20	2.88
10.94	0.75	10.19	0.24	0.18	2.61
10.94	0.75	10.19	0.22	0.16	2.38
10.94	0.75	10.19	0.20	0.15	2.17
10.94	0.75	10.19	0.18	0.13	1.97
10.94	0.75	10.19	0.16	0.12	1.79
10.94	0.75	10.19	0.15	0.11	1.63
10.94	0.75	10.19	0.14	0.10	1.48
10.94	0.75	10.19	0.12	0.09	1.35
10.94	0.75	10.19	0.11	0.08	1.23
11.94	0.75	11.19	0.10	0.08	1.22
11.94	0.75	11.19	0.09	0.07	1.10
11.94	0.75	11.19	0.08	0.06	1.00
11.94	0.75	11.19	0.08	0.06	0.91
11.94	0.75	11.19	0.07	0.05	0.82
11.94	0.75	11.19	0.06	0.05	0.75
11.94	0.75	11.19	0.06	0.04	0.68
11.94	0.75	11.19	0.05	0.04	0.62
11.94	0.75	11.19	0.05	0.04	0.56
11.94	0.75	11.19	0.04	0.03	0.51
13.03	0.75	12.29	0.04	0.03	0.51
13.03	0.75	12.29	0.04	0.03	0.47
13.03	0.75	12.29	0.03	0.02	0.42
13.03	0.75	12.29	0.03	0.02	0.38
13.03	0.75	12.29	0.03	0.02	0.35
13.03	0.75	12.29	0.02	0.02	0.31
13.03	0.75	12.29	0.02	0.02	0.29
13.03	0.75	12.29	0.02	0.01	0.26
13.03	0.75	12.29	0.02	0.01	0.23
451.62	178.18	273.43		133.59	79.94

B/C	0.6
NPW	-53.65
EIRR	5.7%

Table-A1: ECONOMIC GROSS MARGINS "WITH PROJECT" - MAIZE
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	564	787	880	936
	Rate	Rs/Kg	16.00	16.00	16.00	16.00
	Sub Total	Rs	9022	12593	14081	14973
2	By Products	Kg	1128	1574.4	1760.4	1872
	Rate	Rs/Kg	1.84	1.84	1.84	1.84
	Sub Total	Rs	2075.5	2896.9	3239.1	3444.5
Gross Production Value		**Rs**	**11098**	**15490**	**17320**	**18418**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planging	No	2.0	2.5	2.8	3.0
	Rate	Rs/ Pass	207.00	207.00	207.00	207.00
	Sub Total	Rs	414	522	584	621
2	Seed	Kg	12	12	12	12
	Rate	Rs/Kg	12.0	12.0	12.0	12.0
	Sub Total	Rs	143.5	143.5	143.5	143.5
Manure and Fertilizer						
3	Urea	Kg	0	19	22	23
	Rate	Rs/Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs	0	1160	1297	1379
4	DAP	Kg	0	9	10	11
	Rate	Rs/Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs	0	936	1046	1112
5	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs	0	0	0	0
6	FYM	Kg	300	300	300	300
	Rate	Rs/Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs	60.72	60.72	60.72	60.72
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	1	1	1	1
	Area Sprayed	%	0	20	23	24
	Rate	Rs/ Spray	322	322	322	322
	Sub Total	Rs	0	65	73	77
Labour Requirements			13	19	21	22
9	Hired Labour	Mandays	4	6	6	7
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	557	777	869	924
10	Family Labour	Mandays	9	13	14	15
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	1299	1813	2027	2156
Cost Summary		Rs	2474	5477	6100	6474
Gross Margins		Rs	8624	10013	11220	11944
Cost as % of GPV		%	22	35	35	35
Cropped Area		Acres	120	140	146	150
Total Value of Production		**Rs. (Million)**	**1.035**	**1.397**	**1.632**	**1.792**

Table - A2-ECONOMIC GROSS MARGINS - Kh. Fodder
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	5400	7650	9000
	Rate	Rs/Kg	2.76	2.76	2.76	2.76
	Sub Total	Rs	0	14904	21114	24840
2	By Products	Kg	0	0	0	0
	Rate	Rs/Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs	0	0	0	0
Gross Production Value		**Rs**	**0**	**14904**	**21114**	**24840**
Crop Production Expenses						
Cultural Practices						
1	Ploughings	No	0.0	1.8	2.6	3.0
	Rate	Rs/ Pass	207.00	207.00	207.00	207.00
	Sub Total	Rs	0	373	528	621
2	Planking	No	0	0	0	0
	Rate	Rs/ Pass	0	0	0	0
	Sub Total	Rs	0	0	0	0
3	Seed	Kg	0	30	30	30
	Rate	Rs/Kg	11.0	11.0	11.0	11.0
	Sub Total	Rs	0	331.2	331.2	331.2
Manure and Fertilizer						
4	Urea	Kg	0	13	19	22
	Rate	Rs/Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs	0	791	1121	1319
5	DAP	Kg	0	0	0	0
	Rate	Rs/Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs	0	0	0	0
6	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs	0	0	0	0
7	FYM	Kg	0	300	300	300
	Rate	Rs/Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs	0	60.72	60.72	60.72
Plant Protection Measures						
8	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
9	Sprays	No	0	0	0	0
	Area Sprayed	%	0	0	0	0
	Rate	Rs/ Spray	322	322	322	322
	Sub Total	Rs	0	0	0	0
Labour Requirements			0	9	13	15
10	Hired Labour	Mandays	0.0	2.7	3.8	4.5
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	378	536	630
11	Family Labour	Mandays	0.0	6.3	8.9	10.5
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	882	1250	1470
Cost Summary		Rs	0	2816	3826	4432
Gross Margins		Rs	0	12088	17288	20408
Cost as % of GPV		%	0	19	18	18
Cropped Area		Acres	0	20	26	30
Total Value of Production		**Rs. (Million)**	**0.000**	**0.236**	**0.441**	**0.612**

Table - A3: ECONOMIC GROSS MARGINS "WITH PROJECT" - K. VEG.
Shah KaleemDAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	3472	4919	5787
	Rate	Rs/Kg	13.80	13.80	13.80	13.80
	Sub Total	Rs	0	47916	67882	79861
2	By Products	Kg	0	0	0	0
	Rate	Rs/Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs	0.0	0.0	0.0	0.0
Gross Production Value		**Rs**	**0**	**47916**	**67882**	**79861**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planking	No	0.0	2.4	3.4	4.0
	Rate	Rs/ Pass	207.00	207.00	207.00	207.00
	Sub Total	Rs	0	497	704	828
2	Seed	Kg	0	12	12	12
	Rate	Rs/Kg	184.0	184.0	184.0	184.0
	Sub Total	Rs	0	2208	2208	2208
Manure and Fertilizer						
3	Urea	Kg	0	34	48	56
	Rate	Rs/Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs	0	2015	2854	3358
4	DAP	Kg	0	13	18	21
	Rate	Rs/Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs	0	1274	1805	2124
5	K_2SO_4	Kg	0	6	9	10
	Rate	Rs/Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs	0	785.3568	1112.5888	1308.928
6	FYM	Kg	0	500	500	300
	Rate	Rs/Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs	0	101.2	101.2	60.72
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	0	1	1	1
	Area Sprayed	%	0	30	43	50
	Rate	Rs/ Spray	322	322	322	322
	Sub Total	Rs	0	97	137	161
Labour Requirements			0	24	34	40
9	Hired Labour	Mandays	0	10	14	16
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	1344	1904	2240
10	Family Labour	Mandays	0	14	20	24
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	2016	2856	3360
Cost Summary		Rs	0	10337	13682	15648
Gross Margins		Rs	0	37580	54200	64212
Cost as % of GPV		%	#DIV/0!	22	20	20
Cropped Area		Acres	0	31	41	48
Total Value of Production		**Rs. (Million)**	**0.000**	**1.172**	**2.211**	**3.082**

Table - A4: ECONOMIC GROSS MARGINS - SUGARCANE
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	13200	18700	22000
	Rate	Rs/Kg	1.84	1.84	1.84	1.84
	Sub Total	Rs	0	24288	34408	40480
2	By Products	Kg	0	2640	3740	4400
	Rate	Rs/Kg	0.46	0.46	0.46	0.46
	Sub Total	Rs	0	1214	1720	2024
Gross Production Value		**Rs**	**0**	**25502**	**36128**	**42504**
Crop Production Expenses						
Cultural Practices						
1	Ploughings	No	0.0	1.5	2.1	2.5
	Rate	Rs/ Pass	207.00	207	207	207
	Sub Total	Rs	0	311	440	518
2	Planking	No	0	0	0	0
	Rate	Rs/ Pass	0	0	0	0
	Sub Total	Rs	0	0	0	0
3	Seed	Kg	0	4000	4000	3200
	Rate	Rs/Kg	1.8	1.84	1.84	1.84
	Sub Total	Rs	0	7360	7360	5888
Manure and Fertilizer					9	
4	Urea	Kg	0	38	54	63
	Rate	Rs/Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs	0	2267	3211	3778
5	DAP	Kg	0	19	27	32
	Rate	Rs/Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs	0	1942	2751	3236
6	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs	0	0	0	0
7	FYM	Kg	0	300	300	300
	Rate	Rs/Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs	0	60.72	60.72	60.72
Plant Protection Measures						
8	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
9	Sprays	No	0	2	2	2
	Area Sprayed	%	0	24	34	40
	Rate	Rs/ Spray	322	322	322	322
	Sub Total	Rs	0	155	219	258
Labour Requirements			0	21	30	35
10	Hired Labour	Mandays	0.0	6.3	8.9	10.5
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	882	1250	1470
11	Family Labour	Mandays	0.0	14.7	20.8	24.5
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	2058	2916	3430
Cost Summary		Rs	0	15034	18206	18637
Gross Margins		Rs	0	10468	17922	23867
Cost as % of GPV		%	0	59	105	44
Cropped Area		Acres	0	20	26	30
Total Value of Production		**Rs. (Million)**	**0.000**	**0.204**	**0.457**	**0.716**

Table - A5:ECONOMIC GROSS MARGINS "WITH PROJECT" - WHEAT
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	440	744	870	946
	Rate	Rs/Kg	32.23	32.23	32.23	32.23
	Sub Total	Rs	14183	23968	28046	30492
2	By Products	Kg	440	743.6	870.1	946
	Rate	Rs/Kg	1.84	1.84	1.84	1.84
	Sub Total	Rs	809.6	1368.2	1601.0	1740.6
Gross Production Value		**Rs**	**14992**	**25337**	**29647**	**32233**
Crop Production Expenses						
Cultural Practices						
1	Ploughings &Planking	No	2.0	3.1	3.7	4.0
	Rate	Rs/ Pass	207.00	207.00	207.00	207.00
	Sub Total	Rs	414	651	762	828
2	Seed	Kg	50	50	50	50
	Rate	Rs/Kg	23.0	23.0	23.0	23.0
	Sub Total	Rs	1150	1150	1150	1150
Manure and Fertilizer						
3	Urea	Kg	20	34	40	43
	Rate	Rs/Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs	1199	2027	2371	2578
4	DAP	Kg	10	17	20	22
	Rate	Rs/Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs	1035	1749	2046	2225
5	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs	0	0	0	0
6	FYM	Kg	0	300	300	300
	Rate	Rs/Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs	0	60.72	60.72	60.72
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	2	2	2	2
	Area Sprayed	%	0	26	30	33
	Rate	Rs/ Spray	322	322	322	322
	Sub Total	Rs	0	167	195	213
Labour Requirements			9.3	15.7	18.4	20.0
9	Hired Labour	Mandays	3.3	5.5	6.4	7.0
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	456	770	901	980
10	Family Labour	Mandays	6.0	10.2	12.0	13.0
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	847	1431	1674	1820
Cost Summary		Rs	5100	8005	9161	9854
Gross Margins		Rs	9892	17332	20486	22379
Cost as % of GPV		%	34	32	31	31
Cropped Area		Acres	180	219	231	240
Total Value of Production		**Rs. (Million)**	**1.781**	**3.796**	**4.732**	**5.371**

Table - A6:ECONOMIC GROSS MARGINS "WITH PROJECT" - R. Vegetables
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	3300	4675	5500
	Rate	Rs/Kg	9.20	9.20	9.20	9.20
	Sub Total	Rs	0	30360	43010	50600
2	By Products	Kg	0	0	0	0
	Rate	Rs/Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs	0.0	0.0	0.0	0.0
Gross Production Value		**Rs**	**0**	**30360**	**43010**	**50600**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planking	No	0.0	2.4	3.4	4.0
	Rate	Rs/ Pass	207.00	207.00	207.00	207.00
	Sub Total	Rs	0	497	704	828
2	Seed	Kg	0	2.5	2.5	2.5
	Rate	Rs/Kg	184.0	184.0	184.0	184.0
	Sub Total	Rs	0	460	460	460
Manure and Fertilizer						
3	Urea	Kg	0	26	37	43
	Rate	Rs/Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs	0	1547	2192	2578
4	DAP	Kg	0	11	16	19
	Rate	Rs/Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs	0	1153	1633	1921
5	K_2SO_4	Kg	0	5	8	9
	Rate	Rs/Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs	0	706.82112	1001.32992	1178.0352
6	FYM	Kg	0	500	500	500
	Rate	Rs/Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs	0	101.2	101.2	101.2
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	0	1	1	1
	Area Sprayed	%	0	17	24	28
	Rate	Rs/ Spray	322	322	322	322
	Sub Total	Rs	0	54	77	90
Labour Requirements			0.0	18.0	25.5	30.0
9	Hired Labour	Mandays	0.0	7.2	10.2	12.0
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	1008	1428	1680
10	Family Labour	Mandays	0.0	10.8	15.3	18.0
	Rate	Rs/Day	140	140	140	140
	Sub Total	Rs	0	1512	2142	2520
Cost Summary		Rs	0	7039	9738	11357
Gross Margins		Rs	0	23321	33272	39243
Cost as % of GPV		%	#DIV/0!	23	23	22
Cropped Area		Acres	0	31	41	48
Total Value of Production		**Rs. (Million)**	**0.000**	**0.728**	**1.358**	**1.884**

Table - A7:ECONOMIC GROSS MARGINS "WITH PROJECT" - ORCHARDS
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	3660	5185	6100
	Rate	Rs./ Kg	18.40	18.40	18.40	18.40
	Sub Total	Rs.	0	67344	95404	112240
2	By Products	Kg	0	0	0	0
	Rate	Rs./ Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs.	0.0	0.0	0.0	0.0
Gross Production Value		**Rs.**	**0**	**67344**	**95404**	**112240**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planking	No	0.0	1.2	1.7	2.0
	Rate	Rs./ Pass	207.00	207.00	207.00	207.00
	Sub Total	Rs.	0	248	352	414
2	Seed	Kg	0	100	100	100
	Rate	Rs./ Kg	18.4	18.4	18.4	18.4
	Sub Total	Rs.	0	1840	1840	1840
Manure and Fertilizer						
3	Urea	Kg	0	48	68	80
	Rate	Rs./ Kg	60.0	60.0	60.0	60.0
	Sub Total	Rs.	0	2878	4077	4797
4	DAP	Kg	0	24	34	40
	Rate	Rs./ Kg	101.1	101.1	101.1	101.1
	Sub Total	Rs.	0	2427	3438	4045
5	K_2SO_4	Kg	0	9	13	15
	Rate	Rs./ Kg	130.9	130.9	130.9	130.9
	Sub Total	Rs.	0	1178.0352	1668.8832	1963.392
6	FYM	Kg	0	300	300	300
	Rate	Rs./ Kg	0.20	0.20	0.20	0.20
	Sub Total	Rs.	0	60.72	60.72	60.72
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs./ Kg	0	0	0	0
	Sub Total	Rs.	0	0	0	0
8	Sprays	No	0	1	1	1
	Area Sprayed	%	0	18	26	30
	Rate	Rs./ Spray	322	322	322	322
	Sub Total	Rs.	0	58	82	97
Labour Requirements			0.0	19.2	27.2	32.0
9	Hired Labour	Mandays	0.0	7.7	10.9	12.8
	Rate	Rs./ Day	140	140	140	140
	Sub Total	Rs.	0	1075	1523	1792
10	Family Labour	Mandays	0.0	11.5	16.3	19.2
	Rate	Rs./ Day	140	140	140	140
	Sub Total	Rs.	0	1613	2285	2688
Cost Summary		Rs.	0	11378	15327	17697
Gross Margins		Rs.	0	55966	80077	94543
Cost as % of GPV		%	#DIV/0!	17	16	16
Cropped Area		Acres	0	8	10	12
Total Value of Production		**Rs. (Million)**	**0.000**	**0.437**	**0.811**	**1.127**

Table - B1: FINANCIAL GROSS MARGINS "WITH PROJECT" - MAIZE
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	564	787	880	936
	Rate	Rs/Kg	12.70	12.70	12.70	12.70
	Sub Total	Rs	7163	9997	11179	11887
2	By Products	Kg	1128	1574.4	1760.4	1872
	Rate	Rs/Kg	2.00	2.00	2.00	2.00
	Sub Total	Rs	2256.0	3148.8	3520.8	3744.0
Gross Production Value		**Rs**	**9419**	**13146**	**14699**	**15631**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planging	No	2.0	2.5	2.8	3.0
	Rate	Rs/ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs	450	568	635	675
2	Seed	Kg	12	12	12	12
	Rate	Rs/Kg	13.0	13.0	13.0	13.0
	Sub Total	Rs	156	156	156	156
Manure and Fertilizer						
3	Urea	Kg	0	19	22	23
	Rate	Rs/Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs	0	589	658	700
4	DAP	Kg	0	9	10	11
	Rate	Rs/Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs	0	1006	1124	1196
5	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs	0	0	0	0
6	FYM	Kg	300	300	300	300
	Rate	Rs/Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs	66	66	66	66
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	1	1	1	1
	Area Sprayed	%	0	20	23	24
	Rate	Rs/ Spray	350	350	350	350
	Sub Total	Rs	0	71	79	84
Labour Requirements			13.3	18.5	20.7	22.0
9	Hired Labour	Mandays	4.0	5.6	6.2	6.6
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	795	1110	1241	1320
10	Family Labour	Mandays	9.3	13.0	14.5	15.4
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	1856	2590	2896	3080
Cost Summary		Rs	3323	6155	6856	7277
Gross Margins		Rs	6096	6991	7843	8355
Cost as % of GPV		%	35	47	47	47
Cropped Area		Acres	120	140	146	150
Total Value of Production		**Rs. (Million)**	**0.731**	**0.975**	**1.141**	**1.253**

Table - B2: FINANCIAL GROSS MARGINS - Kh. Fodder
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	5400	7650	9000
	Rate	Rs/Kg	3.00	3.00	3.00	3.00
	Sub Total	Rs	0	16200	22950	27000
2	By Products	Kg	0	0	0	0
	Rate	Rs/Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs	0.0	0.0	0.0	0.0
Gross Production Value		**Rs**	**0**	**16200**	**22950**	**27000**
Crop Production Expenses						
Cultural Practices						
1	Ploughings	No	0.0	1.8	2.6	3.0
	Rate	Rs/ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs	0	405	574	675
2	Planking	No	0	0	0	0
	Rate	Rs/ Pass	0	0	0	0
	Sub Total	Rs	0	0	0	0
3	Seed	Kg	0	30	30	30
	Rate	Rs/Kg	12.0	12.0	12.0	12.0
	Sub Total	Rs	0	360	360	360
Manure and Fertilizer						
4	Urea	Kg	0	13	19	22
	Rate	Rs/Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs	0	402	569	670
5	DAP	Kg	0	0	0	0
	Rate	Rs/Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs	0	0	0	0
6	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs	0	0	0	0
7	FYM	Kg	0	300	300	300
	Rate	Rs/Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs	0	66	66	66
Plant Protection Measures						
8	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
9	Sprays	No	0	0	0	0
	Area Sprayed	%	0	0	0	0
	Rate	Rs/ Spray	350	350	350	350
	Sub Total	Rs	0	0	0	0
Labour Requirements			0.0	9.0	12.8	15.0
10	Hired Labour	Mandays	0.0	2.7	3.8	4.5
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	540	765	900
11	Family Labour	Mandays	0.0	6.3	8.9	10.5
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	1260	1785	2100
Cost Summary		Rs	0	3033	4119	4771
Gross Margins		Rs	0	13167	18831	22229
Cost as % of GPV		%	0	19	18	18
Cropped Area		Acres	0	20	26	30
Total Value of Production		**Rs. (Million)**	**0.000**	**0.257**	**0.480**	**0.667**

Table - B3: FINANCIAL GROSS MARGINS "WITH PROJECT" - K. VEG.
Shah KaleemDAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	3472	4919	5787
	Rate	Rs/Kg	15.00	15.00	15.00	15.00
	Sub Total	Rs	0	52083	73784	86805
2	By Products	Kg	0	0	0	0
	Rate	Rs/Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs	0.0	0.0	0.0	0.0
Gross Production Value		**Rs**	**0**	**52083**	**73784**	**86805**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planking	No	0.0	2.4	3.4	4.0
	Rate	Rs/ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs	0	540	765	900
2	Seed	Kg	0	12	12	12
	Rate	Rs/Kg	200.0	200.0	200.0	200.0
	Sub Total	Rs	0	2400	2400	2400
Manure and Fertilizer						
3	Urea	Kg	0	34	48	56
	Rate	Rs/Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs	0	1023	1449	1704
4	DAP	Kg	0	13	18	21
	Rate	Rs/Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs	0	1370	1940	2283
5	K_2SO_4	Kg	0	6	9	10
	Rate	Rs/Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs	0	180	255	300
6	FYM	Kg	0	500	500	300
	Rate	Rs/Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs	0	110	110	66
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	0	1	1	1
	Area Sprayed	%	0	30	43	50
	Rate	Rs/ Spray	350	350	350	350
	Sub Total	Rs	0	105	149	175
Labour Requirements			0.0	24.0	34.0	40.0
9	Hired Labour	Mandays	0.0	9.6	13.6	16.0
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	1920	2720	3200
10	Family Labour	Mandays	0.0	14.4	20.4	24.0
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	2880	4080	4800
Cost Summary		Rs	0	10527	13868	15828
Gross Margins		Rs	0	41556	59917	70977
Cost as % of GPV		%	#DIV/0!	20	19	18
Cropped Area		Acres	0	31	41	48
Total Value of Production		**Rs. (Million)**	**0.000**	**1.297**	**2.445**	**3.407**

Table - B4: FINANCIAL GROSS MARGINS - SUGARCANE
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	13200	18700	22000
	Rate	Rs/Kg	2.00	2.00	2.00	2.00
	Sub Total	Rs	0	26400	37400	44000
2	By Products	Kg	0	2640	3740	4400
	Rate	Rs/Kg	0.50	0.50	0.50	0.50
	Sub Total	Rs	0.0	1320.0	1870.0	2200.0
Gross Production Value		**Rs**	**0**	**27720**	**39270**	**46200**
Crop Production Expenses						
Cultural Practices						
1	Ploughings	No	0.0	1.5	2.1	2.5
	Rate	Rs/ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs	0	338	478	563
2	Planking	No	0	0	0	0
	Rate	Rs/ Pass	0	0	0	0
	Sub Total	Rs	0	0	0	0
3	Seed	Kg	0	4000	4000	3200
	Rate	Rs/Kg	2.0	2.0	2.0	2.0
	Sub Total	Rs	0	8000	8000	6400
Manure and Fertilizer					8.5	
4	Urea	Kg	0	38	54	63
	Rate	Rs/Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs	0	1150	1630	1917
5	DAP	Kg	0	19	27	32
	Rate	Rs/Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs	0	2087	2957	3478
6	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs	0	0	0	0
7	FYM	Kg	0	300	300	300
	Rate	Rs/Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs	0	66	66	66
Plant Protection Measures						
8	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
9	Sprays	No	0	2	2	2
	Area Sprayed	%	0	24	34	40
	Rate	Rs/ Spray	350	350	350	350
	Sub Total	Rs	0	168	238	280
Labour Requirements			0.0	21.0	29.8	35.0
10	Hired Labour	Mandays	0.0	6.3	8.9	10.5
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	1260	1785	2100
11	Family Labour	Mandays	0.0	14.7	20.8	24.5
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	2940	4165	4900
Cost Summary		Rs	0	16009	19318	19704
Gross Margins		Rs	0	11711	19952	26496
Cost as % of GPV		%	0	58	105	43
Cropped Area		Acres	0	20	26	30
Total Value of Production		**Rs. (Million)**	**0.000**	**0.228**	**0.509**	**0.795**

Table - B5: FINANCIAL GROSS MARGINS "WITH PROJECT" - WHEAT
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	440	744	870	946
	Rate	Rs/Kg	23.75	23.75	23.75	23.75
	Sub Total	Rs	10450	17661	20665	22468
2	By Products	Kg	440	743.6	870.1	946
	Rate	Rs/Kg	2.00	2.00	2.00	2.00
	Sub Total	Rs	880.0	1487.2	1740.2	1892.0
Gross Production Value		**Rs**	**11330**	**19148**	**22405**	**24360**
Crop Production Expenses						
Cultural Practices						
1	Ploughings &Planking	No	2.0	3.1	3.7	4.0
	Rate	Rs/ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs	450	707	828	900
2	Seed	Kg	50	50	50	50
	Rate	Rs/Kg	25.0	25.0	25.0	25.0
	Sub Total	Rs	1250	1250	1250	1250
Manure and Fertilizer						
3	Urea	Kg	20	34	40	43
	Rate	Rs/Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs	609	1029	1204	1309
4	DAP	Kg	10	17	20	22
	Rate	Rs/Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs	1112	1880	2199	2391
5	K_2SO_4	Kg	0	0	0	0
	Rate	Rs/Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs	0	0	0	0
6	FYM	Kg	0	300	300	300
	Rate	Rs/Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs	0	66	66	66
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	2	2	2	2
	Area Sprayed	%	0	26	30	33
	Rate	Rs/ Spray	350	350	350	350
	Sub Total	Rs	0	182	212	231
Labour Requirements			9.3	15.7	18.4	20.0
9	Hired Labour	Mandays	3.3	5.5	6.4	7.0
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	651	1100	1288	1400
10	Family Labour	Mandays	6.0	10.2	12.0	13.0
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	1209	2044	2391	2600
Cost Summary		Rs	5281	8258	9438	10147
Gross Margins		Rs	6049	10890	12967	14213
Cost as % of GPV		%	47	43	42	42
Cropped Area		Acres	180	219	231	240
Total Value of Production		**Rs. (Million)**	**1.089**	**2.385**	**2.995**	**3.411**

Table - B6: FINANCIAL GROSS MARGINS "WITH PROJECT" - R. Vegetables
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	3300	4675	5500
	Rate	Rs/Kg	10.00	10.00	10.00	10.00
	Sub Total	Rs	0	33000	46750	55000
2	By Products	Kg	0	0	0	0
	Rate	Rs/Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs	0.0	0.0	0.0	0.0
Gross Production Value		**Rs**	**0**	**33000**	**46750**	**55000**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planking	No	0.0	2.4	3.4	4.0
	Rate	Rs/ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs	0	540	765	900
2	Seed	Kg	0	3	3	3
	Rate	Rs/Kg	200.0	200.0	200.0	200.0
	Sub Total	Rs	0	500	500	500
Manure and Fertilizer						
3	Urea	Kg	0	26	37	43
	Rate	Rs/Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs	0	785	1112	1309
4	DAP	Kg	0	11	16	19
	Rate	Rs/Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs	0	1239	1755	2065
5	K_2SO_4	Kg	0	5	8	9
	Rate	Rs/Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs	0	162	229.5	270
6	FYM	Kg	0	500	500	500
	Rate	Rs/Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs	0	110	110	110
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs/Kg	0	0	0	0
	Sub Total	Rs	0	0	0	0
8	Sprays	No	0	1	1	1
	Area Sprayed	%	0	17	24	28
	Rate	Rs/ Spray	350	350	350	350
	Sub Total	Rs	0	59	83	98
Labour Requirements			0	18	26	30
9	Hired Labour	Mandays	0	7	10	12
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	1440	2040	2400
10	Family Labour	Mandays	0	11	15	18
	Rate	Rs/Day	200	200	200	200
	Sub Total	Rs	0	2160	3060	3600
Cost Summary		Rs	0	6995	9656	11252
Gross Margins		Rs	0	26005	37094	43748
Cost as % of GPV		%	#DIV/0!	21	21	20
Cropped Area		Acres	0	31	41	48
Total Value of Production		**Rs. (Million)**	**0.000**	**0.811**	**1.513**	**2.100**

Table - B7: FINANCIAL GROSS MARGINS "WITH PROJECT" - ORCHARDS
Shah Kaleem DAM

S. No.	Description	Unit	Base Year	Years of development		
				Year 1	Year 2	Year 3
Crop Gross Return						
1	Yield	Kg	0	3660	5185	6100
	Rate	Rs./ Kg	20.00	20.00	20.00	20.00
	Sub Total	Rs.	0	73200	103700	122000
2	By Products	Kg	0	0	0	0
	Rate	Rs./ Kg	0.00	0.00	0.00	0.00
	Sub Total	Rs.	0.0	0.0	0.0	0.0
Gross Production Value		**Rs.**	**0**	**73200**	**103700**	**122000**
Crop Production Expenses						
Cultural Practices						
1	Ploughings & Planking	No	0.0	1.2	1.7	2.0
	Rate	Rs./ Pass	225.00	225.00	225.00	225.00
	Sub Total	Rs.	0	270	383	450
2	Seed	Kg	0	100	100	100
	Rate	Rs./ Kg	20.0	20.0	20.0	20.0
	Sub Total	Rs.	0.0	2000	2000	2000
Manure and Fertilizer						
3	Urea	Kg	0	48	68	80
	Rate	Rs./ Kg	30.4	30.4	30.4	30.4
	Sub Total	Rs.	0	1461	2070	2435
4	DAP	Kg	0	24	34	40
	Rate	Rs./ Kg	108.7	108.7	108.7	108.7
	Sub Total	Rs.	0	2609	3696	4348
5	K_2SO_4	Kg	0	9	13	15
	Rate	Rs./ Kg	30.0	30.0	30.0	30.0
	Sub Total	Rs.	0	270	383	450
6	FYM	Kg	0	300	300	300
	Rate	Rs./ Kg	0.22	0.22	0.22	0.22
	Sub Total	Rs.	0.0	66	66	66
Plant Protection Measures						
7	Granules	Kg	0	0	0	0
	Rate	Rs./ Kg	0	0	0	0
	Sub Total	Rs.	0	0	0	0
8	Sprays	No	0	1	1	1
	Area Sprayed	%	0	18	26	30
	Rate	Rs./ Spray	350	350	350	350
	Sub Total	Rs.	0	63	89	105
Labour Requirements			0	19	27	32
9	Hired Labour	Mandays	0	8	11	13
	Rate	Rs./ Day	200	200	200	200
	Sub Total	Rs.	0	1536	2176	2560
10	Family Labour	Mandays	0	12	16	19
	Rate	Rs./ Day	200	200	200	200
	Sub Total	Rs.	0	2304	3264	3840
Cost Summary		Rs.	0	10579	14125	16254
Gross Margins		Rs.	0	62621	89575	105746
Cost as % of GPV		%	#DIV/0!	14	14	13
Cropped Area		Acres	0	8	10	12
Total Value of Production		**Rs. (Million)**	**0.000**	**0.488**	**0.907**	**1.261**

CHAPTER

14

OPERATION AND MAINTENANCE

OPERATION AND MAINTENANCE

Table of Contents

CHAPTER 14
OPERATION AND MAINTENANCE

14.1 General

An irrigation project may be defined as a tough and constant fight of an irrigation engineer with that intractable element called water. The truth about this fight is that it does not end with construction of irrigation works but exists as long as these works exist. Therefore an irrigation engineer has to be extra-ordinary careful. He should be highly realistic in his every approach to the different problems that arise while he has to deal with water.

14.2 Maintenance Requirements

Operation and Maintenance - refers to the routine costs of project implementation; abbreviated as O&M. It includes all the annual costs related to e.g. labour, material, energy, oil, spare parts etc.

All irrigation works of the project, after construction, should be maintained in the first class condition by frequent supervision, examination and necessary repairs. Some works, if found not working satisfactorily, may require repair/remodeling.

The irrigation channels should work efficiently so that,

(a) The land at their tail get their due share of water.

(b) There is efficient and economical distribution of water.

(c) There is no net scour or silting.

Causes of the defect in works, if any, should be found out and the defects should be rectified at an early date. The cross section of channel should be properly maintained. Weed growth, if any, should be removed periodically. No undesirable vegetal growth should be allowed to grow with canal boundaries.

All masonry works of the project should be inspected regularly and the defects, if any, should be immediately remedied.

The only operation foreseen is of the outlet structure control gates, through which water will be regulated for irrigation purposes. The Canal system also does not have gates, except for the control gates at water course outlets.

Steel work of these structures should be regularly painted. All the working or moving parts of these structures (e.g. gates etc.) should be kept in good working order and should be kept properly oiled or greased.

It will be of interest to an irrigation engineer to keep a record of observation about the following:

a) Rainfall in the catchment of a scheme in his charge

b) Yield of the catchments.

c) Any other miscellaneous hydrographic surveys of utility e.g. flood hydrographs etc.

d) Sedimentation of reservoirs in his charge.

e) Silting of irrigation channels in his jurisdiction.

f) Percolation and seepage through and under the irrigation works in his charge.

g) Water logging and salt efflorescence, if any.

h) Area actually irrigated from the available water; also, the condition and the yield of crops irrigated by the available water.

i) The working (satisfactory or otherwise) of all the irrigation works in his jurisdiction.

14.3 Administration

The operation and Maintenance (O & M) should be under the overall supervision of a Sub-Engineer, who will be looking after a number of other projects also. However, a Regulation Mate should be stationed at the dam site, to look after the O & M of the dam and ancillary works .

The Sub-Engineer would be in charge of the overall O & M but he should be supported with additional staff to operate the gates and look after the day-to-day maintenance. The additional staff may include a gauge reader, a beldar, and a watchman.

It is also suggested that the inspection and maintenance of the gates should also be carried out periodically through an independent workshop.

14.4 Water Management.

It is proposed that a committee headed by an SDO from the Small Dams Organization, with a representative of the local farmers should be established.

This committee should arrange periodic meetings to finalize the releases of water on the basis of water availability, demand and direct the operational staff to regulate the flow.

The provision of community water supplies from the dam, which would be planned subsequently, by Small Dams Organization of the Provincial Irrigation and Power Department, would be looked after by the provincial Public Health Engineering Department, as part of its mandate.

CHAPTER

15

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Table of Contents

CHAPTER – 15
CONCLUSIONS AND RECOMMENDATIONS

15.1 Conclusions

The studies for the dam at site indicate that a 21.4m (70 ft) high, 215 m (705.4 ft) long Main Dam across Shah Kaleem Khwar will create a reservoir of gross storage 646 AF and live storage of 543 AF. This will provide assured regulated supplies to the culturable command area of 600 acres. Releases from the reservoir will made though a multi level intake structure and 0.60 meters diameter circular RCC conduit running through the body of the dam supply irrigation water to the command area for agriculture development.

The catchment area of the Shah Kaleem Dam upto the proposed dam site is 9.96 sq. miles. With average annual rainfall of 17.6 inches and runoff as 1320 AF.

An ECRD is the suitable dam type. An ogee type. 150 ft wide spillway with chute channel is recommended.

Flood routing studies have indicated a 1,000-year flood inflow of 15618 cusecs and routed outflow of 15413 cusecs resulting in the maximum surcharge level of 8.9 ft above the gross storage level. Spillway consisting of chute and stilling basin

Gross area is 2017 acres having 600 acres as culturable area (CCA). The culturable waste is 120 acres (20%). These data show agricultural activity, but there is major constraint of irrigation water for increasing cropped area and productivity.

The designed discharges of the canal / conduit have been fixed as maximum requirement of 1.71 cfs (1.71 for irrigation and .09 for drinking water) for 600 acres of culturable commanded area

Life of reservoir is more than 30 years.

Command area consists of dissected Piedmont Plain, Loess and redeposited Loess on both sides of Pitao Khwar. All the soils is transported and redeposited.

Soils are level to nearly level, moderately well to well drain. They have good water holding capacity and slow to moderately slow permeability. The soils have slight to moderate problem of erosion. They are non - saline, non-alkali, moderately calcareous, medium to moderately structured, silt loams/silty clay loams.

The soils are very deep to shallow with 10 to 15%, gravels on the surface and/or in the soil profile. Overall topography is gentle to slightly undulating.

The Soils pH ranges between 7.49 to 8.41 with mean value of 8.06.

About 95% of the command area is rated as good to very good agricultural land and is highly suitable for all crops adoptable to the climatic conditions. Overall area is highly suitable for wheat, gram and maize.

The surface water as well the ground water has been found fit for irrigation purpose.

15.2 Recommendations

For the advanced stage of study and detailed engineering design the following is recommended.

The Project outlined in this Feasibility Report for the earth core rock fill dam of 215.0 m (705.4 ft) length, crest width of 8.0 m (26.25 ft) and 21.4 m (70.2 ft) high, is technically feasible and recommended for next stage.

Application of N and P is recommended to get good yield from crop/plants.

Organic manures must be added and green mannuring be done to increase the fertility and improve physico-chemical properties of soil.

All the results show that the returns to the economy after the implementation of the project would be satisfactory. Sensitivity analysis also proves that the project is viable for all the constraints. It may, thus, be safely deduced that the project is feasible, sound and viable, and no risk is involved in making the investmentIt may, thus, be safely deduced that the project is feasible, sound and viable, and no risk is involved in making the investment for the project.

The project being technically feasible and economically viable, is, therefore, recommended for implementation for the project. The project is recommended for implementation.

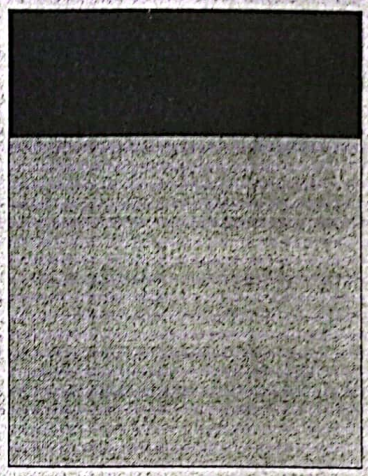


PHOTO GALLERY

Plate No. 1: Team of Geologists at Drilling Site (Shah Kaleem Dam)

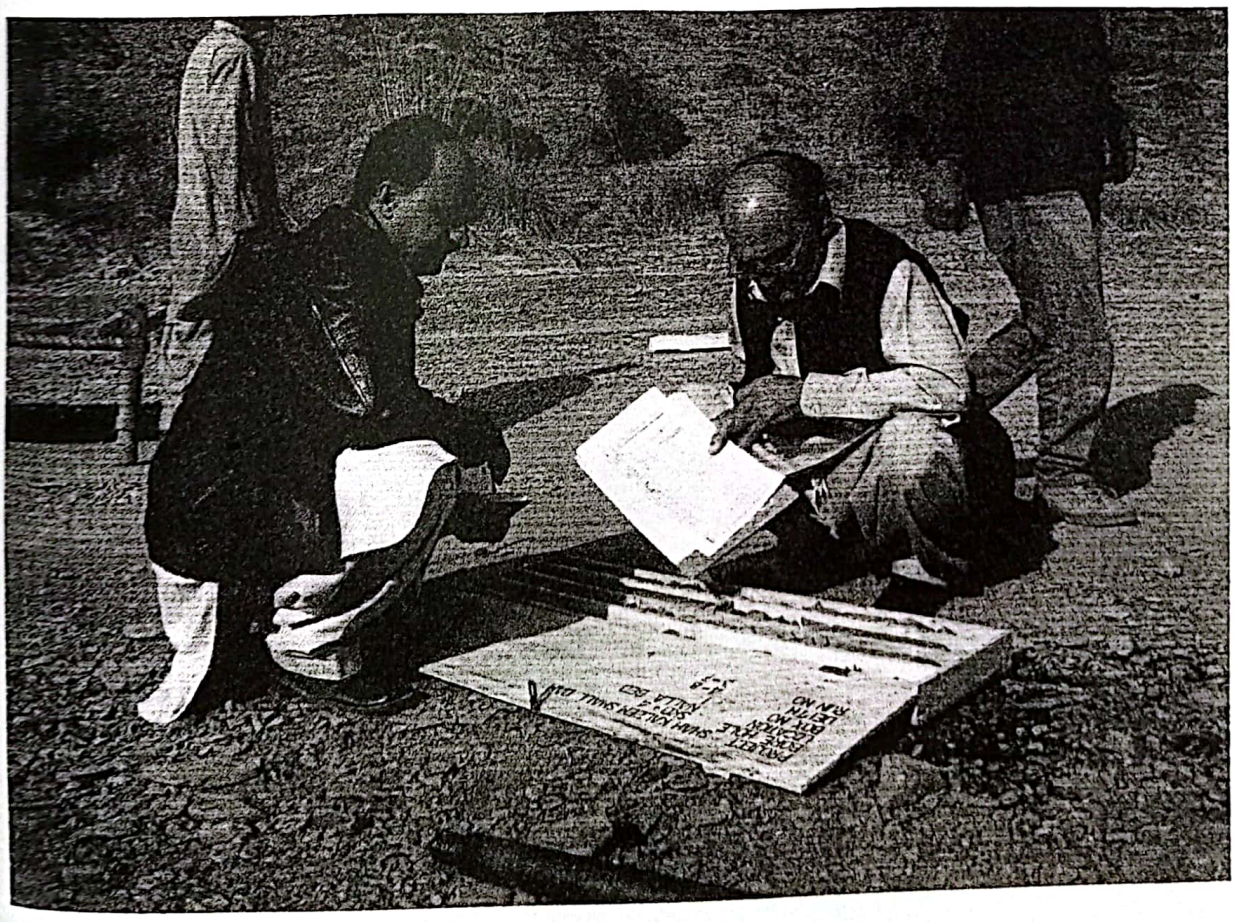


Plate No. 2: Geologists Examining the Core conditions at Shah Kaleem Dam

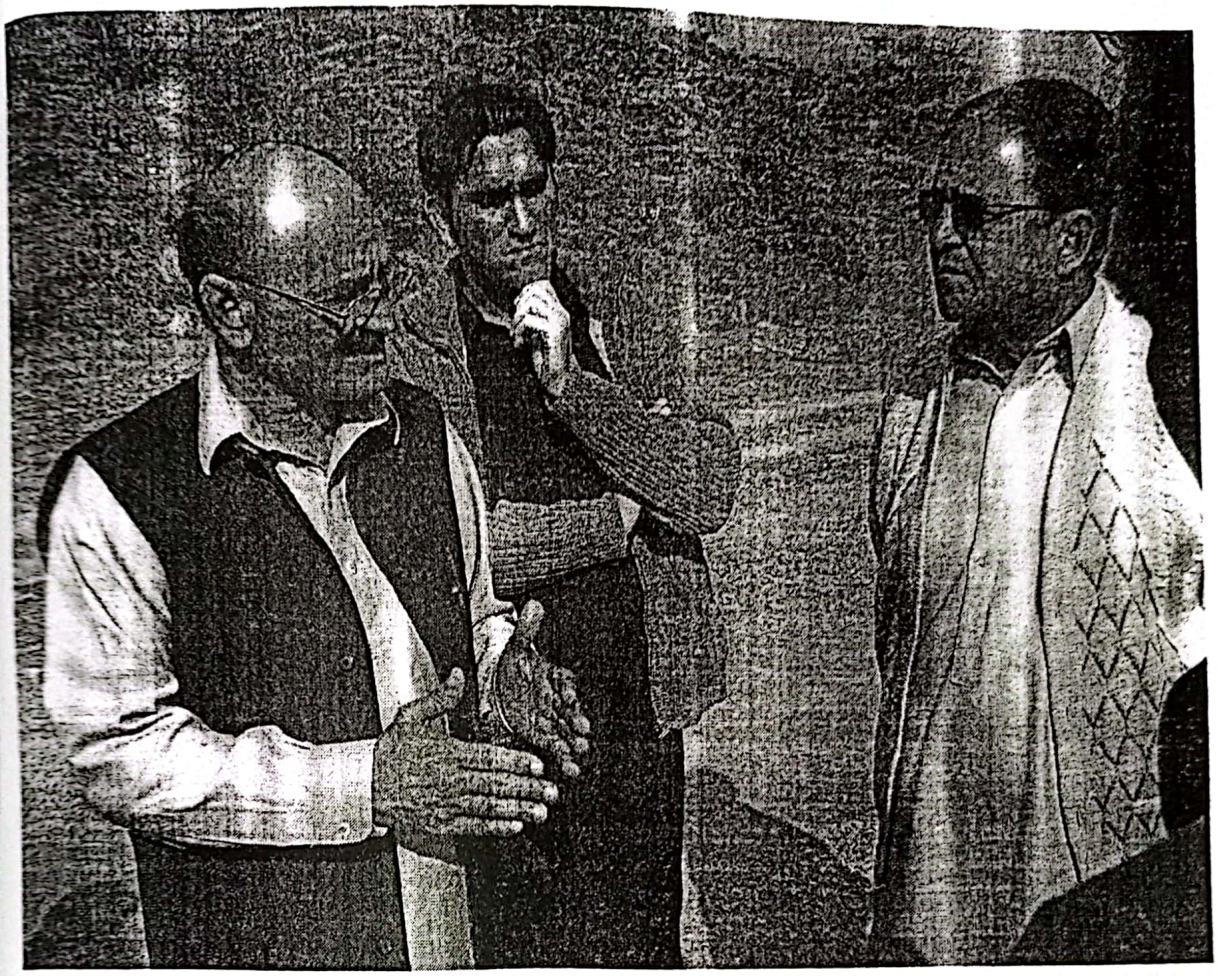


Plate No. 3: Experts discussing at Shah Kaleem Dam site

Plate No. 4: Experts at Shah Kaleem Dam site

Plate No. 5: Experts at Dam site (Shah Kaleem Dam)

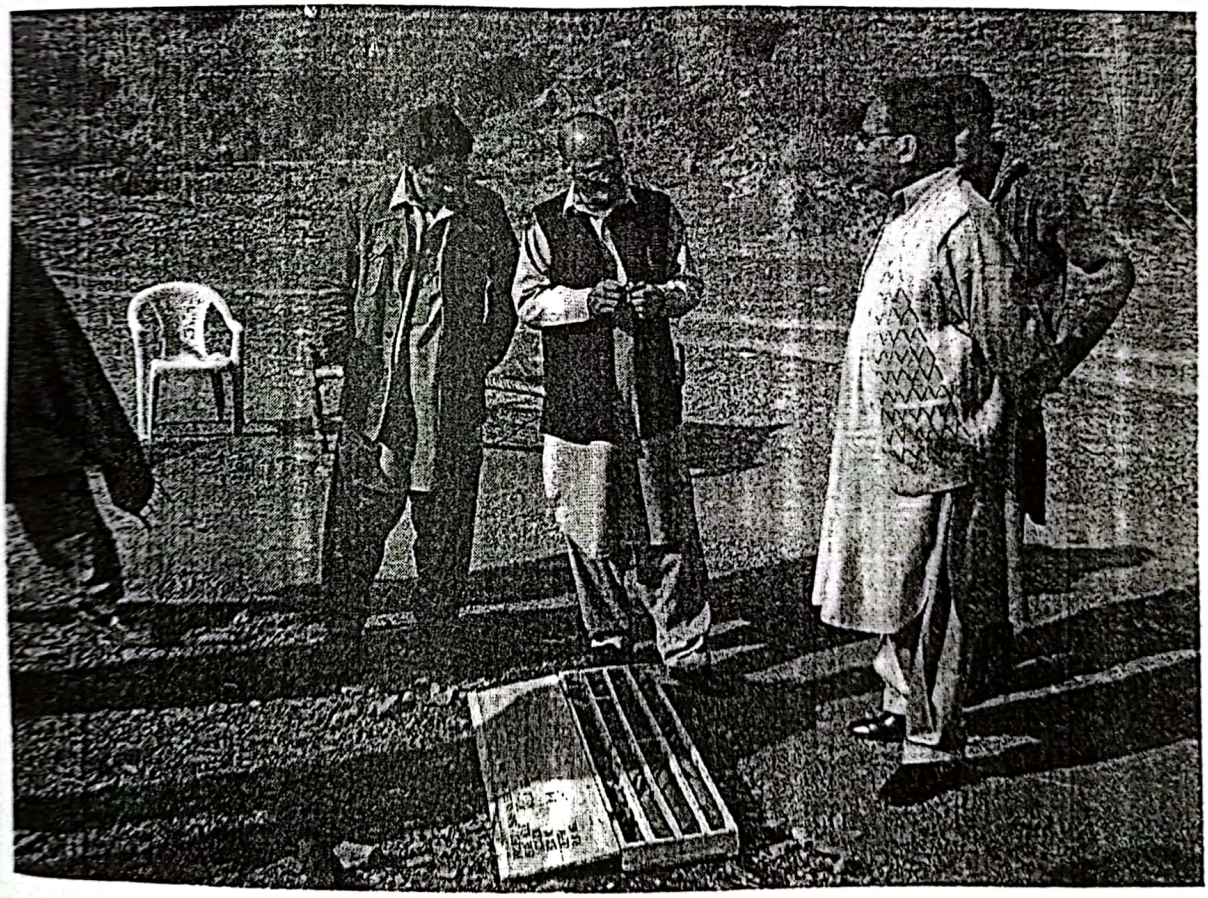


Plate No. 6: Experts Examining Drilling at Shah Kaleem Dam site

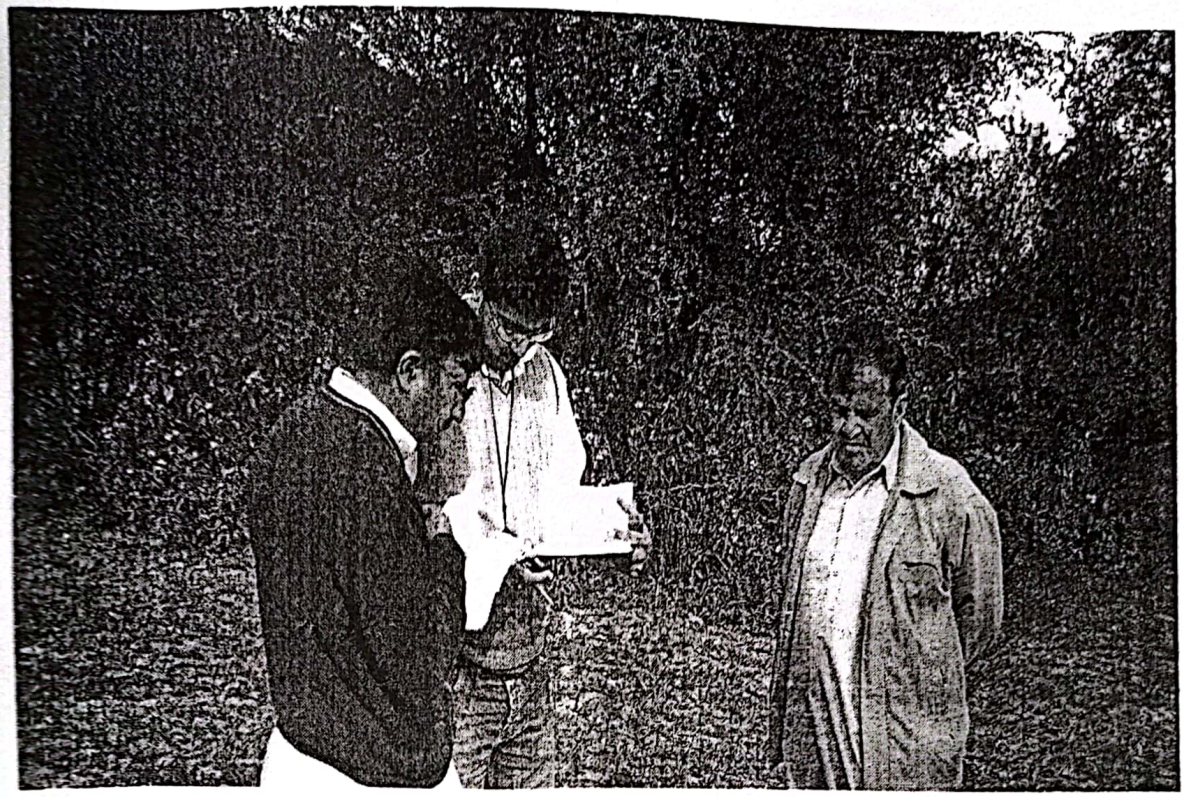


Plate No. 7: Experts discussing Hydrological Conditions (Shah Kaleem Dam)

Plate No. 8: A view of Reservoir Area

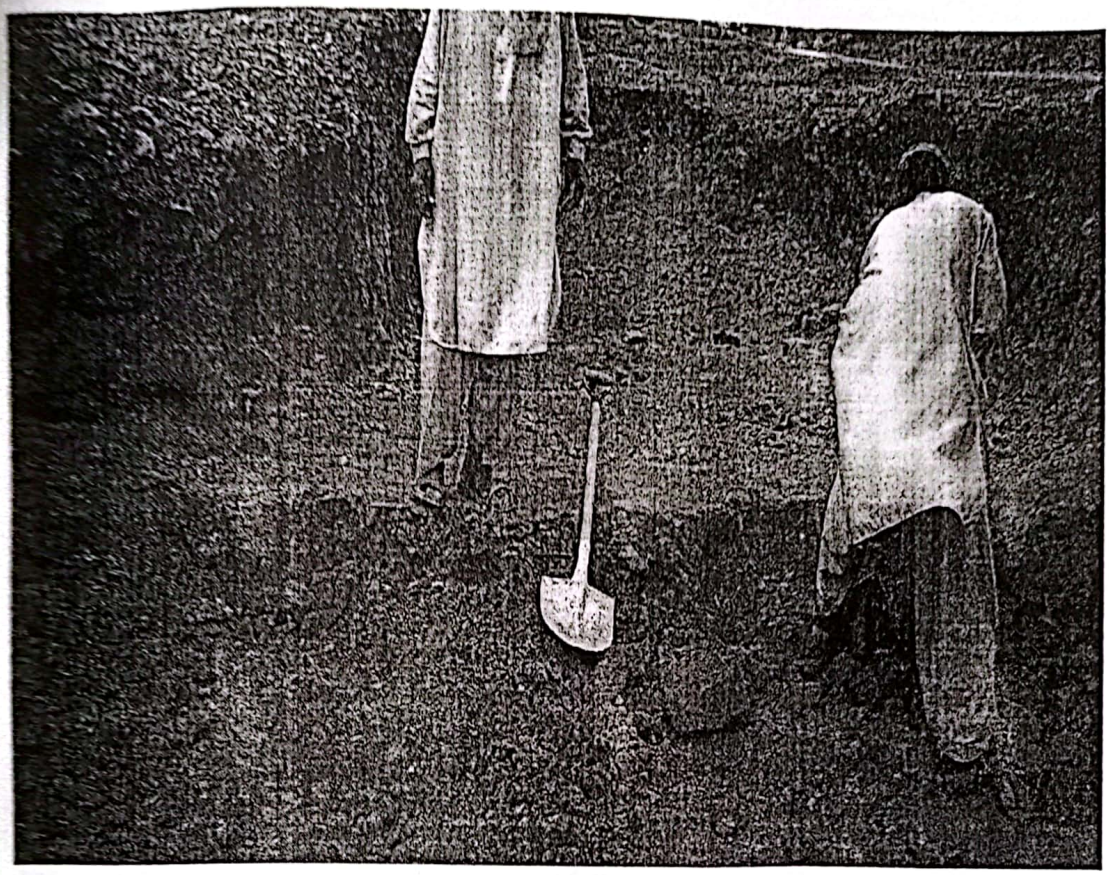


Plate No. 9: Clay Deposits near Shah Kaleem Dam

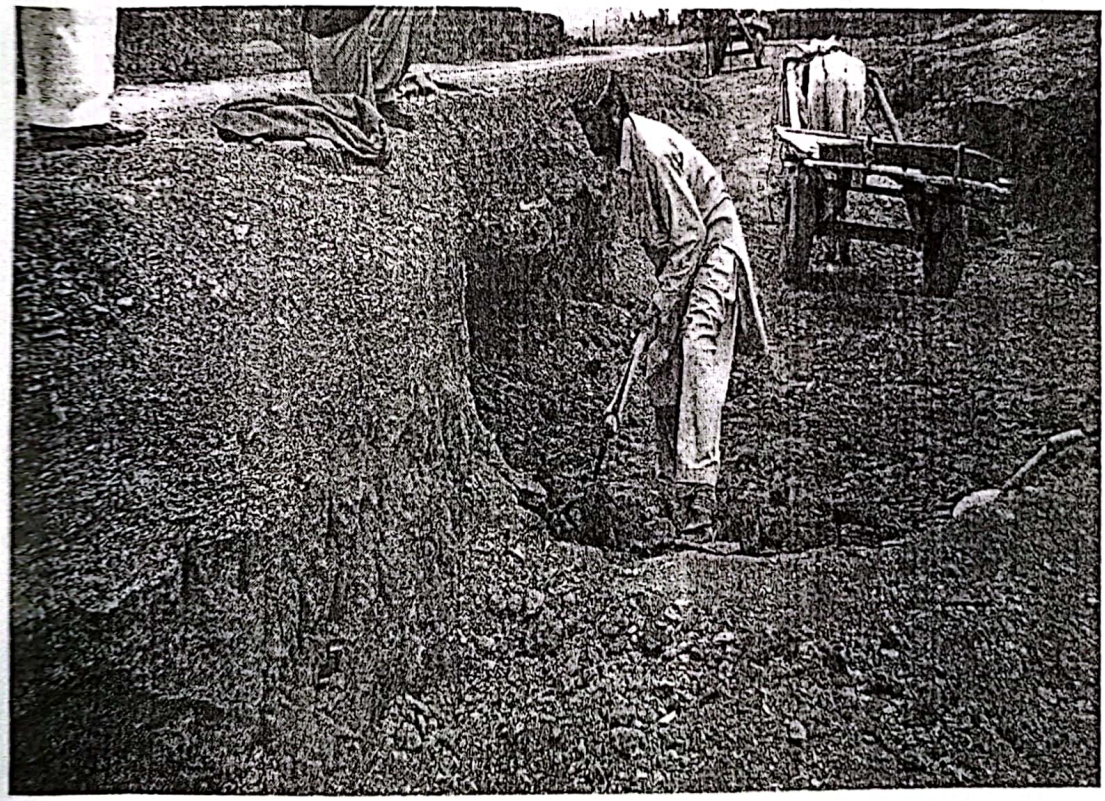


Plate No. 10: Clay Deposit downstream of Shah Kaleem Dam

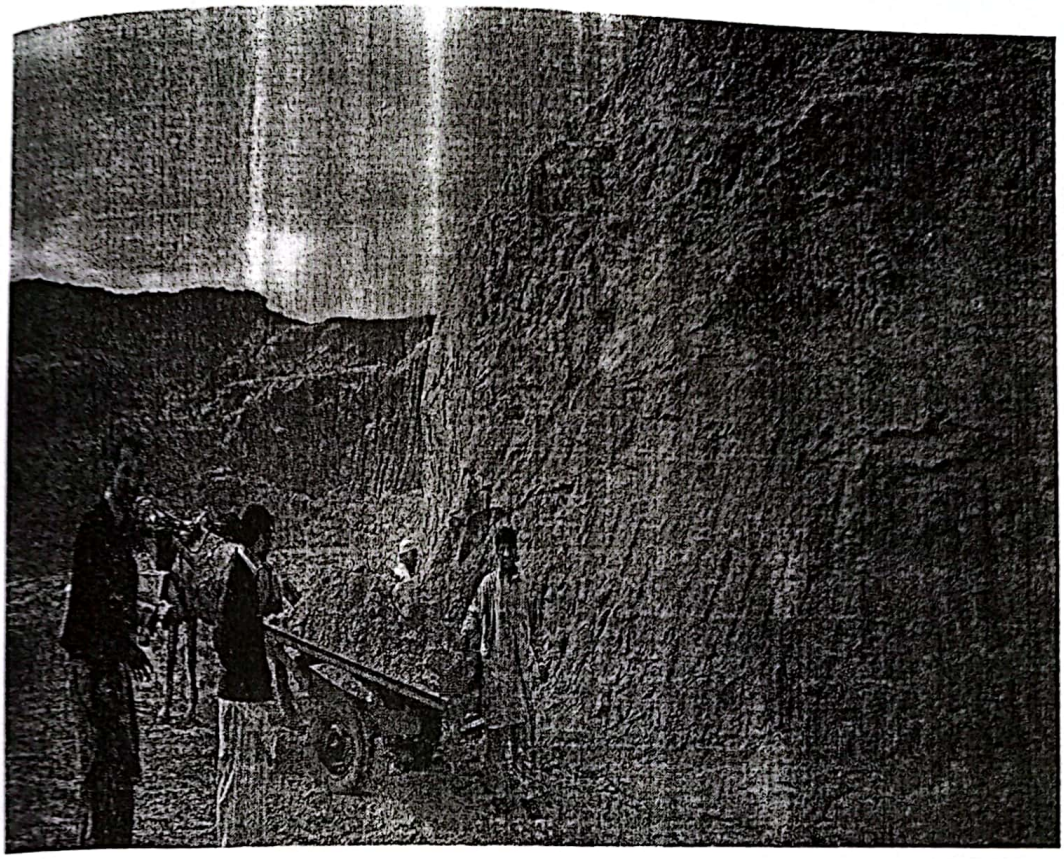


Plate No. 11: Local Sand Deposits near Shah Kaleem Dam

Plate No. 12: Shoulder Material (Silt) near Shah Kaleem Dam