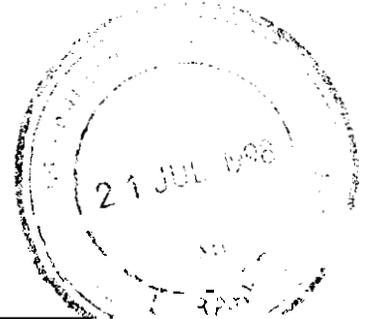


Report No. R41.2

**PILOT PROJECT FOR FARMER-MANAGED IRRIGATED AGRICULTURE
UNDER THE LEFT BANK OUTFALL DRAIN STAGE I PROJECT, PAKISTAN**



**PRELIMINARY BUSINESS PLAN
For
BAREJI DISTRIBUTARY**

by

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1 DESCRIPTION OF BAREJI DISTRIBUTARY

1.1 LOCATION

The Bareji Secondary Canal (Distributary) is situated about 15 km south-east of Mirpurkhas City, Sindh Province, Pakistan. Mirpurkhas is situated 23° to 32° N latitude 55" and 69° E longitude. The elevation of Mirpurkhas District is about 50 feet (ft) above sea level. **This** distributary off-takes at RD 408 (Reduced Distance, 1 RD is equal to 1,000 ft) from the East Jamrao Canal, near 78 *moree* (bridge).

1.1.1 History of the Bareji Distributary

Historically, the Bareji Distributary is as old **as** the Jamrao Canal itself. The Bareji Distributary and Jamrao Canal were excavated simultaneously. In those days, the length of the distributary was 24 Kilo Meter (**km**), and the tail was at Bikhori beyond Dangan.

Mr. Khan Bahadur Ghulam Muhammad Bhurgri was the main landowner (*zamindar*) of the tail reach. Due to acute shortage of water in the tail reach, he obtained direct outlets (watercourses) from the Jamrao and Mithrao Canals. Owing to this reason, the length of this distributary has decreased from 24 km to **12.5** km.

Before 1947, this command area, especially the land in head and middle reaches, was mostly owned by Hindu *zamindars*, some of whom were residing in the Sindh province, while others lived in India. Share croppers mostly used to cultivate these lands under the supervision of the manager (*kamdar*), while the *zamindars* occasionally used to visit their lands at the end of a cropping season. **After** the division of Indo-Pak, the Hindu zamindars left this distributary and claimed agriculture land in India, whereas the Government of Pakistan allotted these agricultural lands to Muslims migrated from India and other local people.

1.2 ADMINISTRATIVE CONTROL

The Bareji Distributary falls under the network of the irrigation system of the Sindh province. The distribution of irrigation water in Sindh is controlled through three barrages, i.e., Guddu, Sukkur and Kotri. The maximum irrigation water is provided by **Sukkur** barrage, which is 65,000 Cubic feet per second (cusecs), with a flushing discharge of 50,000 cusecs. Through the network of canals, it provides irrigation water to 7,630,000 acres of Culturable Command Area (CCA), or approx. 25 percent of the country's canal-irrigated land.

1.2.1 Sukkur Barrage

The Sukkur Barrage and its feeder canals were completed in 1932 at a cost of (then) **Rs.** 200 million. The length of the **Sukkur** Barrage, between abutments, is 4,725 ft. The Sukkur Barrage was built with a clear waterway of 3,960 ft divided into 66 spans of 60 ft each. The height of the weir gates is 22.5 ft and safe cutoff depth of the weir is 185

ft. During the 1980's, all 56 operating gates of this barrage were replaced with new gates by the same British national who had originally fabricated these gates.

There are seven feeder canals which off-take from the Sukkur Barrage; three on the right bank, i.e., the North Western Canal, Rice Canal and Dadu Canal, and four on the left bank, i.e., the Nara Canal, Khairpur Feeder East, Khairpur Feeder West and Rohri Canal. The discharge of this barrage is 65,000 cusecs with a flushing discharge of 50,000 cusecs. The CCA under this barrage is about 7.47 million acres (ma), of which a CCA of about 4.138 ma comes under the LBOD Catchment.

1.2.2 Nara Canal

The Eastern Nara Canal, which is part of an old river, was an inundation canal receiving its supply from the foothills of the Punjab. After traversing Bahawalpur (Punjab Province), it used to enter into the present Nara Canal a few miles downstream from the location of its present head. The Nara Canal, the largest off-taking canal from Sukkur Barrage, is located on both sides of this barrage. This is the longest canal in Pakistan with a length of 226 miles, extending to the western boundary of the Tharparkar District, with a design capacity of 13,602 cusecs and an actual discharge of 14,145 cusecs (source, ISRIP), this canal irrigates a total CCA of 2,069,200 acres.

1.2.3 Jamrao Canal

The construction of the Jamrao Canal commenced in November 1894, and was completed in 1900. Originally, its canal bed width was 125 ft and the full supply depth, 8 ft. The design discharge of the Jamrao Canal is 3,400 cusecs, whereas the actual average discharge is 4,588 cusecs (source ISRIP). The total CCA of the Jamrao Canal is 860,000 acres, out of which approximately 34,000 acres has been transferred to the Mithrao Canal command area. Lately, a new area of about 63,000 acres has been brought under the Jamrao Canal command, for which two minors (Sadrat 1 and 2) have been sanctioned. An area of 14,000 acres previously, part of the tail reach of the Rohri Canal, has also been transferred to the Jamrao system. The re-modeling of the Jamrao Canal was completed in 1994. Therefore, at present, it serves a total CCA of about 892,000 acres. The length of the main canal is 124 miles, while the cumulative length of its distributaries and minors is 426 miles.

West Branch Canal is the largest branch canal which off-takes from the Jamrao Canal at RD 291 on the right side, with a design capacity of 900 cusecs and covering a CCA of 230,800 acres. All the distributaries and minors in the jurisdiction of Mirpurkhas Sub-division off-take from the left bank of this canal.

1.2.4 West Branch Canal

Two (2) distributaries, six (6) minors and sixty-two (62) outlets off-take from the West Branch Canal. The major features of the distributaries/ minors are given in Table 1.

Table 1. Detail of Distributaries and Minors under West Branch Canal.

S.#	Name of the distributary	Parent Channel	"Q" cusecs	CCA Acres	GCA Acres
1	Lakhaki Distributary	West Branch	64	17723	17826
2	Bhitaro Minor	West Branch	27	4512	4628
3	Sangro Distributary	West Branch	105	29029	30806
4	Jarwari Minor	Sangro Distry	24	7178	7562
5	Chahu Minor	Sangro Distry	36	9948	10278
6	Daulatpur Minor	West Branch	49	13556	13853
7	Bellaro Minor	West Branch	42	13224	13522
8	Khumbri Sub-Minor	Belaro Minor	10	2808	2965

Source: Irrigation Department

1.2.5 Sub-divisions of Jamrao Canal

From the management point of view, the Jamrao Canal and its distribution system has been divided into five Sub-divisions, which are as follows:

1. Khadro Sub-division (from RD 0 to 163)
2. Jhol Sub-division (~~from~~ RD 163 to 291)
3. Mirpurkhas Sub-division (from RD 291 to **448** of Jamrao and RD 0 to **143** of West Branch)
4. Kot Ghulam Muhammad Sub-division (from **RD 448** to **RD 602** of Jamrao Canal); and
5. Digri Sub-division (RD **143** to **303** of West Branch)

1.2.6 Mirpurkhas Sub-division

Mirpurkhas is the third sub-division of the Jamrao Canal, which comprises of the Jamrao Canal (from **RD 291** to **443**), West Branch (from RD 0 to **143**) and their distribution system in the given reaches.

There are four (**4**) distributaries, two (2) minors and thirty-four (**34**) outlets drawing directly from the Jamrao Canal, from **RD 291** to **443**. Besides, there are four (**4**) minors which are fed by the fore-stated two (2) distributaries. The main features of these channels are given in Table 2.

Table 2. Detail of Distributaries and Minors under RD 291 to RD 443 of Jamrao Canal.

S. No	Name of Disty/ Minor	Parent Channel	Discharge (cusec)	CCA (acres)	GCA (acre)
1	Mirpur Distributary	Jamrao	64.0	20,693	20,965
2	Mirpur Minor	Mirpur Disty	3.5	787	824
3	Piro Minor	Mirpur Disty	--	--	--
4	Doso Dhararo Dist.	Jamrao	76.5	22,373	23,574
5	Old Doso Minor	Doso Dhararo Disty.	5.0	1,467	1,512
6	Kahu Visro Minor	Jamrao	18.0	5,838	5,898
7	Kahu Minor	Jamrao	44.5	14,984	15,137
8	Sanro Distributary	Jamrao	70.0	18,100	18,349
9	Sanro Minor	Sanro Disty	25.0	6,470	6,486
10	Bareji Distributary	Jamrao	41.5	13,952	--

Source: Irrigation Department

1.2.7 Location of Divisional Office

The office of the Jamrao Division is situated in Mirpurkhas District, 65 km from Hyderabad and 240 km from Karachi. The Executive Engineer, Jamrao Canal, is the head of the division. The detail of staff serving under the Jamrao Canal is given in Annexure 2. The detail of staff serving on work charged regular establishment is given in Annexure 3.

1.2.8 Location of Sub-divisional Office

The office of the Mirpurkhas Sub-division is situated in Mirpurkhas City, at a distance of nearly 0.5 km from the Jamrao Division offices. The Assistant Executive Engineer is the head of the office. The detail of staff is given in Annexure 4.

1.2.9 Irrigation Personnel involved in Bareji Distributary

There are eight irrigation personnel involved in the operation of the Bareji Distributary. The list of the irrigation personnel, along with their designations, is given in Table 3.

Table 3. List of Irrigation Staff at Bareji Distributary.

S.#	Designation	No. of Post
1.	Assistant Executive Engineer	1
2.	Sub-engineer	1
3.	<i>Darogha</i>	1
4.	<i>Senior Jamadar</i>	1
5.	<i>Beldar</i>	3
6.	P.W.D (Mate)	1

Source: Irrigation Department

1.3 PHYSICAL CHARACTERISTICS OF BAREJI DISTRIBUTARY

The Bareji Distributary off-takes from the middle reach of the Main Jamrao Canal through a head regulator consisting of three gates. The length of this distributary is 12 km (RD 39.31) with a design discharge of 41.5 cusecs at the head. The distributary has 24 watercourses of which 7 are lined, and covers a CCA of 11,924 acres. The overall land holding size along the distributary is small to medium, varying from 5 to 100 acres.

The middle and tail reaches of this distributary face the problem of flow into the command area because the water level is lower than the ground elevation, and therefore, the farmers in such areas use lift machines to irrigate their fields.

The farmers of 16 (66.66 %) watercourses irrigate their lands by gravitational flow, while those of the remaining 8 (33.33 %) watercourses irrigate their fields by lift machines. A total of 16 lift machines irrigate these eight watercourses, i.e., 7L, 8L, 9L, 10L, 11L, 12L, 9R and 10R. The detail of lift machine installed at Bareji Distributary is given in Annexure 5. As these lift machines are not sanctioned from the Irrigation Department, therefore, the farmers are paying full abiana (water charges), although comparatively reduced abiana rates are applicable in such cases. The expenditure on one lift machine for one crop season is estimated between Rs. 1,000 and Rs. 8,000.

1.4 SOCIO-ECONOMIC CONDITION

1.4.1 Population

The size and growth rate of population exerts pressure on natural resources. Population growth adds to the supply of labor, but not necessarily to unemployment. In the rural structure, insecurity in old age creates an inclination for more male children in the family. More children in the family creates lofty feelings among the community. This behavior is not only common among tenants, rather, is observed among other water users also. The population of the Bareji Distributary command area, collected through various surveys, is estimated to be 6,800.

1.4.2 Major Communities

The major communities living in the Bareji Distributary command area are Leghari, Mari (from Balochistan) Rajar, Mangrio, Makrani, Punjabi (settlers), Shar, Lashari, Jhulan, and Kolhi and Bheel (scheduled castes).

1.4.3 Cultivators and their Status

There are 1,141 cultivators of different status cultivating their land in the Bareji Distributary command area. The water users include zamindars, owner-cultivators, lessees, kamdars and tenants. The detail of cultivators' status is given in Table 4.

S.#	Cultivator	Quantity
1	<i>Zamindar</i>	178
2	Owner-cultivator	155
3	Lessee	10
4	<i>Kamdar</i>	11
5	Tenants	787

1.4.4 Educational Level

Pakistan has a very weak education base and only **26** percent of the population are literate. Like other rural areas, this command area also lacks education facilities. Due to the absence of schools, or improper functioning of the schools, the literacy rate is very low, especially among tenants. Tenants, or the uneducated, incorporate **75%** of the farmers, who are reluctant to listen, or contact, outsiders. The female education rate is also very low because there are no separate schools for girls in this area. Teachers avoid appointments in the rural areas, **so** most of these schools are used as warehouses *to* store the *zamindar's* inputs and outputs. The summary of the educational level of the farmers is given in Table 5.

Table 5. Educational Level of Farmers of Bareji Distributary.

Levels	Tenants	Contact Farmer	WU A members	WUF members
Illiterate	72.4%	17%	14.66%	06%
Primary	18.2%	33%	45.69%	36%
Secondary	5.3%	27%	18.97%	29%
College	4.1%	23%	20.68%	29%

1.4.5 Rural Indebtedness

Tenants in the rural areas, like those along the Bareji Distributary, **are** treated as commodities. In a way, these tenants are purchased, or sold, in the rural agriculture community. The rural indebtedness of a tenant continues with the passage of time and mutation of the owner. Therefore, the majority of these tenants transfer their debts to their incoming generation.

1.4.6 Land Holding Size

The minimum land holding size in the Bareji Distributary is **5, 2 and 8** acres in the head, middle and tail reaches, respectively, while the maximum land holding along this distributary is **265, 250 and 300** acres in the head, middle and tail reaches, respectively. The average land holding in this command area is about **43.45** and 50 acres in the head, middle and tail reaches, respectively.

1.4.7 Major Crops and Crop Zones

According to the climatic and soil condition in this province, different areas are considered suitable for different crops, the detail of which is given below:

- 1 Upper Sindh
- 2 Middle Sindh
- 3 Lower Sindh
- 4 Desert and Katcho Area

The Bareji Distributary comes under the Lower Sindh crop zone. The lower Sindh crop zone includes:

- i. Upper part of Hyderabad (Hala, Hyderabad and Tando Allahyar Sub-division), Sanghar and Mirpurkhas District are suitable for cotton, wheat, sunflower, soybean, rapeseed, mustard and ground nut.
- ii. Tando Muhammad Khan Sub-division of Hyderabad, District Badin, is suitable for sugarcane and rice crops. Mash and *masoor* pulses are also suitably grown in Thatta and Badin Districts. In this command area, the crops being cultivated are cotton, sugarcane, chilies, wheat, oil seed, fodder, onion and mango orchards.

The total reported area of Sindh is 58.12 million hectare (mha), whereas only **24.90** mha, or **43 %**, is under agricultural use. Out of this **24.90** mha, **3.44** mha, or **14 %** of the agriculture land is under forest, with the remainder under cultivation.

1.4.8 Surface Irrigation Methods and Practices

Traditionally, there are two common irrigation methods followed in this area; basin irrigation and furrow irrigation. In the case of basin irrigation, the farmers prepare land, which is not properly leveled. In recent years, the trend is moving more towards the use of furrow irrigation.

1.4.8.1 *Bash Irrigation*

Some years ago, basin irrigation was common, but now this practice is undergoing slow change, as the farmers have now realized that under this irrigation method, they need precise land leveling. In the *rabi* season mostly wheat, fodder and sugarcane are cultivated using the basin irrigation method.

1.4.8.2 *Furrow Irrigation*

The trend to adopt the furrow irrigation method has increased because farmers believe that they can cultivate more area within their water turns under this method. In the *kharif* season, cotton and chilies crops are being **sown** on ridges, while in *rabi* season, onion and vegetables are being cultivated using this method.

1.4.9 Soil Physical Properties

The Bareji Distributary command area consists of different types of soils. The main type of soils categorized in this command area are loamy, sandy clay, clay, silty and heavy clay.

1.4.10 Climate

The climate is suitable for all major crops, such as cotton, sugarcane, wheat, chilies, oil seeds and bananas. This region is hot in summer, with maximum temperature ranging between 38°C and 43°C, while the mean minimum temperature in winter ranges between 12°C and 20°C. The monthly rainfall in summer is about 40-50 milli meter (mm) while the winter season is practically dry. The average annual precipitation ranges from 200 to 250 mm.

The climate of Sindh is arid and hot. According to the classification made by UNESCO the region has been divided into three zones:

1. Coastal - South of Thatta.
2. Southern - From Thatta through Hyderabad to Nawabshah.
3. Northern - From Nawabshah to Jacobabad.

1.4.11 Warabandi

Two types of *warabandi* practices are followed within the Bareji Canal command area.

- i. Rotational closure, of this distributary.
- ii. *Warabandi* at the watercourse level, which may be further sub-classified as follows:
 - a. *Kachi Warabandi*.
 - b. *Pucci Warabandi*.

i. Distributary Rotational Closure

This type of *warabandi* is practiced at the canal level. During the months of acute shortage of irrigation water (i.e., May, June and July), the distributaries of the head and middle of the Jamrao Canal are closed rotation-wise, so that water may become available into the tail reach of the Jamrao Canal.

ii. *Warabandi at Watercourse Level*

Warabandi at watercourse level is practiced among the *zamindars* only. The tenants of a *zamindar* receive water according to the wishes of their *zamindar*. There are two types of *warabandi* practices followed in this command area, which are explained as follows:

a. ***Kuchi Warubandi***

This type of *wurubundi* is actually distribution of water by mutual understanding. All the *zumindurs* of a watercourse mutually decide the water turns for themselves. The Provincial Irrigation Department (PID) does not interfere in ***Kachi Warabandi***, whereby the water turn of a *zumindur* **remains** intact, even if, at the time of his / her water turn, the distributary is closed due to some reason. **Thus**, the day for the water turn of a *zumindur* is not **fixed**.

b. ***Pucci wurubundi***

The schedule of water turns decided by the PID along a watercourse for its water users is called ***Pucci Warabandi***. Sometimes, **this** kind of *wurubundi* is also set with the mutual consensus of the *zumindurs* along a watercourse. If, at a certain period of time, the distributary is closed the *zumindur* entitled to a water turn at that particular time has to forgo his / her a turn. The water turns under this type of *wurubundi* **are** rigid and officially determined, therefore, farmers cannot challenge, overlap, or break these turns. Under the Bareji Distributary, in most of the watercourses, **this** type of *warabandi* is practiced.

1.4.12 Loan and Credit Facility

The Agricultural Development Bank of Pakistan provides loan facilities credits to the small *zumindurs* for purchasing basic inputs. Besides, other schemes relating to agriculture inputs, e.g., purchase of tractor, etc., are also available to the *zumindurs*. However, due to procedural complexities, only a few *zumindurs* of **this** command 'area benefit from **this** facility.

The National Rural Support Program (NRSP), **also** working for rural communities in the **rural** areas of Mirpurkhas, has recently started work **among** the rural community of the Bareji Distributary command area. The main purpose of **NRSP** is to strengthen and empower the community through different packages of loan and credit schemes.

Mirpurkhas Sugar Mills also play a major role in agriculture development by providing loans and credit to interested sugarcane growers in this vicinity. They also provide fertilizer on the basis of average consumption per acre for the year.

1.4.13 Role of Water Users Organizations/ Farmer Organizations

The objective of IIMI-Pakistan's action research is to transfer responsibilities to water users for the support service of the irrigation system. If such transfer policies work, there exists a **strong** possibility that this will result in an increase of benefits to farmers. In **order** to be successful, **this** action research should be consistent with the realities faced by the water users in terms of financial, technical, social and personal, in order to optimize system benefits and the sharing of system responsibilities.

IIMI-Pakistan has assisted the water users of this command area to form Water Users Associations (WUA) and Water Users Federation (WUF). The main objective is to involve water users in participatory management **so as** to improve the Operation and Maintenance (O&M) of the irrigation system. The underlying concept is that the **WUAs** at the **watercourse** level, and the WUF at the distributary level, would eventually be accountable for the water received at the head of the Bareji Distributary. Furthermore, they will be responsible for water distribution among their members, collection of *abiana*, along with O&M of the combined irrigation and drainage facilities within their distributary. The emphasis of **this** strategy is to increase equity and empowerment through greater involvement of water users, increase commitment and willingness to share costs, and an interest in sustaining the benefits.

In the Bareji Distributary, 24 **WUAs**, i.e., one WUA for each watercourse consisting of President, Vice President, General Secretary, Finance Secretary and one or two members of the executive body. **Two** members from each watercourse, in consultation with the WUA, were selected to form a general body consisting of a total of **48** members (see Annexure 6 for more details), who then selected 11 office bearers with consensus. This body of 11 members is called the Water Users Federation, and the members include President, Vice President, General Secretary, Joint Secretary and Finance Secretary, and six members of the executive body. The names and designations **are** given in Annexure 7. The detailed profile of office bearers of the WUF is given in Annexure 8.

15 DRAINAGE SYSTEM

The command area of the Bareji Distributary comes under the Left Bank Outfall Drainage (LBOD) Project, which is one of the major public sector drainage projects and stretches into three districts of the Sindh province.

There are two types of drainage facilities available in this command area.

- a. Surface drainage; and
- b. Subsurface (tile) drainage.

1.5.1 Surface Drainage

A network of surface drains is required for the disposal of tubewell, or tile, effluent, and for the removal of surplus irrigation water and storm water. In principle, the surface water network is a mirror-image of the canalization network. The sub-drains, generally, are aligned on the command boundaries of the distributary canals. The drains **are** provided with storm water inlets. Field drains are constructed by farmers / water users, **as** necessary, for the removal of excess water and flooding. The capacity of a surface drain is based on the discharge from tiles and tubewells. A freeboard is incorporated, varying from 1 ft in sub-drains, 2 ft in the branch drains and 4 ft in the outfall **drain**.

Four surface drains are located in the command area of the Bareji Distributary, namely 3L, 4L, 4LA, and DC-IR. Sub-drains 3L and DC-IR collect saline water that is pumped out by the sump houses, while sub-drains 4L and 4LA are being used for surface runoff. The spinal drain, which collects the drainage water of all three LBOD districts, is also passing through the pilot command area of Watercourses 6L to 13L. The detail of surface drains is given in Table 6.

Table 6. Detail of Surface Drains in the Bareji Distributary Command Area.

Sr. No.	Name of drain	Design discharge (cfs)	Total Length (km)	Length in command area (km)	Lined/ Unlined
1.	4L Sub drain	25.6	7.0	4.70	Unlined
2	4LA sub drain	16.5	5.0	1.0	Unlined
3.	3L sub drain	--	30.9	12.98	Unlined
4.	DC- 1R		4	4	Unlined
4.	Spinal drain	--	--	10	Unlined

1.5.2 Subsurface Drains

The network of the tile drainage system covers about 9,873 acres of this command area. The 13 pumps, which are about 20 % of the Mirpurkhas sub-project, installed in the Bareji Distributary command area, drain the saline water from the nine (09) *dehs* in the Bareji Distributary command area.

Tile drains are sub-surface corrugated perforated plastic pipes. The material of the pipes may be polyvinyl chloride (PVC), or polyethylene (PE). Field drains are installed at regular intervals of 350 to 650 ft, depending upon the characteristic of the soil. Each field drain outfalls into bigger diameter pipe collectors, varying in diameter from 6 to 15 inches, and with a geotextile surrounds. The depth of the field drains is 6 to 8 ft below ground surface, while that of the collector drain varies from 7.5 to 11 ft. The collector drains outfall into a sump, where the drainage effluent is pumped out into the disposal channels. The disposal channels are small open surface drains. The area drained by one pump station varies from 400 to 1,200 acres. The overall performance of the tile drain depends on proper O&M of the pump station. The cost of capital and operations of this drainage system, as estimated by the LBOD WAPDA, is about Rs. 15000-20,000 per acre and Rs. 80-100 per acre per year, respectively.

1.5.3 Effect of Tile Drainage System on Crop Yield, Cropped Area and Net Income

Various studies have been conducted to evaluate the impact of drainage on crop yield and cropped area. The ultimate objective of the LBOD project is to improve the soil productivity and increase the per acre yield of crops through this drainage system by controlling the water table depths and to reclaim already-affected soils.

The pre- and post-project results of a private farm near Mirpurkhas, wherein a tile drainage unit has been installed under collaborative arrangements in 1989, are given in Table 7.

Table 7. Impact of Drainage System on Farm Income.

Year	Cropped area (Acres)	Inter cropped area (Acres)	Fallow land (Acres)	Net Income (Rs)	Average Net Income per acre from farm area (Rs)
1990-91	60.00	-----	40.00	-----	378.00
1991-92	60.55	10.50	29.45	72,436.00	2,095.00
1992-93	63.00	12.90	27.00	32,688.00	572.00
1993-94	100.00	40.00	Nil	113,739.00	4,460.00
1994-95	98.00	6.00	2.00	81,451.00	4,998.00
1995-96	100.00	25.00	Nil	20,508.00	5,970.00
1996-97	99.00	50.00	1.00	*	4,392.00

* Data under compilation

Source:-Out reach Workshop on Collaborative Drainage at Nawazabad near Mirpurkhas.

1.5.4 Water Table Depth

Before 1932, the water table depth in the LBOD area was below 12 ft; however, after 50 years, 75% of the area has water tables below 5 ft from the surface, and 20 % below 8ft from the surface. Since 1983, water tables have continued to rise throughout the LBOD area.

The water table depth is measured twice a week by the IIMI-Mirpurkhas field team through piezometers installed in this command area. IIMI-Pakistan has installed a total of 65 piezometers in the head, middle and tail reaches of each of the 24 watercourses of this distributary. The average water table depth has been observed at 3 ft, 4.4 ft and 5.61 ft at head, middle and tail reach of command area, respectively; however, the minimum and maximum average water table depth observed is 0.63 ft and 9.1 ft, respectively. The average water table depth observed in the Bareji Distributary command area is about 4.42 ft.

1.5.5 Effect of Water Table Depth on Crop Yields

Water table depth plays a major role in achieving a righteous yield of different crops. The total area in Pakistan with water table depths between zero and five feet is reported to be 22,616,000 acres. The percentage in the Sindh province is the highest when compared with other provinces, i.e., 12,236,000 acres, or 54.10 %, of the total area in this range. The effect of water table depths at varying levels on crop yield is given in Table 8.

Table 8. Effect of Water Table Depth on Crop Yields.

Water table Depths (cm)	CROPS PERCENTAGE YIELD DECREASE					
	Cotton	Sugarcane	Wheat	Barseem	Fodder	Mango
0-25	98	91	79	77	80	100
25-50	57	66	49	45	27	100
50-75	35	46	28	24	0	100
75-100	21	29	13	09	0	87
100-125	12	1	5	2	0	63
125-150	5	5	1	0	0	38
150-175	0	0	0	0	0	0

Source: Water Sector Investment Planning study, vol.1.

1.5.6 Groundwater Quality

The groundwater in this distributary command area is mostly saline. During the collection of data on wafer quality, it was observed that the water quality varies from field to field, and sump house to sump house. However, the water pumped out from the sump houses is saline and cannot feasibly be used for imigation. The water samples collected ~~from~~ the 65 piezometers installed in the command area show that the water contains total dissolved solids (TDS), a measure of total salinity, from 400 parts per million (ppm) to 19,000 ppm.

The Electrical Conductivity (EC) of the groundwater has been observed at 300 ppm to 12,500 ppm, 450 ppm to 10,500 ppm and 500 ppm to 50,112 ppm in the head, middle and tail reach areas, respectively. The minimum and maximum EC is 300 ppm and 50,112, respectively, while the average for this distributary has been calculated at 5,323 ppm.

The quality of groundwater, in ppm, with different ranges of suitability for irrigation use, is given in Table 9.

Table 9. Range of Groundwater Quality in PPM Suitable for Irrigation use.

S.#	Range of Ground water (ppm)	Suitability for irrigation use
1	0-700	First class irrigation water
2	700-1200	Second class irrigation water
3	Greater than 1200	Unfit for irrigation purpose

Source: Field data by IIMI, Mirpurkhas staff

1.5.7 Farmers' Perceptions about Drainage System

The project of tile drainage was completed on January 31, 1996 (Completion report of Sub-surface Drain III, Contract # T40 IB1). However, farmers informed that this is due to the irregular functioning of this network (interrupted electric supply). For the last two years, the waterlogging and salinity conditions around the sump houses have

deteriorated as the saline water accumulates around the sump houses, and is thus the cause of low yields in these fields (see Annexure 9 for detail of pump stations).

The operational hours for each pump installed in the Bareji Distributary command area is given in Table 10.

Table 10. Operational hours for Pumps Installed in the Bareji Distributary Command Area.

S.#	Pump station	Feb, 97	March, 97	April, 97	May, 97	June 97	July, 97	Aug, 97	Sept, 97	Oct, 97
1	SD-19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.8
2	SD-21A	542.8	0.0	843.6	0.0	0.0	917.0	956.7	1,071.5	1,256.5
3	SD-22	0.0	0.0	89.7	0.0	0.0	1,035.0	0.0	1,144.8	1,147.8
4	SD-24	0.0	0.0	1,082.7	0.0	0.0	1,082.7	0.0	0.0	1,082.7
5	3L-17 P1	0.0	0.0	838.6	0.0	0.0	922.1	984.6	1,150.2	1,150.2
	P2	0.0	0.0	229.8	0.0	0.0	229.8	230.9	230.9	230.9
6	3L-20 P1	0.0	642.6	678.5	0.0	0.0	709.0	717.6	0.0	717.6
	P2	0.0	750.9	750.9	0.0	0.0	850.9	850.9	0.0	850.9
7	3L-21 P1	0.0	0.0	261.0	0.0	0.0	470.9	688.2	750.9	787.7
	P2	0.0	0.0	845.5	0.0	0.0	845.9	846.8	894.7	978.1
8	3L-22A	0.0	0.0	314.1	0.0	0.0	428.3	474.7	497.0	497.7
9	3L-22B	0.0	0.0	223.2	0.0	0.0	231.4	0.0	231.4	231.4
10	3L-23	0.0	255.1	446.9	0.0	0.0	583.0	675.8	732.1	732.1
11	3L-24	0.0	0.0	491.0	612.9	0.0	612.9	0.0	674.5	930.7
12	3L-25A	0.0	0.0	646.5	0.0	0.0	713.6	807.0	869.9	869.9
13	3L-26	0.0	0.0	574.6	0.0	0.0	574.6	0.0	0.0	574.6

Source: Field Data by IIMI, Mirpurkhas

2 CURRENT FINANCIAL. SITUATION

2.1 SOURCE OF INCOME

2.1.1 Abiana

Abiana is the seasonal service charge for water delivery paid by the *zamindar* for different cultivated crops, at different rates, to the Revenue Department, Government of Sindh (GoS). The rates for *abiana* vary from canal to canal, and / or barrage to barrage. The *abiana* is recovered from the water users for each season (*rabi* and *kharif*), according to rates fixed for different crops by the GoS every year.

The increase in rates for different crops is announced by the GoS, or the rate list is released from the *Mukhtiarkar* of the concerned area. Abiuna rates for different crops for last four years are given in Table 11.

Table 11. Abiuna Rates for Different Crops for the Last Four Years.

S.#	Crop	1993-94	1994-95	1995-96	1996-97
1	Sugarcane	88.00	101.20	126.5	158.13
2	Rice, Tobacco, Waternut, Jute	42.96	49.40	61.65	77.18
3	Cotton	45.03	51.78	64.73	80.88
4	<i>Kharif</i> Pulses, Bajra, Maize, Fodder	19.25	22.14	27.68	34.60
5	Chilies, <i>Kharif</i> Oil seed, Melon	36.44	41.91	52.39	65.49
6	Wheat	25.78	29.65	37.06	46.33
7	Garden Onion, Banana, Vegetable	68.75	79.06	98.83	123.54
8	<i>Rabi</i> Oil seed, Pulses	25.78	29.65	37.06	46.33
9	Forest Plantation	13.06	15.02	18.78	23.48

2.1.2 Land Tax

All land, for whatever purpose applied, and to whatever statute, is liable to the payment of land revenue to the Government, except;

- a) Such land as has been wholly exempted from that liability by special contract with the Government, or by the provisions of any law for the time being in force;
- b) Such land as is included in village sites;
- c) Such land as is included in cantonment limits;
- d) Land on which property tax under the [West Pakistan] Urban immovable Property Tax Act, 1958 (W.P Act V of 1958) is payable;
- e) Waste land and barren land not under cultivation for a continuous period of not less than six years immediately before the date of notification of general assessment under section 59; provided that where any waste and barren land is brought under cultivation at any time after the date of such

notification, such land not be liable to the payment of land revenue **for** a period of six years from the date it is so brought under cultivation.

The details of crop-wise land revenue rates are given in Table 12.

Table 12. Crop-wise Land Revenue Rates.

S #	Crop	Land Revenue Rate
1	Sugarcane	3.75
2	Rice, Tobacco, Waternut, Jute	3.40
3	Cotton	8.55
4	Kharif Pulses, Bajra, Maize, Fodder	1.50
5	Chilies, Kharif Oil seed, Melon	1.50
6	Wheat	6.35
7	Garden Onion, Banana, Vegetable (1/2 years)	Kharif =2.25 & Rabi =1.50
8	Rabi Oil seed, Pulses	1.50
9	Forest Plantation	1.50

The land revenue rates have been unchanged for the above-mentioned crops **for** the last **20** years, and are applicable with respect to land holding sizes. The categories for land holding sizes, with rates, are given in Table 13.

Table 13. Categories, and Rates, for Land Holding Sizes.

S#	Land Holding Size	Rate
1	Up to 12 acres of land	1.50 Times
2	12 to 25 acres of land	2.00 Times
3	25 to 50 acres of Land	3.00 Times
4	> 50 acres of Land	4.00 Times

2.1.3 Usher

Usher is a type of tax levied by **Islam** on Muslims generating income from the cultivation of agriculture lands. **Usher** is equivalent to one-tenth (10 %) of the income, but in the Sindh province, due to other taxes, the **zamindar** is liable to pay one-fifth (5%) **of** the income from agriculture on account of **Usher**.

The rates **for Usher** vary **from deh to deh, Taluka to Taluka** and Division to Division due to the average per acre production. Details of **Usher** rates for the **Kharif** and **Rubi** seasons, respectively, are given in Tables 14 and 15.

Table 14. Usher Rates for the *Kharif* Season.

Sr.No.	Crop	1997-98	1996-97	1995-96
1.	cotton	262.50	168.75	225.00
2.	Paddy	72.00	60.00	48.00
3.	Sugarcane	405.00	270.00	278.50
4.	Chilies	462.00	600.00	600.00
7.	Maize	37.50	37.50	37.50
10.	Banana	562.50	562.00	562.50
12.	Juntar	18.75	15.00	15.00
13.	Vegetables	93.75	75.00	75.00
14.	Nursery	131.25	112.00	112.50
15.	Hurri	112.50	112.00	112.50

Table 15. Usher Rates for the Rabi season.

Sr. No	Crop	1995-96	1996-97
1.	Wheat	Rs. 131.10	180.00
2.	Oil seed	Rs. 90.00	90.00
3.	Onion	Rs. 56.25	56.25
4.	Tomatoes	Rs. 112.50	112.50
6.	Vegetables	Rs. 131.25	131.25
7.	Orchard	Rs. 262.50	262.50
8.	Soofi Bair	Rs. 112.50	112.50
9.	Fodder	Rs. 112.50	112.50
10.	Saunf	Rs. 281.25	28.50

2.1.4 Other Taxes (Local Cess)

Local Cess is the tax paid to the concerned District Council, through the Revenue Department, by the *zamindar*. The rate for local cess is Rs. 10 per acre.

2.1.5 Agriculture Tax

Agriculture tax was levied through the Sindh Agricultural Income Tax (Amendment) Ordinance, 1997. According to this act, owners with a total land holding size of twelve acres, or less, in the barrage area, and twenty-four acres, or less, in the non-barrage area, will not pay tax. The agriculture tax for different crops is given in Table 16.

Table 16. Agriculture Tax for different Crops.

S.#	Crops	Rate
1	Sugarcane	75.00
2	Rice, Tobacco, Waternuts, Jute	30.00
3	Cotton	75.00
4	<i>Kharif</i> Pulses, Bajra, Maize, Fodder	40.00
5	Chilies, <i>Kharif</i> Oil seed, Melons	40.00
6	Wheat	40.00
7	Garden Onion, Banana, Vegetable (1/2 years)	300.00
8	<i>Rabi</i> Oil seed, pulses	40.00

Note: The tax in the non-barrage areas is half that of the above rates.

2.2 TAX ASSESSMENT AND TAX COLLECTION PROCEDURE

According to the Land Revenue Act, 1969, and Land Revenue Rules (Sardar Muhammad Iqbal Khan Mokal) before the commencement of *Jumabandi* inspection, all forms should be completed by the *Tapedar*, and tested by the supervising *Tapedars*. Village accounts must be closed by the *Tapedar* within the revenue year as a matter of course, and the *Mukhtiarkar* should then examine and correct these where necessary.

All taxes, i.e., *Abiana*, Land Revenue, Agriculture Tax and Local Cess, are assessed by the Revenue Department in the concerned district. As far as crop assessment, or cultivation assessment, is concerned, this is undertaken by both, the Irrigation and Revenue Departments. From the Irrigation Department, the *Abdur* appraises the cultivation, and the from the Revenue Department, the *Tapedar* assesses. Both these departments then equate their figures. The *Abdur* and *Tapedur* inspect every acre of land of each *deh* during both cropping seasons. However, lower estimated cultivation is shown for recovery without a detailed survey having been conducted. Once figures are agreed upon by these two departments, the assessed cultivation data is submitted to the *Mukhtiarkar* and the Assistant Commissioner. This is perceived to be a primary “bribe” stage from the water users.

The *Tapedar* then issues invoices to individual *zamindars*, along with the rates, and requests payment. *Zamindars*, usually, are not fully conversant with the rates and procedures, and request discounts, although these invoices are based on fabricated data. In the end, both parties agree to a lower amount.

The *Tapedur* is also authorized to receive cash and provide receipts to *zamindars*. On the basis of field observations, the receipt amount specifies much less than the amount received by the *Tapedar*. In many cases, receipts are not even provided to the *zamindars*.

2.3 EXPENDITURES

Assistant Executive Engineers of the concerned Sub-divisions submit their demands for Maintenance and Repairs to their respective Executive Engineers. After verification, the Executive Engineers forward these for estimates. The demand, along with the estimation, is then given to the Superintendent Engineer (SE), Nara Circle, who compiles all the estimates for this circle, and presents these to the Chief Engineer, Sukkur Barrage. The Chief Engineer compiles all the estimates for each division before sending these to the Secretary of Irrigation, who, after exoneration, forwards these estimates to the Ministry of Finance for budgetary approval.

The Executive Engineer of a division has the authority to approve development schemes for amounts not exceeding Rs. 0.2 million, while the Superintendent Engineer may approve development work between Rs. 0.2 and Rs. 0.5 million.

Executive Engineers submit their summaries to the Superintendent Engineer in order to solicit approval for a Tender Declaration for each Development Scheme,

2.4 OPERATION AND MAINTENANCE

Various expenditures are incurred at the irrigation divisional level and **are** normally categorized under two heads, namely (1) Operation and (2) Maintenance.

2.4.1 Operation

Operation are those actions taken **to** ensure performance of the irrigation system in accordance with the instruction for use **as** spelled out by the designer, and in agreement with the developer, **so** that the objective of the project can be fully attained. The operation function also incorporates, with provision for technical support and other related advisory services for system users, exercise of responsibility for balanced management in order **to** ensure compliance with both, statutory regulations and system rules governing users. In other words, the administration of water stock and policing of water regulations are included (Alexander Vibre, IIMI).

2.4.2 Maintenance

Maintenance is the set of actions that make it possible to maintain an investment in a given condition, and for its restoration that would enable it to continue providing a given service. Thus, the purpose of maintenance is to guarantee the uninterrupted normal functioning of a system **so** that it can meet its assigned objective

2.4.3 Current Irrigation Operation and Maintenance

Prior to this pilot project, the water user's only involvement in the operation and maintenance (O&M) of distributaries has been the provision of labor for desilting. **zamindars**, typically, provide **two** sharecropping tenants for desilting of the canal sections supplying their watercourses. The work may be initiated by water users themselves, or by the IPD, but the laborer does not receive payment. Water users observe that this arrangement tends to be treated **as** a formality, and that the work is disorganized and frequently not completed to the required standards. The use of manual labor alone is often inadequate for the scale of work required, **as** well **as** for removing major obstructions. However, any desilting does tend to improve water **flow**, and the practice is more common in tail reach areas. Some **zamindars** in the head reach may not see the need to **desilt** the canal, with the result that the work along their stretches may be carried **out** by those from the tail. The IPD regulates the discharge in the distributary and **sanctions** and monitors the withdrawal of water via the outlets. In practice, very little maintenance work is carried out on the distributary. **An Abdur** and **Baildar** are each responsible for routine maintenance, including minor repairs to inspection paths, removal of fallen trees and other vegetation from the canal, and repair of minor rain and cattle cuts in embankments.

Most of the activities for operation and maintenance are interrelated. However, after thorough evaluation, it ~~was~~ observed that there are three main accounting entries that may represent the total Operation and Maintenance costs. These three entries are listed under the categories of Maintenance and Repairs (M&R), Extension and Improvements (E&I), and Establishment in the budget. M&R and E&I fall under maintenance costs, while Establishment is considered ~~as~~ an Operation cost.

The major activities under Maintenance and Repair are the maintenance of vehicles, electricity / telephone charges, breaches, maintenance of residential and non-residential buildings, transportation charges, advertisement charges, earth work, construction of inspection paths, repairs to modules / regulators / gates / gears / machines, silt clearance, dumping of stones, repair of banks, etc.. Major activities conducted under Extension and Improvement (E & I) are:

- a. Reconditioning of banks;
- b. Earth work maintenance of **banks**;
- c. Re-handling of spoils; and
- d. Re-sectioning of soil.

The details of staff engaged in the Mirpurkhas Division, Sub-division and the Bareji Distributary, along with their basic pay scales, are attached as Annexes 2, 3 and **4**, respectively. Salaries for each pay scale is also annexed.

3 FARM INCOME ANALYSIS

3.1 BACKGROUND

A farmer derives his / her source of income by selling agricultural produce. Being conservative by nature, a farmer would only incur any additional expense, like that of an investment in his / her favor, if, in return, these additional expenses contribute towards the farm income.

In acknowledgement of this preference, a methodology, which is explained later in this chapter, was devised in order to calculate the net farm income, and to understand, in more detail, the different factors affecting farm income.

Generally, three techniques, namely, (a) farm income analysis; (b) fund flow analysis; and (c) farm investment analysis, are used to measure the performance of an agriculture project. Whereas the latter two techniques are used to determine the liquidity and attractiveness of a proposed investment, farm income analysis is normally used to evaluate the performance of a farm in a particular year (Gittinger 1992).

Farm income analysis technique has been favored in this report, **as**, at present, our primary objective is to test the financial viability of the FO's for a possible take-over of Operation and Maintenance of the Bareji Distributary.

3.1.1 Cropping Intensity and Cropping Pattern - Importance

Cropping intensity is normally expressed in percentage, and is referred to **as** the cropped land within a given CCA, while cropping pattern means identification of different crops in a given cropped area.

The values for these two are needed to calculate the following:

- a) forming the basis to calculate crop yields;
- b) forming the basis to calculate farm inputs; and
- c) forming the basis to calculate *abiana*.

The foregoing are considered core requirements to ascertain the farm income. Furthermore, calculating *abiana* payable by a farmer also depends entirely on this information.

3.1.2 Information Collected on Cropping Intensities at Different Intervals

IIMI's field office in Mirpurkhas has been collecting information about cropping intensities since 1996. Information has also been obtained from the Revenue Department. Mr. Amin Sohani, Financial Analyst, conducted a special survey with the help of field

staff to collect this information. The information thus collated, utilizing different sources, is summarized in Table 17.

Table 17. Cropping Intensities for Bareji Distributary.

Crop Season	Cropping Intensity (in %)	Remarks
Kharif	28.00	Designed Intensity
Rabi	53.00	Designed Intensity
Rabi 95/96	60.00	Mean figures by A. Sohani
Rabi 96/97	41.68	Survey by field team
Kharif 96	60.00	Mean figures by A. Sohani
Kharif 96	130.70	Survey by field team
Kharif 97	148.91	Survey by field team

3.1.3 Farm Revenue and Farm Expenses

Amin Sohani (1997), reported the farm revenue and farm expenses for this distributary, as given in Table IS.

Season	Mean Farm Revenue (CCA Acre)	Mean Farm Expense (CCA Acre)	Mean Farm Income (CCA Acre)
Rabi 95-96	1,873	1,495	378
Kharif 96	5,631	3,811	1,820

3.2 JUSTIFICATION OF REVIEW OF THE EXISTING DATA

One of the specific objectives in organizing the farmers is to promote their maximum involvement in the operation and maintenance of distributary / minor canals (Phase II Report, 1997). This preliminary Business Plan (financial framework) is intended to facilitate the Farmers Organizations (FOs) of this distributary in managing its financial affairs amicably.

The variance in the existing data is somewhat substantial, although the data collected the by IIMI field team sounds more reasonable. However, since this data is largely based on samples, therefore, the chances of inherent limitations are possible. Considering the sensitive nature of the final product involved, i.e., a preliminary framework (financial) which is also acceptable to the farmers, the authors of this report felt the need for a more comprehensive survey of this distributary.

Furthermore, the need to obtain more confidence by having **indepth** knowledge about this distributary was also felt, to enable, on one hand, extending maximum assistance to FOs during negotiations in the Joint Management Agreement, and, on the other hand, to come up with the best possible financial solutions.

3.3 DATA ENTRY AND DATA COLLECTION METHODOLOGY

The first important step, **as** considered by the authors, was to become familiar with the IIMI-Mirpurkhas field staff, **as well as** with the Bareji Distributary. Therefore, a field visit was undertaken in August 1997. Mr. Waryam Baloach, Supervisory Social Organizer and head of the IIMI field station, assisted by other members of his team, provided a detailed presentation of this distributary. Later, he accompanied the authors to a field visit of the command area. At the end of this visit, it was decided to have the authors of this Business Plan meet for a full day at the Hyderabad office.

The purpose for this meeting was to devise a preliminary strategy for the collection of necessary data. Since information on cropping intensities and patterns was considered essential, therefore, it was resolved to conduct a 100% detailed survey of this distributary by hiring the part-time services of *abdars*, who were to be equally assisted by IIMI-Mirpurkhas field staff members.

This strategy was discussed in detail with Dr. Yameen Memon, IIMI-team leader for the Sindh Province, Mr. Don J. Bandaragoda, Project Leader, and Professor Gaylord V. Skogerboe, Director, IIMI-Pakistan, whereby it was decided to organize a one-day workshop in Hyderabad that would be attended by all the Sindh-based project staff.

The workshop started with the authors providing a simple introduction to the Business **Plan**, while Dr. Yameen Memon described the purpose of the proposed survey, **as well as** the expectations from field staff during this period. Later, an open session was held with participants, in order to gather different ideas to improve the quality of this survey, and corrective measures to be adopted when bottlenecks arose. Participants agreed to the suggestion of conducting this survey at the level of each watercourse, and also to prepare maps at the same time. Accordingly, an initial questionnaire (**proforma**) **was** developed. The recommendations of this workshop are as follows:

- Technical persons, adequately familiar with the command area, and with about **5 years'** field experience, to be hired;
- One field staff person to accompany this technical person, for both to go to the fields for data collection and filling proformas together;
- Two proformas were suggested; one for mapping and the other for crop identification;
- Each member to be responsible for the accuracy and correctness of data, by comparing the **two** proformas with each other; and
- Supervisory Social Organiser (SSO) of the Mirpurkhas field station to be responsible for the final verification of data, before sending it to the IIMI-Hyderabad office.

The proformas developed at the end of the workshop were pre-tested on the following day. In Mirpurkhas, this questionnaire was jointly tested by the IIMI field

member and the *abdar*, and based on the performance of pre-testing, the proforma was modified and reviewed by the IIMI field team, financial analyst and team leader.

The salient features of this proforma are as follows:

- 9 A one-page questionnaire in landscape format.
- Data is easy to record.
- 9 One page can easily record information for 9 blocks.
- 9 The basic information relating to cultivators includes: (1) watercourse number; (2) survey, or block number; (3) deh name; (4) holding, in acres; (5) owner's name; (6) managed by; (7) status; (8) number of tenants; (9) water allocation (hr.); and (10) day and time of water allocation.
- Information for each crop cultivated, including orchards and vegetables.
- Information about uncropped land, i.e., fallow.
- 9 Information about waterlogged and salinized lands.
- 5, Information about abandoned land.
- Information relating to drainage infrastructure.
- 9 Information about lift pumps and piezometers situated in the area.
- 9 The last column for use to record any special information.

3.3.1 Data Collection in the Field

The person hired to compile the inventory assessment of the Bareji Distributary command area is the *abdar* of the Irrigation Department. Mr. Jamil (*abdar*) has been serving with the Irrigation Department for the last 15 years. However, from IIMI-Mirpurkhas, each field team member assisted Mr. Jamil with the assessment of the inventory. This strategy proved to be helpful, as watercourses of this distributary have been classified among the field team members so that they may focus full attention on a particular command area, and develop a close liaison with the water users.

All *dehs* concerned with the Bareji Distributary command area fall under the area identified by the PID for crop assessment.

The existing location of each and every item of the inventory, i.e., each type of crop, drainage facilities, villages, roads, pump houses and piezometers installed, along with the area covered by each item, were identified in the map proforma.

In the evening, the field team members again reviewed the proforma and maps so that any modifications could be made. In this way, many entries of an ambiguous nature were corrected. For final verification and validation of data, the field team leader checked each entry on the proforma.

3.3.2 Major Observations During Data Collection

This job was very tiring; however, the IIMI team accomplished this survey smoothly and successfully. Some interesting observations made by the field staff are given below:

- The major part of the land is un-surveyed, **so** the holdings are irregular.
- The land transferred to the Mithrao Canal has not been updated.
- The area falling under the drainage system, i.e., Spinal, Sub-drain, Surface drain, was not updated in the government records.
- Schools and villages were not reflected in the deh maps issued by the Revenue Department.
- Land transferred, or new **zamindars**, are not amended in the Irrigation Department records.
- Only one person could be arranged for the inventory survey, therefore, whenever he absent, the survey had to be deferred.

One of the field team members faced a serious barrier when one **zumindur** of Watercourse 10R, Mr. Agedino Dal, misbehaved and became hostile. This **zamindar** owns about 500 acres and is considered to be one of the biggest **zumindur** along this distributary therefore, assessment of crops created some doubts for him; actually recording cultivation that may result in the actual payment of taxes.

Later, the field team leader and a few members of the WUF met with him and explained the purpose and aims of this survey, **as** well **as** the benefits of the FOs. He apologized to the members for his behavior with the IIMI team member.

Due to irregular design of survey numbers, the field team faced a problem when recording the actual area of each item. The PACING **METHOD** was adopted to confirm the area of crop and other items.

3.4 FARM REVENUE ANALYSIS

Farm revenue is calculated by multiplying the physical productivity with the per unit price of the commodity. The formula used to calculate the farm revenue is:

$$FR = (TYP * Pr) + (TYB * Pr).$$

Where,

FR = Farm Revenue

TYP= Total Yield of Principle Crop

TYB= Total Yield of By-product

Pr = Per Unit Price

Farm revenue analysis was considered very important to make a Business Plan for the FOs; on the basis of these analyses, judgments could be formed about the financial efficiency, incentives, creditworthiness and liquidity. The following information is important to calculate farm revenue:

- Total land holding of a farmer.
- Cropping pattern.
- Cropping Intensity.
- Total Production.
- Farm-gate Prices.

3.4.1 Farm-gate Price

The best point of first sale to use is, generally, the Boundary of the farm; what the farmer receives when he sells his product, is termed *farmgate* price. A good rule to use when determining a market price for agriculture commodities produced, is to seek the price at the point of first sale. Usually, the point of first sale is the point that the farmer has easy access to, without any transportation costs, or octroi charges. The farm-gate price is generally the best price at which to evaluate home-consumed production.

3.4.2 Collection of Farm-gate Price Process Evolved

The estimation of actual farm-gate price is a process of investigation that covers different inquiries related to farm production marketing. The major indicators of the farm-gate prices are the market price of the production per unit, transportation charges on per unit production, other expenditures, i.e., taxes, octroi, etc..

The farm-gate price for the farm income analysis was calculated by a detailed survey depicting the project command area. Besides other different expenditures and revenue, transportation charges and different taxes pertaining to marketing **the** product, has also been computed.

The exact method, or formula, is given below:

$$\text{Farm-gate price} = \text{Per unit rate} - (\text{Transportation charges} + \text{Octroi/ Tax})$$

Farm-gate prices calculated for different crops cultivated under the Bareji Distributary command area are given in Table 19.

S #	Crops	Farm-gate price (Maund per acre)
1	Cotton	813.15
2	Sugarcane	37.20
3	Chilies	1,220.38
4	Wheat	255.90
5	Onion	156.18

3.4.3 Collection of Crop Yield Process Evolved

This is the most recent information pertaining to average yield collected through the survey. A questionnaire was designed to record the information gathered from the water users regarding inputs and outputs. The criteria for the selection of water users was based on average land quality reliability. Data based was on information collected about farm inputs and production, or yield, for each crop. Information regarding yield foster the calculation of the farm revenue.

The yield of each crop depicts the command area of the Barejī Distributary. The 24 samples from each watercourse show the average yield for each crop. The average yield of the production is very low due to a severe salinity and waterlogging problem in command area.

For the purposes of the farm revenue analysis in this report, farm-gate prices have been calculated by deducting the cost of transportation and local taxes on the agricultural produce from the market price at the time of first produce arriving in the market. These prices were obtained from the contact farmers of each watercourse (who have retained copies of sale receipts).

3.4.4 Land Considered as Affected Due to Waterlogging, Salinity and Other Reasons

During this survey, parts of the uncultivated agricultural land were categorized as waterlogged, salinized and abandoned. The reasons for these categorizations are based on farmers' perceptions, as described below:

- a. According to the farmers, a substantial amount of irrigation water seeps underground from the canals, watercourses and fields. This seepage, with no natural means of escape, continues to accumulate underground, and the level of underground water continues to rise until it reaches the ground surface. This creates waterlogged conditions. Therefore, in this report, such areas have been considered as waterlogged.
- b. According to the farmers, sometimes, when water pushes upwards, water salts also rise to the surface and is deposited at the root zone, rendering the soil unproductive, or forms a white layer on the surface. Irrigation with water (canal or groundwater) containing large amounts of salts causes salinization. Therefore, non-cropped areas of land, where layers of white salts were visible, have been considered as salinized fields in this report.
- c. According to the farmers, other reasons for uncultivated land are either sand dunes, and / or non-availability of canal irrigation water, and in such areas, a very low quality ground water. Therefore, in this report, such areas have been categorized as abandoned lands.

3.5 FARM LAND REVENUE OF BAREJI DISTRIBUTARY

The information deemed necessary, as explained in Section 3.4, was available at the end of this survey for the *kharif* 1997 cropping season. However, the same information for the *rubi* 96-97 was not possible through this survey. In order to form an opinion regarding the economic strength of the farmers, farm land revenue should be calculated for a period of one year. Therefore, field data collected by the IIMI-Mirpurkhas team, using the sampling method, has been relied upon to compute the figures for the *rubi* 96-97 cropping season.

The other important factor in arriving at the farm revenue, is crop yield per acre. Again, contact farmers were contacted from each watercourse with land that can be considered as fairly representative of the whole watercourse. The information provided by these farmers was further cross-checked with the information available for the other two pilot distributaries, and may be considered as being fairly reliable. The yield per acre of major crops in this command area, when compared to that of national and international information, is given in Table 20.

Table 20. Comparison of Crops in different Countries.

Country	Cotton (kg/ha)	Wheat (kg/ha)	Maize (kg/ha)	Sugarcane (kg/ha)	Rice (Paddy) (kg/ha)
USA	1,902.25	2,566.25	7,450.00	76,846.25	6,377.50
China	2,302.25	3,229.75	4,375.25	-	5,664.75
Turkey	2,445.75	2,027.50	4,082.00	-	-
Mexico	2,351.25	4,102.50	1,944.75	-	-
Iran	1,883.00	1,473.25	-	-	-
India	742.50	2,298.00	1,558.25	63,680.75	2,617.50
Pakistan	1,865.25	1,900.50	1,386.00	42,176.75	2,323.75
Bareji Distributary	1,665.20	2,445.30	-	81,016.00	2,717.00

Source: Agricultural Statistics of Pakistan 1992-1993.

For the purposes of calculating farm land revenue, expenditure and income, it was assumed that a farmer hides actual cropped area, whereas, (s)he normally imparts the correct information about the crop yield, crop prices and crop expenditures as other sources, to confirm, or negate, this information, which is readily available. Therefore, the main emphasis was to collect accurate information (maximum possible) regarding cropped area and pattern.

Important information collected during data collection regarding crops, cropped area for these crops divided into maximum and minimum area, average water table depths, average water quality in ppm, and average water duty, is given in Table 21. This information can be used to explain the farmer's preference to certain crops in their respective watercourses.

Table 21. Farmers Preferences for selected crops in different watercourses.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Chilies	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	5L	4R	3L	10R	5L	1R	5R	9R	10L	1L
Land;										
Cultivated in acres	356	27	173	2	291	17	62	1	82	1
Total Cropped in acres	532	169	352	173	497	46	313	213	279	220
CCA in acres	1,530	292	622	788	1,530	219	589	436	330	592
W/Quality in ppm (avg.)	754	3,988	2,363	8,267	754	4,771	1,336	8,800	5,847	6,784
W/Table depth (avg.)	4.73	3.69	3.33	5.77	4.73	3.72	3.31	6.69	7.96	2.74
W/Duty (avg.)	2.86	4.06	6.04	1.76	2.86	7.00	4.72	2.96	7.14	5.60

Source: For cultivated area and crops identification survey by IIMI-Mirpurkhas. For water quality, water table depth and water duty average of time-series data for the last 5 months collected by IIMI- Mirpurkhas field staff.

The only reason for a high cotton crop in Watercourse 5L, is that it is the biggest watercourse along the Bareji Distributary. One-third is cropped, out of which two-thirds is cropped for cotton. While low cotton-cropped area in Watercourse 4R is due to a low water table depth from the surface and high water quality, i.e., 3.68 and 3,988, respectively.

From the above table, it is interesting to note that in Watercourse 3L has highest cropped area of sugarcane, which can be attributed towards a very high water duty, i.e., 6.04 per 1000 and a lower water table depth from the surface, i.e., only 3.33 A, but is high quality groundwater, i.e., 2,363 ppm. However, high groundwater quality leaches down with high water duty. Sugarcane is a very high water-consuming crop, and 16% of the total sugarcane cultivated in this command area is cultivated in this watercourse, which has a CCA of only 622 acres out of a total CCA of 11,924 acres. Sugarcane is at an extreme low in Watercourse 1R where water duty is 1.76, and has a higher water table depth from the surface, i.e., 5.77 A.

The high cropped area for wheat in Watercourse 5L is due to good ground water quality, i.e., 754 ppm, a normal water table depth from the surface, i.e., 4.73 ft, which is considered quite good for this crop, although its water duty is quite normal, i.e., 2.86. Low-cropped wheat in Watercourse 1R is due to high ground water quality, i.e., 4,771 ppm, and low water table depth from the surface, i.e., 3.72 ft.

In the case of chilies, Watercourse 10L has a high cropped area, the reason being a high water table depth from the surface and high water duty, i.e., 7.96 feet and 7.14 per 1000, respectively. The lowest chilies-cropped watercourse is 1L, the reason for this is high ground water quality and low water table depth from surface, i.e., 6,784 ppm and 2.74 A respectively.

A study to: (1) identify groundwater contribution to the water requirements of major crops; (2) develop irrigation management strategies for major crops under different water table conditions; and (3) evaluate the effect of groundwater quality on soil

salinization and crop yields under different water table depths have been conducted by Mona Reclamation and Experimental Project (MREP) and Lower Indus (LIM) over a period of three years. The conclusions of this paper are as follows:

- a. Low Water table depth **from** surface is, generally, not conducive for good crop yields. Water supplied to a crop by capillary rise from shallow groundwater can be an important resource. However, it reduces the depth of root zone and increases the threat of soil salinization, especially when ground water quality is inferior, and ultimately affects the crop yields.
- b. The general practice of applying **5-6** irrigations to wheat and cotton crops is wasteful and unproductive on soils with water table less than 9 A from the ground surface. For good yields, **1-2** irrigations at a water table depth of **3 to 6 ft.**, and **2-3** irrigations at a water table depth of **6 to 9 A**, are required.
- c. At shallow water tables, bed planting of crops not only provides better soil conditions during the rainy season, but also saves more water when compared to conventional flat / basin methods.

The results of LIM, based in the Sindh province, identifying groundwater contribution to the water requirement of major crops, is given in Table 22.

Table 22. Groundwater contribution to Crop Water Requirement of Selected Crops.

Particulars	W/table depth	W/table depth	W/table depth	W/table depth	Surface Water Application.
	Less than 3 ft.	3 to 6 ft.	6 to 9 ft.	9 to 12 ft.	
Total ET losses (cm)	77.9	53.8	50.7	55.5	
G/water cont. (% of total ET)	82.8	24.2	7.6	3.8	
Sub-irrigation (cm)	64.5	13.1	3.9	2.1	
Cotton yield (kg/acre)	196.4	279.4	620.2	736.0	30 cm or 4 irrig.
Sugarcane yield (kg/acre)	31,500.0	31,780.0	26,520.0	26,480.0	91 cm
Wheat yield (kg/acre)	446.2	579.8	1,323.9	1,545.7	30 cm or 4 irrig.

Source: Benefits of Shallow Drainage, paper by MREP & LIM

The data of watercourses of the Bareji Distributary, indicating maximum and minimum crop yields, water table depth from the surface, ground water quality and water duty, is given in Table 23.

Table 23. Crop Yields, Water Quality, Water Table Depth from Surface and Water Duty of Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Chilies	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	11L	9L	8L	1R	7R	9L	1R	10R	10L	2R
Yield in kg. Per acre	1,000	280	40,000	24,000	1,600	600	2,857	1,714	1,200	400
W/Quality in ppm (avg.)	11,869	3,055	1,722	4,771	6,798	3,055	4,771	8,267	5,847	1,866
W/Table depth (avg.)	4.64	4.81	3.67	3.72	6.25	4.81	3.72	5.77	7.96	2.81
W/Duty (avg.)	6.81	7.63	4.52	7.00	6.83	7.63	7.00	1.76	7.14	6.03

The high yields for sugarcane and wheat in this command area are nearly equal to those obtained by LIM under the relevant water table depths. However, results for cotton are different. Low yields for cotton and wheat are due to high ground water quality in this watercourse, i.e., 3,055 ppm, thus rendering it inappropriate for irrigation use. However, low yields for sugarcane remain to unexplained.

The farmers of this distributary normally sell their agriculture produce in the nearby grain market. However, sugarcane and cotton are usually sold to the sugar mills and cotton ginning factories, which are also nearby, while wheat is sold to the food department which purchases it at the rates established by the GoP. The important information regarding maximum and minimum farm-gate prices for major crops is given in Table 24.

Table 24. Farm Gate Prices, Water Quality, Water Table Depth and Water Duty of Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Chillies	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	7R	9L	5R	5L	12L	11R	1R	10R	4L	10L
Price per kgs. In Rupees	22.00	19.00	1.03	0.83	6.40	6.40	0.87	0.87	32.40	28.78
W/Quality in ppm (avg.)	6,798	3,055	1,336	754	3,824	9,238	4,771	8,267	1,740	5,847
W/Table depth (avg.)	6.25	4.81	3.31	4.73	4.95	4.93	3.72	5.77	5.74	7.96
W/Duty (Avg.)	6.83	7.63	4.72	2.86	4.78	2.33	7.00	1.76	9.50	7.14

The mean farm-gate prices for these major crops are calculated at **Rs. 20.33** per kg. for cotton, **Rs. 0.93** per kg. for sugarcane, **Rs. 6.40** per kg. for wheat, **Rs. 0.87** per kg. for fodder and **Rs. 30.51** per kg. for chillies. The purchase price of wheat is fixed by the GoP.

The prices which a crop can fetch depends on its quality, which, in turn, depends on various factors, e.g., availability of water, soil conditions, quality of seed, quantity and quality of fertilizer, pesticides and farming practices. Therefore, the above analysis becomes more meaningful when seen with the farm-input costs, which is explained later in this chapter. Here the purpose is to see the range of prices the farmers of this distributary fetch for major crops.

Although bi-products of crops like wheat and cotton are either sold by the farmers, or are consumed domestically, the value of these bi-products has not been considered in this report. Thus, farm revenue, calculated by multiplying the physical productivity with the per unit farm-gate price of the commodity, for the *rabi 96/97* and *kharif 97* cropping seasons for the Bareji Distributary command area, comes to **Rs. 5,822** and **Rs.17,575**, respectively, per cropped acre. This comes to a total of **Rs. 23,397** per cropped acre. The important information derived from farm revenue analysis for this distributary is given in Table 25.

Table 25. Gross Agriculture Revenue Analysis.

Particulars	Rabi – 96-97	Kharif – 97	Total (one year)
Cropped Area in acres	4,970	5,684	10,654
Fallow Area in acres	2,085	1,371	--
Waterlogged Area in acres	133	133	--
Salinized Area in acres	798	798	--
Abandoned Area in acres	3,938	3,938	--
CCA in acres	11,924	11,924	--
Cropping Intensity (in %age)	41.68	48.91	90.59
Gross Revenue (Rupees)	28,932,902	99,900,048	128,832,950
Gross Revenue per cropped acre (Rupees)	5,822	17,575	23,397
Gross Revenue per CCA acre (Rupees)	2,426	8,378	10,804
Gross Revenue (US\$)	657,566	2,270,456	2,928,022
Gross Revenue per cropped acre (US\$)	132	400	532
Gross Revenue per CCA acre (US\$)	55	191	246
Avg. price of land per acre (Rupees)	70,000	70,000	70,000
G/revenue to land (Crop) price in %age.	8.32	25.11	33.42
G/revenue to land (CCA) price in %age.	3.47	11.97	15.44

Rate applied 1 US\$ = Pakistan Rupees 44.00.

The total uncultivated land in this command area categorized as waterlogged, salinized or abandoned is **4,869** acres. The mean **gross** revenue per cultivated acre is Rs. **23,397**, hence, the farmers of this command area, in one cropping season, have lost a gross revenue of about **Rs. 113.920 million (US\$ 2.589 million)**. This comes to Rs. **9,553.84** per CCA acre and a decrease in the cropping intensity by **40.83%**.

The revenue of this command area as compared with other available information for Pakistan, as given in Table 25.

Particulars	All-Pakistan	LBOD Baseline	IIMI-Various	Bareji Distributary
Gross Revenue (Rs/Acre)	3,644	5,263	3,240- 10,120	10,804
Gross Revenue (US\$/Acre)	83	120	74 - 230	246

Source: Consultancy report by **Dr. Christopher Perry**

The **gross** revenue of each watercourse of this distributary has been analyzed, important findings of this analysis summarizing the two watercourses with the highest **gross** revenue, when compared to that of the watercourse earning minimum **gross** revenue, and the mean gross revenue, is given in Table 27.

Table 27. Maximum, Minimum and Mean Gross Agriculture Revenue within Bareji Distributary.

Particulars	Revenue Max.		Revenue Max.		Revenue Min.		Revenue Mean	
	K-97	R-96	K-97	R-96	K-97	R-96	K-97	R-96
Watercourse no.	4R	13L	10L	7R	11R	10L	Avg.	Avg.
Per cult. Acres	27,982	9,966	23,173	9,459	11,470	2,514	17,575	5,822
Per CCA Acres	16,263	4,586	19,611	3,700	4,692	1,904	8,378	2,426
Cropping Intensity	73.65	46.02	87.20	39.12	40.90	75.73	48.91	41.68
W/Quality in ppm (avg.)	3,988	1,196	5,847	6,798	9,238	5,847	5,141	5,141
W/Table depth (avg.)	3.69	3.95	7.96	6.25	4.93	7.96	4.42	4.42
W/Duty (avg.)	4.06	4.80	7.14	6.83	2.33	7.14	5.29	5.29

In the case of Watercourse 11R, the shortage of water and high quality have been observed as the reasons for the lowest gross revenue. In the case of Watercourse 10L, where there are orchards that do not generate revenue in the *rabi* season, the main reason for the lowest gross revenue.

The other point observed is the effect of non-availability of adequate water on the gross revenue. The gross revenue of Watercourse 11R, when compared to the mean gross revenue for the *kharif* season of this command area, is less by an amount of Rs. 3,686 per CCA acre. This figure of Rs.3,686 per CCA acre can be considered for the calculation of opportunity cost of water.

3.6 FARM EXPENDITURE ANALYSIS

Generally, Farm expenditure is calculated by multiplying the quantity of inputs with the rates of these inputs. Farm expenditure is the sum total of all costs, from sowing to harvesting and marketing. These farm expenses can be classified into fixed costs and variable costs. In fixed costs, fixed taxes, and sometimes the rent of land on opportunity cost-basis, is included. The variable inputs include: land preparation, seed, fertilizer, pesticides, taxes, fuel, and labor.

The different methods used to calculate farm expenditures, are:

A. Operating expenditures

Operating expenditures imply an element of land preparation, inputs, labor, equipment maintenance, fuel, electricity, salaries for *kamdars*, etc., the method used to calculate farm expenditures applied for the financial feasibility analysis of the command area.

B. Fixed Expenditures

Fixed expenditures are those which imply an element, like the depreciation of land, machinery, family labor, and also, debt payments, installments of machinery, etc..

3.7 CLASSIFICATION OF FARM INPUTS

The most common inputs used by the farmers are seed, fertilizer, pesticides, labor and machinery.

3.7.1 Seed

Seed is a symbol and foundation of good plant life. High yielding varieties are suited to the environmental conditions of the area. A seed of good quality is free from off-seeds, weed seeds, broken seeds, admixtures and seed-borne disease. The high germination capacity ensures a good stand of crop, and reduces production costs by providing the seed rate application and achieving high yields.

Government agencies and private firms introduce new seed varieties according to climatical conditions. The seed reaches the growers after four stages of seed multiplication:

- a) Breeder seed, or Nuclear seed
- b) Foundation seed
- c) Registered seed
- d) Certified seed

Longevity and germination depends on moisture, oxygen and proper temperature. Three main regulatory agencies are involved in the registration and testing of new varieties, stability and seed certification system.

Seed processing is the activity done by the seed agencies or water users. Various operations are required to prepare the harvested seed, which includes drying of raw seed, shelling, cleaning, sizing, grading, treating, packaging and final storage.

The above-said operations require equipment when the seed is processed on a large scale, but small scale water users mostly adopt traditional methods.

The water users of this command area adopted two ways of procuring seed (1) they purchased seed from the nearby market; and (2) they processed their own seed for future years. The method of utilization varies from crop to crop.

3.7.1.1 cotton

Cotton is one of the major crop grown in this command area. Among all cultivated area, the total for the cotton crop is about **47.8%**. Cotton seed is mostly purchased from the nearby market. The most common seed variety grown in the Bareji Distributary command area, is **NIAB-78**.

3.7.1.2 *Wheat*

Wheat is a major cereal crop in this command area. Wheat, of the cultivated area, constitutes about 46.3%. The most common seed variety grown by the water users is *SARSABZ*, which covers almost the entire area under wheat cultivation. The majority of the water users preserve their own seed, while others purchase certified seed every year.

3.7.1.3 *Rice*

Rice cultivation is not so common in this command area, but a few water users cultivate in order to reclaim their land by over-irrigation application, even though rice cultivation is prohibited in project area. IR6 is the common variety grown by the water users.

3.7.1.4 *Sugarcane*

Sugarcane is the second major crop cultivated in the Bareji Distributary command area. Sugarcane constitutes about 19.0% of total cultivated land. The most common variety cultivated in this command area is EL-4, which covers almost whole the area for sugarcane cultivation, The majority of the water users keep their own seed.

3.7.1.5 *Chilies*

Favorable climatic conditions allow water users to grow chilies, the cultivation of which constitutes 10.0% of the cultivated area. The most common variety grown in this project area is LONGY. Most of the growers preserve their own seed, while a few others purchase new seed every year.

3.7.1.6 *Onion*

Onion cultivation is equal to about 8.0% of the total cultivated area. The ability for this crop to mature in a short span of time encourages water users to grow more onions. Onion is mostly inter-cultivated with sugarcane, which reduces production costs, and provides financial benefit to the water users. The most common variety sown in the project area is PHALKARO. Most water users purchase the seed for each season, while others purchase *paneeri* (small plant).

3.7.2 **Fertilizer**

Fertilizers are one of the most important factors, which, when properly added according to soil conditions in order to supply one, or more, plant nutrients to increase crop yields. There are two major kinds of fertilizers:

3.7.2.1 *Manure*

Manure is still the backbone in soil fertility. However, due to the rapid increase in the use of commercial fertilizers, as greater interest for the most fruitful production exists, the use of manure has been neglected. In order to sustain fertility, the use of

manure is imperative for each crop. The manure from poultry and sheep carry the highest percentage of nitrogen, which is about **15.6%** to 14%, respectively. This method is adopted in the project area, but the intensity of applying farm manure is low.

3.7.2.2 *Green Manuring*

Green manuring is an age-old practice adopted to increase productivity. The crop preferred are usually legumes. The highest amount of nitrogen, in kilogram per hectare, is present in Sum-hemp and Dhanicha, which is about 84.1 and **77.3**. This technique is not applied in the command area.

3.7.2.3 *Chemical Fertilizer*

Among the most various nutrients required for plants which are generally available in culturable lands, the most important are nitrogen, phosphorus and potassium. These elements **are** available in the market in of four categories of fertilizer:

- A. Nitrogen fertilizer
- B. Phosphatic fertilizer
- C. Potassic fertilizer
- D. Complex fertilizer

A. Nitrogen Fertilizer

In Nitrogen fertilizers, the following are available in the market: Urea, Ammonium Sulfate and Calcium Ammonium Nitrate.

B. Phosphatic Fertilizer

Under this category, the following are available in the market: Single Super Phosphate (SSP) and Triple Super Phosphate (TSP).

C. Potassic Fertilizer

In the this category only one is available in the market, i.e., Potassium Sulfate

D. Complex Fertilizer

For Complex Fertilizer, the following are available in the market: Nitrophos (NP), or **23*23**, Dia-Ammonium Phosphate (DAP), Mono-Ammonium Phosphate, NPK, etc..

The water users along the Bareji Distributary mostly apply fertilizer without any analysis of soil and proper dosage. DAP and UREA are among the most commonly-used fertilizers in this command area, while Nitrophos (**23*23**) and *Ammonium Nitrate* are also applied by a few water users.

3.7.3 Pesticides

Most of the water users apply pesticides after consultation with the dealer. The main focus of the dealers is to get the maximum benefit from the product, so they sell their products with maximum margins. The lack of awareness and little extension services is puzzling to the water users when they attempt to select proper pesticides for affected crops. They apply pesticides without diagnosis. They are also unfamiliar with proper methods and times to spray.

The most common pesticides used for cotton and chilies are *THAIODAN*, *TALSTAR*, *KARATE*, *NOVACRAN*, *MATHAMADOPHOS*. Water users apply *PADAN* to sugarcane and rice crops. Pesticides are not used for the wheat crop, and only few farmers use weedicide for wheat crops.

3.7.4 Machinery Rentals

The farmers of Bareji command area mostly rent out machinery for land preparation.

3.7.4.1 Land Preparation

From the time of preparation of land to harvesting the crop, water users pass through different mechanical equipment used in agri-business, especially in the first stage of land preparation, which requires more concentration ~~for~~ the grower. The purpose of tillage is to cut loose, granulate and invert the soil, and to prepare a seed bed that would provide adequate soil and water environment for the plant. The useful purposes of tillage are seed bed preparation, weed control, mixing crop residue, shatter clay pans, breakup compaction, and soil and water conservation to improve water. The water users of the Bareji Distributary adopt mechanical machinery instead of the traditional way of plowing. But, some of them still use bullocks for deep plowing. The mostly machinery used on rental, are described below.

3.7.4.2 Disc Plow (GOBAL)

Used initially to invert the soil, the disc plow penetrates the soil with its sheer weight. The disc plow is traditionally preferred to partially bury the crop residue, and on soils with rocks, tree roots and extremely hard soil. The rates for the per acre running in this project command area is Rs. 150 per hour. The application of the *GOBAL* varies from one stretch of land to another.

3.7.4.3 Cultivators

These use tinned implements like shovels and chisel points. The soil is stirred and the soil aggregate is arranged for use to kill weeds in row crops. The rates for the cultivator is same as for the disc plow, i.e. Rs. 150 per acre.

3.7.4.4 Levelers (*Keen*)

Keens are used to level the land. The final application of the land preparation requires more importance in terms of better irrigation and inputs application, made possible by leveled land. The rate for *keen* in the Bareji Distributary command area is about Rs. 200 per hour.

3.7.4.5 Spraying Machines

The most common spray machines used in this command area is the hand spray. The water users spray their cotton and chilies crops. This activity is, most times, carried out by the tenant or the owner-cultivator. Only a few water users use heavy machines to spray on orchards.

3.7.4.6 Thresher

Threshers are the mostly used in this command area. Water users rent threshers for wheat threshing. Threshing in this command area is charged in kind; 3-4 kg of wheat per maund.

3.7.5 Labor for Agriculture

To assess the actual wage for labor involved in different activities on the farm is not easy. Wages for labor may be equal to the value of the additional produce that one additional laborer can produce. During peak seasons, more labor can find employment, especially during the sowing, cutting, picking and harvesting seasons. The wage rate varies to demand and supply.

Farmer families include older sons, with the wife entitled to a share of family income. For sharecroppers, *zamindars* pay 50% of the expenditure, except for land preparation, which the tenant pays. The tenant, along with his family, works in the field for a 50 % share in input and output

3.7.6 Classification of Labor

Different type of labor is used for agriculture. Labor can be classified into four types; (i.) Tenant (ii.) *Kamdur* (iii.) Family labor (iv) casual labor.

3.7.6.1 Tenant

Tenants serve as sharecroppers and take 50 % of the net profit. Except for land preparation, the *zamindars* share 50 % of the expenditures and get 50 % of the output.

3.7.6.2 *Kamdur*

The *kamdur* is a salaried employee hired for the supervision of agriculture farms. Salaries for *kamdurs* vary in accordance with skill and experience.

3.7.6.3 Family Labor

In most cases, the tenant's, or owner-cultivator's, family members perform activities like sowing, picking, cutting and threshing, although no transaction is entered into; but, the opportunity cost of family labor varies with the working efficiency of labor.

3.7.6.4 Casual Labor

In the peak seasons of cotton, sugarcane, rice, chilies, wheat and orchard production, labor is required for different farm activities, i.e., cutting, picking, harvesting and cross-culturing. The rates fluctuate on the basis of demand and supply and differ from area to area. The most common rate in the Bareji Distributary command area for picking cotton and chilies, is Rs. 30-60 per maund, the sugarcane-cutting rate ranges from Rs. 2-4 per maund, and the wheat-cutting charges start from 1.5 maund of wheat per acre.

3.7.7 Taxes to Government

Farmers pay different taxes for different crops to relevant government authorities. The detail of these taxes has already been discussed in Chapter 2 of this report.

3.8 FARM LAND EXPENDITURE OF BAREJI DISTRIBUTARY

This information was collected from the farmers through interviews. The field staff was adequately briefed to understand the importance of accuracy in this information, thus, before the interview process, they went to the local markets to familiarize themselves with the different kinds of pesticides, fertilizers and seed qualities and their prices.

Farmers in this command area keep a fairly good record of farm inputs. Most of the farmers interviewed had kept the original receipts for different inputs purchased. Information regarding maximum and minimum costs per acre incurred by farmers on different farm inputs for key crops along this distributary's command area, is given in Table 28.

Table 28. Maximum, Minimum Agriculture Input Costs Within Bareji Distributary.

Input	Cotton		Sugarcane		Wheat		Rice		Chili	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Land prep.cost/ acre	2,000	600	2,000	800	1,100	600	1,100	300	1,500	750
Seeds cost/acre	400	90	2,700	2,960	1,000	300	600	200	800	200
Fertilizer cost/acre	3,550	1,250	4,800	2,150	1,950	1,250	900	350	2,850	1,500
Pesticides cost/acre	3,000	600	500	500	1,600	1,600	-	-	2,500	400
Labor cost/acre	1,400	350	3,700	1,600	1,300	780	-	-	1,200	360

The range of costs per cropped acre for different key crops incurred by the farmers can be inferred from the above table. Furthermore, it is observed that farmers spend steep amounts on the land preparation for crops. Expenses for the purchase of

seeds are high for sugarcane crop. Expenses for the purchase of fertilizers are comparatively high for sugarcane and cotton crops. Farmers also incur high costs on the purchase of pesticides for the cotton crop, while this expense is the lowest on wheat crop, and nil for fodder and oil seed. Farmers pay high rates for labor for sugarcane and cotton crops.

The information on maximum and minimum farm input costs by the farmers of this distributary command area, grouped by watercourse numbers for major crops, is given in Table 29.

Table 29. Maximum and Minimum Agriculture Input Costs on Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Chilies	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Watercourse number:	7L	9L	12L	1R	10L	5L	10L	11R	11L	4R
Land prep. cost/ acre	1,300	800	1,100	1,000	1,100	800	1,100	300	1,500	900
Seeds cost/acre	250	150	3,700	2,960	600	600	400	600	250	200
Fertilizer cost/acre	3,550	1,250	4,800	2,650	1,950	1,250	754	350	2,850	1,860
Pesticides cost/acre	3,000	800	500	500	1,600	1,600	-	-	2,500	600
Labor cost/acre	900	350	2,400	1,800	975	780	-	-	792	480
Total in Pakistan Rupees:	9,000	3,350	12,500	8,910	6,225	5,030	2,254	1,250	7,892	4,040
Total in US Dollars:	205	76	284	203	141	114	51	28	179	92

The mean costs for these major crops per cropped acre are (1) Cotton Rs. 5,641 (US\$128); (2) Sugarcane Rs. 10,760 (US\$245); (3) Wheat Rs. 5,599 (US\$127); (4) Fodder Rs. 1,808 (US\$41); and (5) Chilies Rs. 5,497 (US\$125).

The mean cost per cropped acre for sugarcane, which is a year-round crop, is the highest among different crops, i.e., Rs 10,760 (US\$ 245) per acre. Other crops are bi-annual. Farmers in this command area usually utilize their land by cultivating different combinations of crops during one cropped year. These different combinations, and accumulated mean costs per acre for these combinations in one year, is given in Table 30.

Table 30. Mean Agriculture Input Costs for different Crop Combinations.

Crop Combinations	Mean cost of Crop no. 1 in Rupees	Mean cost of Crop no. 2 in Rupees	Total Mean cost of Crop in Rupees	Total Mean cost of Crop in US Dollars
Sugarcane only	10,760		10,760	245
Cotton + Fodder	5,641	1,808	7,449	169
Cotton + Wheat	5,641	5,599	11,240	255
Wheat + Chilies	5,599	5,497	11,096	252
Fodder + Chilies	1,808	5,497	7,305	166
Fodder + Wheat	1,808	5,599	7,407	168

Therefore, as compared to sugarcane crop the combination of cotton and wheat crop is the most expensive, while that of fodder and chilies is the least expensive combination.

The farm input costs, calculated by multiplying the crop inputs with the per unit cost of these inputs, for the *rabi 96/97* and *kharif 97* cropping seasons for the Bareji command area, amounts to Rs 3,239 and Rs 6,169, respectively, per cropped acre. For one cropped year, this totals Rs 9,408 per cropped acre. The important information derived from farm input cost analysis for this distributary is given in Table 31.

Table 31. Agriculture Input Costs Analysis.

Particulars	Rabi - 96-97	Kharif - 97	Total (1 year)
Cropped Area in acres	4,970	5,684	10,654
Fallow Area in acres	2,085	1,371	-
Waterlogged Area in acres	133	133	-
Salinized Area in acres	798	798	-
Abandoned Area in acres	3,938	3,938	-
CCA in acres	11,924	11,924	-
Cropping Intensity (in %age)	41.68	48.91	90.59
Gross input costs (Rupees)	16,098,713	35,065,075	51,163,788
Gross input costs per cropped acre (Rupees)	3,239	6,169	9,408
Gross input costs per CCA acre (Rupees)	1,350	2,941	4,291
Gross input costs (US\$)	365,880	796,934	1,162,813
Gross input costs per cropped acre (US\$)	74	140	214
Gross input costs per CCA acre (US\$)	31	67	98
Avg. price of land per acre (Rupees)	70,000	70,000	70,000
G/input cost to land (Crop) price in %age.	4.63	8.81	13.44
G/input cost to land (CCA) price in %age.	1.93	4.20	6.13

Rate applied: 1 US\$ = Pakistan Rupees 44.00.

39 CALCULATION OF ABIANA, USHER AND TAXES PAYABLE IN BAREJI DISTRIBUTARY

Abiana payable has been calculated by multiplying the cropping pattern of the Bareji Distributary with the rates of *abiana* for this period. Similarly local cess and *usher* have been arrived at by multiplying area by rate. However, to calculate agriculture tax, the data was arranged according to a farmer's total agriculture land holding. Various taxes and their rates have been discussed in detail in Chapter 2. The information for these taxes is given in Table 32.

Table 32. Agriculture Land Taxes Analysis.

Particulars	Rabi - 96-97		Kharif - 97		Total (1 year)	
	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre
Cropped Area in acres		4,970		5,684		10,654
CCA in acres		11,924		11,924		-
Cropping Intensity (in %age)		41.68		48.91		90.59
Abiana total in rupees		205,590		535,689		741,279
Agriculture Tax total in rupees		92,637		468,626		561,262
Local Cess total in rupees		34,012		113,035		147,047
Usher total in rupees		560,394		950,246		1,510,640
Total Taxes in rupees:		892,632		2,067,596		2,960,228
Total Taxes in US Dollars:		20,287		46,991		67,278
	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre
Abiana in rupees	41	17	94	45	135	62
Agriculture Tax in rupees	19	8	82	39	101	47
Local Cess in rupees	7	3	20	9	27	12
Usher in rupees	113	47	167	80	280	127
Total Taxes in rupees:	180	75	364	173	544	248
Total Taxes in US Dollars:	4	2	8	4	12	6

Therefore, *abiana* (water service charges) per cropped land payable for one year in the Bareji Distributary comes to Rs. 135 (US\$3.07) per acre, or **Rs. 333 (US\$7.58)** per hectare. *Abiana* per CCA comes to Rs. 62 (US\$1.41) per acre, or Rs. 153 (US\$3.48) per hectare. Usher, levied by Islam, is about 51% of the total taxes payable by the farmers in one year.

3.10 CALCULATION OF FARM INCOME IN BAREJI DISTRIBUTARY

The information considered useful during farm income analysis, which can be used to identify the range of farm inputs and net farm income per kilogram of major crops, is given in Table 33.

Table 33. Net Agriculture Income Analysis per Kilogram of Yield for Selected crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Chillies	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	8R	9L	4R	7L	7R	3L	11R	10R	10R	11L
Revenue per kg in Rupees	19.50	19.00	0.950	0.950	6.40	6.40	0.87	0.87	28.78	30.53
Land Preparation/Kg (Rs.)	0.80	2.86	0.023	0.054	0.38	1.56	0.11	0.47	1.08	3.13
Seed/Kg in Rupees	0.40	0.54	0.074	0.154	0.38	0.94	0.21	0.23	0.16	0.52
Fertilizer/Kg in Rupees	1.50	4.46	0.071	0.177	1.00	2.50	0.12	0.53	1.92	5.94
Pesticide/Kg in Rupees	1.40	2.86	0.013	0.021	1.00	2.50	-	-	1.67	5.21
Labor/Kg in Rupees	1.00	1.25	0.075	0.075	0.73	1.26	-	-	0.75	1.65
Total Cost/Kg:	5.10	11.96	0.256	0.481	3.49	8.76	0.44	1.23	5.58	16.45
Net return/Kg in Rupees	14.40	7.04	0.694	0.469	2.91	(2.36)	0.43	(0.36)	23.20	14.08

The mean net farm income of the farmers in the Bareji Distributary, for major crops, has been calculated by multiplying the mean yield for these crops by the mean net return per kilogram for each crop. The results of these calculations are given in Table 34.

Table 34. Mean Profit Analysis for Selected Crops.

Particulars	Cotton	Sugarcane	Wheat	Fodder	Chilies
Mean yield per acre in kg	674.17	32,800.00	990.00	2,447.09	665.00
Mean price/kg in rupees	20.33	0.93	6.40	0.87	30.51
Mean costs/kg in rupees	8.37	0.33	5.66	0.74	8.27
Mean return/kg in rupees	11.96	0.60	0.74	0.13	22.24
Mean profit per acre	8,063.07	19,680.00	732.60	318.12	14,789.00

The main finding of this table is that when compared to sugarcane, which is an annual crop, the combination of wheat crop with chilies crop, both of which are seasonal crops, yields less net farm income than sugarcane crop to the farmers of this command area. The other reason why farmers tend to plant sugarcane is that this is a very low risk crop.

Information derived during farm income analysis, which can be used to identify the factors that effect the yield of major crops, is given in Table 37.

Table 35. Effects of Cost-of-Inputs, GW/Quality, W.T/Depth and W/Duty on Yield for Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Chilies	
	11L	9L	8L	1R	7R	9L	1R	10R	10L	2R
W/Course number	1,000	280	40,000	24,000	1,600	600	2,857	1,714	1,200	400
Yield in kg. Per acre	1,500	800	1,000	1,000	600	600	700	800	1,300	750
Land prep. per/acre in Rs.	150	150	3,700	2,960	600	500	200	400	200	400
Seed per acre in Rs.	2,850	1,250	2,850	2,650	1,600	1,600	900	900	2,300	1,950
Fertilizer per acre in Rs.	3,000	800	500	500	1,600	1,600	-	-	2,000	1,275
Pesticide per acre in Rs.	1,000	350	3,700	1,800	1,170	780	-	-	900	500
Labor per acre in Rs.	16,869	3,055	1,722	4,771	6,798	3,470	4,771	8,267	5,847	1,866
W/Quality in ppm (avg.)	4.64	4.81	3.67	3.72	6.25	4.81	3.72	5.77	7.96	2.81
W/Table depth (avg.)	6.81	7.63	4.52	7.00	6.83	7.63	7.00	1.76	7.14	6.03
W/Duty (avg.)										

Reasons for low yields in the cotton and chilies crops are mainly due to:

1. Less money spent on land preparation, i.e., less by Rs. 700 and Rs. 550 per acre, respectively, for cotton and chilies crops.
2. Less money spent on the purchase of fertilizer, i.e., less by Rs. 1600 and Rs. 350 per acre, respectively, for cotton and chilies crops.
3. Less money spent on the purchase of pesticides, i.e., less by Rs. 2200 and Rs. 725, respectively, for cotton and chilies.

In the case of sugarcane crops, low yields can be attributed to less money spent on the purchase of seed and fertilizers by Rs. 740 and Rs. 200, respectively. The other reason is the higher quality of ground water and high water tables, when compared to that of

producing the highest yield watercourse for the sugarcane crop. The reason for **low** yield in the wheat crop in Watercourse 9L remains to be investigated.

The analysis of farm income along all the watercourses of this command area reveals that there is a big disparity in the earning capacity of farmers. The range of farm income for this distributary is given in Table 36.

Table 36. Maximum, Minimum and Mean Agriculture Net Revenue of Bareji Distributary.

Particulars	Revenue Max.			Revenue Min.			Revenue Mean
	K-97	R-96	Total	K-97	R-96	Total	Total
Watercourse no.	5L	5L	5L	7R	7R	7R	Total
Farm-gate revenue	9,451,544	3,170,817	12,622,361	1,239,547	501,315	1,740,862	5,368,040
Gross input costs	4,093,544	1,734,402	5,827,946	275,554	247,663	523,218	2,131,825
Gross taxes	205,688	101,800	307,488	25,266	11,545	36,811	123,343
Total expenditures	4,299,232	1,836,202	6,135,434	300,820	259,208	560,029	2,255,168
Net income	5,152,312	1,334,615	6,486,928	938,727	242,106	1,180,833	3,112,872
Per cult. Acres	9,683	2,685	12,368	12,626	4,568	17,194	13,445
Per CCA Acres	3,368	872	4,240	6,929	1,787	8,716	6,266

There are a total of **24** watercourses in the Bareji Distributary. The farm income of **9** watercourses is **less** than the mean farm income by approximately 36%. The minimum farm income of Watercourse 7R is less than the mean farm income by **62%**. The cropping intensity of this watercourse is low, and the groundwater quality **has** affected the farm income. On average, other watercourses are earning very well.

Farm income has been calculated by subtracting farm expenditure and farm taxes from the gross farm revenue. The total farm income for one crop year and other important information is given in Table 37.

Table 37. Net Agriculture Income Analysis.

Particulars	Rabi - 96-97		Kharif - 97		Total (1 year)	
Cropped Area in acres	4,790		5,684		10,654	
Fallow Area in acres	2,085		1,371		-	
Waterlogged Area in acres	133		133		-	
Salinized Area in acres	798		798		-	
Abandoned Area in acres	3,938		3,938		-	
CCA in acres	11,924		11,924		-	
Cropping Intensity (in %age)	41.68		48.71		90.59	
Gross Revenue (Rupees)	28,932,902		99,900,048		128,832,950	
Gross input costs (Rupees)	16,098,713		35,065,075		51,163,788	
Total Taxes (Rupees)	892,632		2,067,596		2,960,228	
Total Expenditure	16,991,345		37,132,671		54,124,016	
Farm Income (Rupees)	11,941,557		62,767,377		74,708,934	
Farm Income (before taxes) in percentage	44.36		64.90		60.29	
Farm Income (after taxes) in percentage	41.27		62.83		57.99	
Farm taxes to Farm income (Bef./tax) in %age	6.96		3.19		3.81	
	Per Crop Acre	Per CCA	Per Crop Acre	Per CCA	Per Crop Acre	Per CCA
Gross Revenue (Rupees)	5,822	2,426	17,575	8,378	23,397	10,804
Gross input costs (Rupees)	3,239	1,350	6,169	2,941	9,408	4,291
Total Taxes (Rupees)	180	75	364	173	544	248
Total Expenditure	3,419	1,425	6,533	3,114	9,952	4,539
Farm Income (Rupees)	2,403	1,001	11,043	5,265	13,445	6,266
Farm Income (US Dollars)	55	23	251	120	306	143
Avg. price of land per acre (Rupees)	70,000		70,000		70,000	
Farm Income to land (Crop) price in %age.	3.43		15.78		19.21	

Rate applied: 1 US\$ =Pakistan Rupees 44.00

The analysis of farm income of the Bareji Distributary reveals the following facts:

- Farm** income percentage during *kharif* is higher by **21.56%**, mainly due to two reasons; considering the fact that orchard is taxed in the *rabi* season, and does not generate revenue, while in *kharif*, orchard generates revenue, as well as sugarcane, which is more profitable crop.
- Although the cropping intensity in *kharif* is higher by **7.03%** when compared with that of the *rabi* season, the farm income in *kharif* is more by **426%**. Therefore, *kharif* crops (cotton, sugarcane, chilies, etc.) are more revenue-generating when compared to that of the *rabi* crops (wheat, onion etc.).
- Loss of farm income to the farmers of this command area due to uncultivated land of about **4,869** acres is estimated at Rs. **65.464** million (US\$**0.1.488** million). If this land is reclaimed, the per CCA farm income can increase to Rs. **11,756** per acre (US\$**267**) when compared to that of the existing per CCA farm income of Rs. **6,266** per acre (US\$**143**).

- d. The bank fixed deposit schemes generate a higher interest rate, i.e., about **17.5%**, which, after tax and *Zakat*, comes to about **15.31%**. Apart from these two taxes by banks, an investor has to pay wealth tax also, the rates of which vary from **2.5% to 10%**. Assuming a rate of **5%** wealth tax, the effective rate of interest comes to **14.44%**. At first glance, this rate appears to be quite lucrative. However, when we consider the time value of money with an inflation rate of **12%**, in reality, the rate of return is only 2.44%. One year ago the average land price in the Bareji Distributary was approximately **Rs. 70,000** per acre. The net farm income before tax' per cropped acre to the average land price, comes to **19.98%**, and farm income after tax comes to **19.21%**. Since the prices of land and crops increase nearly at par with the inflation rate, the farmers of the Bareji Distributary can be considered as earning fairly well.
- e. The banks give an interest rate of **12.5%** on all Pakistan rupee saving accounts; however, by law they deduct **12.5%** (water tax is 10% plus, *Zakat* **2.5%**) on the amount of interest earned on these accounts, thereby reducing the interest rate to 10.94%. Again, considering the time value of money by assuming an inflation rate of **12%**, the effective interest rate comes to 1.06% negative.
- f. The income tax authorities in Pakistan, for the purposes of income tax, consider a net profit (before tax) percentage of **20-30%** as reasonable in the case of sole proprietorship and partnership concerns. In drawing up the profit and loss account of sole proprietorship and partnership concerns, the salaries of partners are not considered as an expense, therefore, for the purposes of comparison, the farming community can be considered as sole proprietorship or partnership concerns. In the Bareji Distributary, net farm income in percentage to the farm revenue, is **57.99%**. This makes farming in the Bareji Distributary a very reasonable profession.

4 NEED FOR A BUSINESS PLAN FOR BAREJI DISTRIBUTARY

4.1 COUNTRY SETTING

Pakistan encompasses about 80 mha. of land, of which about 26% is cultivated. Pakistan is divided into three hydrological regions; the Indus Basin, covering more than 56 mha. (70% of the country's area), the Kharan Desert in the west of Balochistan, and the arid Makran coast along the Arabian Sea in southern Balochistan. The deserts in the south (Thar and Cholistan) have no water resources.

Pakistan's climate is arid to semi-arid. The annual rainfall over much of the Indus Plain is uneven and does not exceed 150 mm, while evaporation rates are high, varying from 1,250 to 2,800 mm. Agriculture is crucial to Pakistan's economy, but non-irrigated agriculture within the Indus Plain is impossible. The importance, therefore, of an efficient and effective irrigation network cannot be overstated.

Although Pakistan has substantial natural water resources, these are inadequate for crop production on all irrigable land. River **flows** are highly seasonal, with roughly 85% of annual flow occurring during the *kharif* season. Due to limitations on water availability, cropping intensities tend to be low. Furthermore, the majority of irrigation systems suffer from low delivery efficiencies, inequitable water distribution, inadequate system maintenance, insufficient cost recovery from beneficiaries and the need to improve drainage.

Despite Pakistan's growth being agriculturally based, parallel non-agricultural growth has occurred in areas with large employment bases. Wages have been increasing, in real terms, and absolute poverty has been declining.

4.2 POLICY REVIEW

. Current national and provincial agricultural policies seek the same fundamental goals; raising rural incomes, reducing imports and increasing exports of raw materials and processed goods. However, the 1988 Report by the National Commission on Agriculture concludes that in order to meet the demands of Pakistan's high population growth rate (3% per annum), accelerated growth in agriculture production is essential. The present rate (estimated at 3.8% per annum in 1993) is inadequate; agricultural growth must rise by an average of 5% per annum if the GoP strategy of virtual self-sufficiency is to be achieved and sustained.

4.3 A FRAMEWORK FOR REFORMS

The institutional reforms, which are essential to safeguard future agriculture production, have been the focus of a major study sponsored by GoP and the World Bank (Institutional Reforms to Accelerated Irrigated Agriculture, 1994). The major conclusions and recommendations for policy reform arising from this study are:

➤ Fertilizer Policy:

Currently, fertilizer is grossly underused, and requires the implementation of policies that will bring effective competitive fertilizer supply and a distribution system that encourages private competition.

➤ Research and Extension:

There is **gross** under-investment in research, which requires the doubling of expenditure and the introduction of a large competitive grants program.

➤ Irrigation and Agriculture:

The deterioration of the irrigation infrastructure poses serious long term problems; the underlying causes of deterioration are effectively built into the operation procedures, and requires radical change by establishing farmers' irrigation groups, an irrigation commission to enforce efficient and equitable management, and shifting irrigation systems to semi-autonomous water authorities.

➤ Price Policy:

Import subsidy on wheat should be gradually removed and abolished; sugar prices should be decreased to promote a shift to higher value crops, and direct taxes on agriculture increased to support expenditures on rural infrastructure programs.

The radical change required for irrigation operation procedure was further discussed through a seminar on Participatory Irrigation Management (PIM) held in October 1994. This seminar was co-sponsored by the Economic Development Institute (EDI) of the World Bank, with the primary objective of identifying ways to increase food production through improved irrigation management. One of the products of the seminar was a series of provincial action plans prepared by WAPDA, using, as a starting point, current OFWM programs, but generally aiming for the pilot introduction of a WUA federation responsible for assessment, collection and disbursement of irrigation fees. Further, it was understood that the pilot turnover of a distributary, or minor canal, to water users will be implemented under the Left Bank Outfall Drain (LBOD) (North West Canal Remodeling Project, Interim Report, March 1995).

The LBOD project management, in consultation with the World Bank and Swiss Development Cooperation (SDC), entered into a consultancy agreement with the International Irrigation Management Institute (IIMI) to implement three pilot projects, in which Water Users Organizations (WUO's) would be established to operate and maintain (O&M) irrigation facilities in distributary/minor canal command areas (Inception Report, 1995).

44 CURRENT STATUS

The farmers of the Bareji Distributary formed their federation with the assistance of IIMI-Pakistan and elected its office bearers in December 1996. The aspiration is for this WUF to operate and maintain their distributary in the future. Specifically, it is

anticipated that the WUF can achieve a more equitable distribution of water, improved reliability and timeliness of delivery, and through collaboration with the extension department, OFWM and IIMI-Pakistan, increased adoption of improved irrigation and agricultural practices.

With this policy and research background, the WUF needs to be assisted by testing its financial viability to bear the O&M costs of the irrigation facilities. And, by developing a framework for sound financial planning and management, including mobilization of resources in the achievement of the aforesaid goals.

The importance of a financial framework for the WUF is further established with the fact that in 1997, the Sindh Assembly passed a bill to provide for the establishment of the irrigation and drainage authority (SIDA). For equitable distribution of irrigation water and effective drainage and flood control sustainable on a long term basis through participation of beneficiaries in the operation and management of irrigation drainage network, and to provide for matters connected therewith, or incidental thereto.

The relevant sections and sub-sections of this bill directly affecting the finances of the Bareji Distributary WUF are reproduced as follows:

Section 21(2) The rates at which the Authority shall supply water shall be so fixed as to provide for meeting the operation and maintenance cost of the system within a period of seven to ten years; provided always that before proposing any enhancement in the existing rates and/or agreeing to the same, the Authority/AWBs concerned shall use their best endeavors to reduce the quantum of the following measures:

- (i) reducing costs;
- (ii) improving assessment and collection of water rates and drainage cess;
- (iii) recovery of arrears;
- (iv) recovery of cost for providing drainage flood control to non-farming beneficiaries; and
- (v) dis-investment of fresh water tubewells in **SCARP** areas.

Section 21(3) The components of O&M to be recovered from the **farmers** in the form of *abiana* shall be the full O&M cost of Irrigation Canals and Secondary Drains.

Section 21 (4) The O&M cost of flood protection and public sector FWG tubewells will be excluded from *abiana*. A nominal proportion (say five to ten percent) of the O&M cost of SGW tubewells and/or main drains may, however, be borne by the farmers, should such a need be felt by the Authority.

Section 26 C (4) To collect the agreed water charges/other dues, if any, from its water users and pay the agreed consideration for supply of irrigation water and

conveyance and/or disposal of drainage effluent to the SIDA or A WB concerned.

Section 26 C (5) To engage, hire or employ any consultants, advisors and employees as may be deemed necessary, or be otherwise reasonably required for the due and effective performance of various powers and functions on such terms and conditions as may be prescribed, including terms and conditions relevant to the conclusion or premature termination of such engagement, etc., of any consultants, advisors or employees, as the case may be.

4.5 CURRENT EXPENDITURE ON IRRIGATION INFRASTRUCTURE BY THE GoS

The Finance Department of the GoS prepares a detailed budget for the province of Sindh each year, covering the period from July 1 to June 30 the following year. The budget for the Irrigation infrastructure appears in Volume III, containing demand numbers 25 to 50. Demand number 37 represents irrigation. For the year 1997-98, the total demand, and voted, is Rs. 1,236,691,240 or Rs. 1.237 billion, i.e., US Dollars 28.100 million.

These costs are mainly categorized under four heads of expenses, namely: (1) Irrigation Administration; (2) Irrigation Dams; (3) Machinery and Equipment; and (4) Repair and Maintenance. The breakdown of these heads of expenses in various sub-heads, and their rate per CCA acre for the province of Sindh, is presented in Tables 38, 39, 40 and 41.

Table 38. Irrigation Administration.

Description	Salaries and Benefits	Supplies and Services	Communication	Utilities	Total	Per CCA acre
Irrigation Secretariat	13,360,810	1,210,460	446,980	450	15,018,700	1.14
Chief Engineers:						
Sukkur Barrage	6,634,230	629,060	290,010	79,480	7,632,780	0.58
Irrig. Development	2,822,030	213,700	66,000	61,000	3,162,730	0.24
Kotri Barrage	5,490,730	389,980	82,110	61,730	6,024,550	0.46
Guddu Barrage	2,932,330	334,610	150,150	30,240	3,447,330	0.26
Superin. Engineers:						
Superin. Engineers	19,559,750	839,600	346,680	144,800	20,890,830	1.58
Guddu Barrage	1,845,310	164,350	88,830	17,960	2,116,450	0.16
Executive Engineers:						
Executive Engineers	668,932,620	2,619,880	1,537,470	581,170	673,671,140	51.05
Guddu Barrage	90,283,620	498,240	211,560	63,900	91,057,320	6.90
Director Regulation	5,080,910	270,140	146,000	2,270	5,499,320	0.42
Spec. Revenue Est.:						
Spec. Revenue Est.	29,761,510	225,340	80,430	43,680	30,110,960	2.28
Guddu Barrage	5,253,650	61,950	5,990	5,250	5,326,840	0.40
Medical	589,410	56,970	2,250	2,700	651,330	0.05
Director Irr. Res.	5,283,260	190,260	57,540	2,730	5,533,790	0.42
Director Irr. Design	2,900,400	27,900	-	10,450	2,938,750	0.22
Total:	860,730,570	7,732,440	3,512,000	1,107,810	873,082,820	66.16
Per CCA acre	65.23	0.27	0.08	0.59	66.16	

The Provincial Irrigation Department spends about 70.60% of its total allocated budget (i.e., Rs. 1,236.691 million) on irrigation establishment. Other percentages within the establishment costs are Salaries and Benefits, 69.60%, office supplies (rent, rates, stationery, newspapers, maintenance etc.), 0.63%, Communications, 0.28% and Utility bills, 0.09%.

The irrigation secretariat is situated in Karachi. The percentage share within the total establishment cost is about 2%, while the costs for Special Revenue Establishment is 4.06%.

The Provincial Irrigation Department spends about 3.00% of its total allocated budget (i.e., Rs. 1,236.691 million) on irrigation dams. Other percentages within the Irrigation Dams cost are Maintenance and Repairs; 2.56%. Stone Pitching and Repairs and Carriage make up the balance of 0.46%.

Table 39. Irrigation Dams.

Description	Maint. And Repairs	Recouping of Stone Pitching and apron of Ruk Loop Bund	Repairs and Carriage	Total	Per CCA acre
Sukkur Barrage	14,584,920	1,523,970		16,108,890	1.22
Kotri Barrage	5,784,870			5,784,870	0.44
Guddu Barrage	7,196,050			7,196,050	0.55
Machinery & Equipment:					
Research Division			52,390	52,390	0.00
Disch. Observation Cell			42,530	42,530	0.00
Embark. & Drainage Works:					
S.M.H.L	307,330			307,330	0.02
Kinjhar Lake	724,520			724,520	0.05
Machinery & Equipment			25,410	25,410	0.00
Other Charges:					
Ghar Inspect. Bungalow	291,060			291,060	0.02
Research Division	2,138,200			2,128,200	0.16
Disch. Observation Cell	94,920			94,920	0.01
Rest House at Lahore	65,830			65,830	0.00
Soil Mechanic & Hydraulic Lab.	506,100			506,100	0.04
Total:	31,693,800	1,523,970	120,330	33,338,100	2.53
Per CCA acre	2.40	0.12	0.01	2.53	

Table 40. Machinery & Equipment.

Description	Machinery & Equipment	Sukkur Barrage	Chief Engineer Irrigation Develop.	Kotri Barrage	Guddu Barrage	Total	Per CCA acres
Durable Goods	4,971,000					4,971,000	0.38
Repairs & Carriage		1,020,810	99,220	796,850	392,700	2,309,580	0.18
Total:	4,971,000	1,020,810	99,220	796,850	392,700	7,280,580	0.56
Per CCA acre	0.38	0.08	0.01	0.06	0.03	0.56	

Table 41. Repair and Maintenance.

Description	Sukkur Barrage	Guddu Barrage	Kotri Barrage	Silt Clearance	Makhi Dhand	Thatta Sajawal Road	Dadu Moro Road	Malir River	Total	Per CCA acres
Irrig. Head Works	5,754,520	5,635,980	2,675,930						14,066,430	1.11
Main Canal Feeders	91,470,220	27,603,660	34,921,420						153,995,300	12.21
Silt Clearance				116,644,500					116,644,500	9.25
Lift Irrigation Schemes:										
Maintenance & Repairs	9,332,000		701,510						10,033,510	0.80
Electricity Charges	10,120,640		2,252,250						12,372,890	0.98
Drainage Schemes			10,383,130		3,152,520				13,535,650	1.07
Bridges						1,045,590	950,570		1,996,160	0.16
Operat. & Maintenance								345,520	345,240	0.03
Total:	116,677,380	33,239,640	50,934,240	116,644,500	3,152,520	1,045,590	950,570	345,520	322,989,680	24.48
Per CCA acre	8.84	2.52	3.86	8.84	0.24	0.08	0.07	0.03	24.48	

The Provincial Irrigation Department spends about 26.00% of its-total allocated budget (i.e., Rs. 1,236.691 million) on the Repair and Maintenance of Irrigation Canals. Other significant percentages within the Repair and Maintenance of Irrigation Canals are Sukkur Barrage, 9.00%, Guddu Barrage, 3.00%, Kotri Barrage, 4.00% and Silt Clearance, 9.00%.

The summary of costs for the four main budget line items for the Irrigation Department, Government of Sindh, is presented in Table 42.

Table 42. Summary of Costs.

Description	Total Cost in Rupees	Rupees per CCA acre
Irrigation Administration	873,082,820	66.16
Irrigation Dams	33,338,100	2.53
Machinery & Equipment	7,280,580	0.56
Repairs & Maintenance	322,989,680	24.48
Total:	1,236,691,180	93.73
Irrigation Establishment	873,082,820	66.16
O&M without Establishment	363,608,360	27.51

The GoS spends a total of Rs. 1,236.691 million (Rs. 93.73 per CCA acre) on the Provincial Irrigation Department, out of which 71% (Rs. 66.16 per CCA acre) is spent on the irrigation establishment, while the rest, i.e., 29% (Rs. 27.57 per CCA acre), is spent on maintenance activities.

In 1986/87, a detailed Yard Stick for O&M costs was prepared by the Irrigation Department and submitted to the Government of Sindh. According to this Yard Stick in 1986/87, Rs. 25.16 per CCA acre was required for Irrigation O&M Costs to attain a reasonable efficiency level in the system.

Table 43. Reasonable Requirements for O&M of Irrigation Infrastructure.

	Quantity or Units	Unit Yard-Stick Rate	Amount (Millions Rs.)	Remarks
Irrigation Works.				
Flow Irrigation (including Irrigation Colonies)	14,865 Virtual Miles.	13,333	198.195	
Repair & Maintenance of Barrage Gates & other E&I works.	50,000*1,659		82.95	
Lift Irrigation (small Irrigation schemes):				
(a) On Rivers.	1,750 H. Power	4,963	8.685	
(b) On Canals.	3,155 H. Power	4,834	15.251	
Flood Embankments:				
(a) Main Bunds (River)	935.00	27,470	25.684	
(b) Loop Bunds (River)	339.00	21,131	7.164	
(c) Hill Torrent Bunds	198.50	19,967	3.963	
(d) Kinjhar Lake (Bund)	12.50	54,940	0.687	
Total Irrigation:			342.579	Rs. In millions
CCA (acres) of three barrages including Inundation canals & Lift Irrigation Schemes			13,615	Acres in Millions
Rate per CCA acre			25.16	Rupees

Although this Yard Stick is a good measurement for required O&M costs, it does not take into account the Establishment Cost, which is a major fixed proportion of the O&M costs. In order to calculate a **true** maintenance cost (based on Yard Stick), the recommended cost has been adjusted for the current prices by applying a **GDP** deflator, which is given in Table 44.

Year	GDP- Deflator	Index	Per CCA acre of Irrigation O&M without Establishment cost
86-87	142	1	25
96-97	387	2.7	68

This data is based on a 1986 analysis by NESPAK, updated as above to 1996-97 prices. In IIMI's opinion, these figures are a minimum level. A similar study in north India, in a state with similar infrastructure (Haryana Water Resources Consolidation Project, World Bank, 1995), but where costs and wage rates are somewhat higher, indicated costs approximately double those indicated above, but no more detailed analysis on current needs in Sindh is available (Dr. Christopher Perry, Status Report on Financial Feasibility Analysis).

Hence, a minimum estimate for maintenance costs amounts to Rs. 68 per acre, whereas, the Irrigation Department intends to spend only Rs. 27.57 per acre, thus, there is a shortfall of Rs. 40.43 per acre. In other words, the Sindh Irrigation Department is going to under-spend by 59% during the year 1997/98 on the maintenance of irrigation infrastructure.

Therefore, to maintain the irrigation infrastructure in order to meet the system adequately, so that the design service can be given on a continuing basis, the total O&M cost comes to Rs. 134.16 (US\$3.04) per acre, or Rs. 331.38 (US\$7.51) per hectare. However, this does not mean that the farmers have to pay for all of these costs, as the main cities of Sindh, i.e., Karachi and Hyderabad, also consume this water for domestic use. The total capacity of the Indus Basin Irrigation System is around 110 million area feet (MAF) per annum, out of which the share for Sindh is about 46 MAF. The cities in the Sindh province use about 3.3 MAF of water for domestic use, while about 10 MAF water goes into the Arabian Sea (Indian Ocean).

Hence, out of a total of 36 MAF (46-10) of water available for the Sindh province, about 9.17% is utilized for non-agricultural purposes. Non-agricultural use of water generates high economic returns, therefore, the rate for non-agricultural use is proposed to be comparatively higher, i.e., twice the rate that farmers are to be charged. These calculations are given in Table 45:

Table 45. Irrigation Water Consumed in Sindh Province.

Description	Amount in Millions	Water Available	Rate per MAF
Used in Sindh Province	1,236.70	36.0	34.35
Deduct: Maint. Cost	(363.61)	36.0	
Add: Y. Stick Maint. Cost	924.96	36.0	
Estimated O&M Cost	1,798.05	36.0	49.95
Non-irrig. Use at double rate	329.67	3.3	99.90
Irrig. Use cost	1,468.38	32.7	44.90

Therefore, the cost of water to the farmers amounts to around Rs. 108 per CCA acre (Rs. 1,468.38 m/13.615 ma), or Rs. 267 per hectare.

5 ORGANIZATIONAL AND OPERATIONAL COSTS OF BAREJI DISTRIBUTARY WATER USERS FEDERATION

The Bareji Distributary has **24** watercourses. The water users of this command area have elected **24** Water Users Organizations, i.e., one for each watercourse, and 1 Water Users Federation at the level of this distributary itself. Presently, each WUO and the WUF each comprises of **5** members, besides the executive body members. The Presidents are administratively in-charge of these organizations and the federation.

Once this distributary is transferred to the Bareji Distributary WUF, the overall management of the distributary command area will also become the responsibility of this federation. These responsibilities will include, but not be limited, to the following:

1. Levy of *abiana* mechanism on its members
2. Supervision of the staff hired
3. O&M of the distributary
4. Collection of *abiana* from its members
5. Payment of cost of water to the Area Water Board
6. Conflict resolution
7. Maintaining proper account books

5.1 LEVY OF ABIANA MECHANISM ON MEMBERS

Broadly, ~~three~~ mechanisms can be implemented, namely, (a) a crop-based charge, broadly relating the *abiana* to water consumption; (b) a volumetric charge; and (c) a flat rate, independent of crop type or cropping intensity.

a. A Crop-based Charge

This is the present mechanism in practice. The farmers pay according to the rates specified by the government for different crops. The line agencies claim that these rates have been developed in view of the crop water requirements for different crops. However, ~~this~~ system has two main flaws: (1) assessment of the cropping pattern of each farmer is required at the end of each cropping season; and (2) involvement of judgment, ~~as~~ precise assessment of the cropping pattern is not possible.

b. A Volumetric Charge

This is the most preferred mechanism by the engineers; water meters ~~are~~ installed, hence, water charges relate to the water consumed. This mechanism is not popularly installed around the world, although certain countries, e.g., Taiwan, **South** Korea and certain areas of Australia and America use this system. If installed, this system will require a complete overhaul of the present system, and ~~a~~ huge investment. Two other methods resembling ~~this~~ mechanism favored by some consultants, and the farmers, ~~are~~ explained as follows:

- 1 The *moghas* (modules or outlets) should be of the open flume type to ensure proportional flow at varying water levels. Water level

gauges should be installed and monitored, and the data processed on computer on a daily basis. A simple spreadsheet would enable a reasonable assessment of water delivered to the farmers.

- ii The *moghas* are calibrated and their designs noted down. Water users pay *abiana* according to the time of water allowed for their turn, the hourly rate of which will be calculated in view of the water discharge agreed with the Irrigation Department at the head of the regulator.

The first method involves the use of computers. The question of whether the Irrigation Department will agree with the daily data processed by the WUF, remains unanswered. The success of the second method will largely depend on a continuous and reliable water supply at the head regulator, as well as the effectiveness of the *warabandi* lists.

c. A Flat Rate Charge

This is a simple mechanism whereby farmers are charged a flat rate per acre, according to their individual land holdings. The success of this method depends on the ability of the WUF to provide water to its members on an equitable basis. Otherwise, the farmers at the tail reaches of the distributary will not agree with this method.

d. Another Approach

The World Bank (WB) staff Appraisal Report, Pakistan, for NDP, discusses the levy of *abiana* from a different angle under Section 1.31, as reproduced below:

Lessons from Research: The lessons from research on water rights in other countries are also of interest: (i) there are very substantial welfare and income gains from permitting trade in water, at whatever level; (ii) water rights should be separated from land; (iii) water rights should be allocated based on historical usage, and surplus amounts to usage should be auctioned off; (iv) transaction costs for trading in water is very low, and the availability of adjustable gates is helpful to facilitate such trading; (v) environmental regulations need to be enforced; (vi) the Government has a role to play in resolving the conflicts that could arise; and (vii) public subsidies for O&M of irrigation obstruct water markets development.

The historical water rights in Pakistan are based on the design of IBIS in 1932. Since then, the situation has changed due to the construction of new dams and storage facilities, which have increased the availability of water over the years. Auctioning of surplus water will certainly yield more economic returns, but then, only the wealthy will benefit; poor farmers of this country will sell off their lands. This is what has happened in Mexico.

5.1.1 Suggested Mechanism for the Levy of *Abiana*

The WUF will be responsible for the collection of *abiana* from its members, therefore, a simple mechanism to charge a flat rate is suggested. However, the WUF will have to ensure that the watercourses receive their share of water in an equitable and reliable manner, and at the watercourse level, the WUO's will have to ensure that its members receive water according to their land holdings.

5.2 SUPERVISION OF THE STAFF HIRED

Currently, these organizations, and the federation, are collecting cash contributions for repairs and other expenses. However, the water users will eventually be managing their distributary command areas independently. Certainly, this will require a good set-up consisting of technical, secretarial and unskilled staff.

Based on the observations of the IIMI-Mirpurkhas field staff, the following set of employees in the initial stages is suggested for the Bareji Distributary WUF:

1. Assistant Engineer
2. Administrative Assistant
3. *Darogha*
4. *Tandail*
5. *Baidars*

The above-stated personnel, their qualifications, range of salaries and job descriptions are suggested as follows:

Assistant Engineer

Qualification: Diploma in Agricultural, or Civil Engineering.

Experience of rural areas will be preferred.

Age: Under 35 years.

Salary: Rs 5,500 to Rs 6,000, inclusive of all benefits.

Job Description:

This person will be answerable to the members of the WUF, and will act as the federation's right hand person; however, he will not deal with water users on his own, but rather, will only inform the WUF. The main duties of this person will be as follows:

- a. To correspond with the Irrigation Department
- b. Supervision of all O&M activities in this command area.
- c. To record the water discharge at the head regulator, and to pursue a decrease with the ID.
- d. To record the design (width and depth) of the outlets.
- e. To record the discharge at the outlets.
- f. To advise the WUF about the design, and discharge, of the outlets.

- g. To ensure that the banks, berms and inspection paths of the distributary are in a reasonably good condition.
- h. To advise the WUF on desilting timings.
- i. To bring issues reported by the darogha to the attention of the WUF.

Logistic Requirements:

- 1. Motorbike
- 2. Table, chair and chairs for visitors
- 3. Bookshelves

Darogha

Qualification: Intermediate, however, a diploma holder will be preferred.
Rural experience will be preferred.

Age: Under 40 years.

Salary: Rs 4,500 to Rs 5,000, inclusive of all benefits.

Job Description:

This person will be answerable to the Assistant Engineer (AE), and will act as his right hand person. The main duties of this person will be as follows:

- a. Take readings of the water discharge at the outlets.
- b. **OFF** and on, to verify the design of the outlets with that of the design list approved by the WUF, and to report any variations to the AE.
- c. Regular monitoring of the banks, berms and inspection path, and to report serious cases to the AE immediately, as well as supervising *baidars* for minor repairs.
- d. Monitoring of the overhead bridge and culverts.
- e. To report theft of trees along the inspection path, tampering of outlets, or insertion of dikes, to the AE immediately.
- f. To supervise the *baidars*.
- g. To assist the WUF in the absence of the AE

Logistic Requirements:

- 1. Bicycle
- 2. Water measuring devices

Administrative Assistant

Qualification: Intermediate.

Typing skills, computer-literacy will be preferred.

Age: Under 40 years.

Salary: Rs 3,500 to Rs 4,000, inclusive of all benefits.

Job Description:

This person will be answerable to the Assistant Engineer. The main duties of this person will include:

- a. Typing.
- b. Maintaining files and related records.
- c. WUF meeting letters and agenda.
- d. Maintenance of mail and dispatch registers.
- e. Record petty cash expenses.
- f. Assist the AE in the maintenance of discharge readings for both, the head regulator and outlets.
- g. Assist the WUF in the absence of the AE.

Logistic Requirements:

1. Typewriter
2. Table, chair and chairs for visitors
3. Bookshelves

Tandail (2, for 12-hour daily rotations)

Qualification: Primary or Middle.

Rural background with some mechanical work experience.

Age: Under 50 years.

Salary: Rs 3,000, inclusive of all benefits.

Job Description:

These persons will be answerable to the Assistant Engineer. Their main duties will include:

- a. Maintaining the head regulator's gauge books on an hourly basis.
- b. Operating the gate of the head regulator.
- c. Greasing, oiling and cleaning the head regulator.
- d. To report fluctuations in the water discharge to the AE, or the WUF.

Logistic Requirements:

1. Tool kit
2. Torch
3. Lubricants
4. Gauge book

Baildar (3, at the head, middle and tail reaches of the Bareji Distributary)

Qualification: Good physical health.

Rural background with some relevant work experience.

Age: Under 45 years.

Salary: Rs 3,000, inclusive of all benefits.

Job Description:

These persons will be answerable to the *darogha*. Their main duties will be as follows:

- a. Removing vegetation from the berms, banks and inspection paths.
- b. Sprinkling water on the inspection paths.

- c. Earth work repairs to the inspection paths.
- d. Preventing animals from destroying the inspection paths.
- e. Notice, and report, any instances of water theft.

Logistic Requirements:

1. Spade
2. Bucket
3. Axe
4. ~~Earth~~ work bowls

5.2.1 Establishment Cost of Bareji Distributary

Based on the fore-stated staff deployment and their logistic needs, the budget estimates for the first year are given in Table 46. The capital equipment costs will only appear in the first year. WLJF establishment costs will be reduced in the subsequent periods, i.e., Rs 438,400 per annum (Rs. 428,400, plus contingencies Rs. 10,000). Hence, the requirement for establishment costs below the head of this distributary will be Rs. 36.77 per acre, which, in the first year, will increase to Rs. 44.62 per acre due to investment required for the purchase of capital items.

Table 46. WUF Establishment Budget.

Particulars	Period	Qty.	Base cost	Amount
Salaries				
Assistant Engineer	12 m.	1	6,000	72,000
Darogha	12 m.	1	5,000	60,000
Administrative Assistant	12 m.	1	4,000	48,000
Tandail	12 m.	2	3,000	72,000
Baildar	12 m.	3	3,000	108,000
Subtotal:				360,000
Supplies & Services				
Utility bills for office	12 m.	1	3,000	36,000
Stationery	12 m.	1	500	6,000
Meeting exp. & other supplies	12 m.	1	800	9,600
Subtotal:				51,600
Travel				
Maintenance of M/Bike	12 m.	1	1,000	12,000
Local Travel	12 m.	1	400	4,800
Subtotal:				16,800
Capital Equipment				
Motor Bike	1st year	1	70,000	70,000
Bicycle	- do -	1	3,000	3,000
Office furniture sets	- do -	2	6,500	13,000
Repairs & Maint. Equipment	- do -	Estimated	5,600	5,600
Typewriter	- do -	1	2,000	2,000
Subtotal:				93,600
Contingencies				
				10,000
Total:				532,000
Per CCA acre full costs				44.62
Per CCA acre w/o Capital Cost				36.77

5.3 MAINTENANCE AND IMPROVEMENT COSTS OF BAREJI DISTRIBUTARY

A general description of the physical phenomenon occurring in the irrigation system needs to be presented in order to understand the relationship between the field maintenance inventory and the proposed solution contained in the form of maintenance needs, including activities, costs and manpower. From the diagnostic walk-thru survey, different major, and minor, maintenance problems were observed. Most of these problems are inter-related. The inventory of these main problems is given below:

- a. Essential Structural Maintenance
- b. Sedimentation
- c. Vegetation
- d. Weak Banks
- e. Erosion
- f. Wider cross sections
- g. Lack of Inspection Path

A. Essential Structural Maintenance

Essential Structural Maintenance (ESM) is considered to be the minimum level of investment that should be made in order to improve water deliveries. This maintenance requires correctness of all flow control structures (repair of gates), water measurement (repair of damaged outlet structures) or installing new structures. The major problems observed under ESM are as follows:

- i. Head Regulator of Bareji Distributary: The head regulator for the Bareji Distributary has three cast iron gates of different dimensions, which are manually operated. The gates were installed recently and are in good condition.
- ii. Outlet Structure: In Bareji Distributary, there are 24 outlets. The percentage of outlets tampered (changing design of its throat and crest) is very high, i.e., 75%. Water Users also tamper outlets by making side openings.
- iii. Culverts: Only 10% were observed as damaged, 28% of the outlets were either without culverts, or these had been damaged completely, while the remaining 62% were found to be partially damaged.
- iv. Bridges: Bridges over channels are used to cross roads near the villages. The Bareji Distributary has four bridges which are in a fairly good condition, whereas, side raising walls are either missing, or need repairs.

B,C, D& E. Sedimentation, Vegetation, Weak Banks and Erosion

The most serious problem in earthen channels is sedimentation, which is often the case for lined channels also. Erosion has also been observed in a few channels.

Vegetative and aquatic growth has also created difficulties in the flow of water. The farmers of this distributary are aware of this problem, and therefore, they decided to desilt this distributary on a self-help basis. For this purpose, the length of the Bareji Distributary was divided into **24** equal parts, and each WUA undertook to clean 500 meters of this distributary.

F. Wider Cross Sections

Due to non-maintenance of this distributary, the shape of this distributary has changed and its cross sections have widened with the passage of time. These wider cross sections are also one cause for slow velocity of water in the distributary.

G. Lack of Inspection Path

Inspection paths serve a dual purpose of banks and conveyance path. The physical condition of banks of the Bareji Distributary is in good at the head and middle, while the tail portion is weak in many places.

The estimate of these costs is given in Table 47.

Type of Maintenance	Amount
Essential Structural Maintenance	102,786
Excavation of Sediment	23,546
Weak Bank Improvement	53,900
Dressing and Repairs of Inspection Path	51,472
Total:	231,704
Per CCA acre:	19.43

Therefore, it can safely be assumed that maintenance cost per acre requirement below the head of this distributary **will** be Rs. **19.43** per CCA acre.

5.3.1 Operations and Maintenance Cost of Bareji Distributary

From Sections 5.2 and 5.3, it is estimated that the O&M costs of the Bareji Distributary will be Rs. **56.20** per CCA acre, i.e., establishment cost Rs. **36.77** per acre and maintenance cost Rs. **19.43** per CCA acre. While, in the first year, this cost will be higher by Rs. **7.85** per CCA acre due to the purchase of capital nature items. The share of O&M costs by the farmers of Sindh to cover the costs of the irrigation infrastructure comes to Rs. **108** per acre (see Chapter 4 for more details). Therefore, O&M costs above the distributary total Rs. **51.80** per acre. The total amount of Rs. **108** per acre to the farmers may seem to be on the higher side. Based on experience in Mexico, where, after the introduction of farmer management, the staffing levels within the farmer-operated areas declined by as much as two-thirds. The experience in Senegal, where farmers demanded the right to hire their own staff, choosing SAED (the agency providing irrigation services) operators only if they had performed well (and even then reducing

their salaries from the full civil service package). There is a reasonable chance that the same situation may also prevail in the province of Sindh. Therefore, a total O&M cost at Rs. 100 per acre will be reasonable for recovery from the farmers.

These figures can be compared with the findings of Dr. Christopher Perry. In his status report, the estimated requirement for O&M expenditures at the level of the division has been calculated at Rs. 81 per CCA acre, the breakdown of which is Rs. 43 below the distributary, and Rs. 38 above the distributary.

5.3.2 Suggested *Abiana* to the Bareji Distributary WUF

Based on the analysis in Section 5.3.1, the Bareji Distributary WUF has suggested a flat rate charge of Rs. 100 per acre to its members as *abiana*. In addition it has also been suggested that the WUF charge an annual membership fee of Rs. 10 per acre to its members. This additional amount should be treated as reserve funds by the WUF, and may be used to pay for unusual expenditures, like capital replacements, consultants' fees, emergency repairs, etc..

5.3.3 Justification of the *Abiana* Rate

The Revenue Department is responsible for the assessment and collection of *abiana*, however, the Irrigation Department assists the Revenue Department at the time of assessment. Their *modus operandi* has been explained in detail in Chapter 2 of this report.

The Revenue Department, upon request, provided figures of various taxes assessed during the previous 5 years, i.e., from 1991-92 to 1995-96. The Revenue Department makes assessments on the basis of *dehs*, and not on the basis of hydrological boundaries of the Bareji Distributary. The figures for the last 5 years are given in Table 48.

Table 48. Assessed Agriculture Land Taxes for Previous 5 Years.

Year	<i>Abiana</i>	Other taxes
1991-92	241,621	96,914
1992-93	224,669	140,772
1993-94	253,950	242,769
1994-95	325,958	269,486
1995-96	420,882	132,445
Average	293,416	176,477
CCA acres	18,217	18,217
Per CCA acre	16.11	9.68
Latest Assessed	23.10	7.27

Note: ~~Other~~ Taxes include; Local Cess, Land Revenue and *Usher*.

Source: Revenue Department, Mirpurkhas.

The different taxes payable by the farmers of this distributary, per CCA acre, have been analyzed in Chapter 3. These values, when compared with the assessed figures of the Revenue Department, are given in Table 49.

Table 49. Comparison of Agriculture Land Taxes Assessed and Payable

Particulars	<i>Abiana</i>	Other Taxes
Payable on the basis of survey per CCA acre	62.00	186.00
Revenue Deptt. assess. (latest)	23.10	7.27
Unexplained Difference per CCA acre	38.90	178.73

This unexplained difference of Rs. 217.63 per CCA acre can be explained on the basis of the findings of the interim report captioned “Financial Feasibility Analysis of Operation and Maintenance Costs for Water Users Federations on three Pilot Distributaries in Province of Sindh, Pakistan” (A. Sohani, 1997). Here, he concludes that farmers pay about Rs. 64.51 per acre as water-related charges (rent-seeking) to the Irrigation and Revenue Departments, and that the remaining unexplained amount of Rs. 153.12 per cropped acre can be considered as a saving in the payment of taxes by the farmers.

5.3.3.1 Conclusion

The following points form the basis to conclude the justification of the *abiana* rate (Rs. 100 per acre) suggested to the Bareji Distributary WUF:

- a. Presently, the *abiana* rate payable comes to Rs. 62 per acre. The suggested rate of Rs 100 per acre will increase *abiana* payable by Rs. 38, or by 61 %. Taking the examples of Senegal, where farmers paid an irrigation service fee 2 to 4 times as high after the transfer, and Mexico, where the fees increased by 400% to 600%. Comparatively, this suggested increase of 30% in *abiana*, is insignificant.
- b. On average, the farmers are depositing Rs 23.10 per acre as *abiana* to the Revenue Department (1996-97). However, considering the amount of rent-seeking paid, along with this tax, the total amount comes to around Rs 87.15 per acre. Therefore, by collecting the *abiana* themselves, the farmers will pay more Rs 12.85 per acre (Rs 100 – Rs 87.15).
- c. Apart from rent-seeking, the farmers’ agriculture income is presently Rs 13,445 per cultivated acre, or Rs 6,266 per CCA acre (see Chapter 3 for details). The suggested rate will decrease this agricultural income by only Rs. 38, i.e., by 0.28% per cultivated acre, or 0.61% per CCA acre.
- d. The WUF will keep Rs 56 per acre for the O&M of the Bareji Distributary, while they will pay the Area Water Board Rs 44 per acre, which is Rs 20.90, or 90.48%, more than what is currently being collected from the farmers.
- e. Presently, the Sindh Irrigation Department’s cost is Rs. 94 per CCA acre. The estimated cost will be Rs 108 per CCA acre, which is inclusive of estimated

costs below the head of the distributary / minors. The suggested *abiana* rate is Rs 100 per acre. Nearly all the current staff employed with the Irrigation Department will fit into the suggested staffing requirement of the Bareji Distributary WUF. Therefore, the costs to maintain this distributary can be deducted from the total amount payable to the SIDA. Since the FOs are expected to be self-sufficient within a period of seven years, therefore, in the interim period, the GoP is expected to finance the shortfall in the Irrigation Department's budgets.

5.4 COLLECTION OF ABIANA FROM WATER USERS

The farmers of the Bareji Distributary have been organized using the two-tier approach, i.e., WUOs at the level of the watercourses, and a WUF at the level of the distributary itself. This is a very effective organizational setup, as delegation of authority takes place from top to bottom. In view of this setup, the following *modus operandi*, for the collection of *abiana*, is suggested:

- a. The WUF to negotiate with the AWB for the supply of water at least equal to the average of what has been received in the previous year. The IIMI-Mirpurkhas field station has the time series record of the discharge for the year 1997.
- b. The WUF to distribute the sanctioned discharge among the different watercourses in proportion to the CCA of each watercourse. This discharge list to the various watercourses should be approved in the general meeting of the federation.
- c. The *moghas* of all the watercourses to be designed in accordance with the water discharge calculated in step b. above. The *moghas* situated at the head and middle reaches of this distributary to be Adjustable Proportional Modules (APM), so that excess water received, if any, at the head of the distributary, does not flow into the fields. While the *moghas* in the tail reaches of the distributary are preferred as open flume type, since excess water, if any, may flow into the fields as no excess water escapes, have been provided in the existing system, and over-topping of water from the distributary may create major maintenance problems.
- d. The physical condition of the distributary should permit flow of water to the tail reach *moghas* freely.
- e. The relevant WUO's to prepare *warabandi* lists of its members in proportion to the land holding of each farmer along their watercourse. These *warabandi* lists to be approved in the WUOs' general meeting, and a copy be given with the WUF for their record.
- f. Once the lists of *warabandi* are approved, the farmers should be free to choose their own set of cropping patterns, and / or to sell their share of water time in part, or full, to other farmers, like water markets.
- g. If lift machines are to be installed in certain fields, their capital and O&M costs will be the responsibility of the respective WUO.

- h. Installation of the tubewells and conjunctive use of ground water and the canal water should be allowed only after obtaining permission from the WUF, which will normally grant approval, except in such cases where the ground water quality is not good for irrigation use. **All** expenses relating to tubewells should be the responsibility of individual farmers, and they will be free to buy or sell this water.
- i. The WUF's financial year is suggested from July 1 to June **30** of the next year.
- j. WUOs to collect *abiana* bi-annually from its members; at the start of the cropping season, i.e., in advance, while the annual membership fee should be collected once a year in the month of July each year.
- k. The WUO's Finance Secretary should prepare bank *challan* forms of its bank account in triplicate, indicating the amount of *abiana*, membership fee and / or other charges payable in different columns, and after obtaining the organization's approval, issue these to the members. The members should deposit the amounts into the bank account through these *challans*, keep one copy for themselves, the bank will retain one copy, while the bank should be instructed to provide the third copy to the WUO's Finance Secretary.
- l. **A** period of 10 days is to be given to the members for depositing these amounts into the bank account; failure to deposit the same will result in a surcharge of Rs 50 per day, up to a period of 10 days, to be levied on the members in default. On complaint from the WUO Finance Secretary, the WUO may consider to stop the water turn of any such member who does not deposit the amount within **20** days of the receipt of these bank *challans*. **A** WUO meeting to be called to decide ways in which this amount can be recovered.
- m. The WUF Finance Secretary should prepare bank *challan* forms in triplicate of its bank account, indicating the amount of *abiana*, membership fee and / or other charges payable in different columns, and after obtaining the federation's approval, issue these *challans* to the relevant WUO's. The relevant WUOs should deposit the amounts into the bank account through these *challans*, keep one copy for their personal records, the bank will retain one copy, while the bank should be instructed to provide the third copy to the WUF's Finance Secretary.
- n. **A** period of 30 days is to be given to the WUO's for depositing these amounts into the bank account: failure to deposit the same will result in a surcharge of Rs 100 per day, up to a period of 10 days, to WUO's in default. On complaint from the WUF Finance Secretary, the WUF may issue a warning to such WUOs who fail to deposit the amount within 40 days of the receipt of these bank *challans*. **A** meeting of the WUF be called to decide ways in which this amount can be recovered.

This system of depositing the payments into the bank accounts of the relevant WUOs and the WUF will ensure safety of *abiana* thus collected. Furthermore, a surcharge for late deposit of *abiana* will ensure timely collection from the water users and the WUO's. **Also** suggested, is that the Finance Secretaries of the relevant **WUOs**

should present abiana collection status reports at the end of 20 days, in a special WUO meeting. Similarly, the WUF Finance Secretary should present an **abiana** collection status report at the end of **40** days in a special meeting of the WUF.

5.5 PAYMENT OF COST OF WATER TO THE AREA WATER BOARD

The major task of the WUF is to negotiate the allocation of water discharge for the Bareji Distributary with the **AWB**, and deductions in abiana due to usage of lift machines and / or short delivery of water, if any. Once the discharge is approved, the WUF should maintain a proper record of the discharge being received at the head of the distributary. The discharge rating tables may need revision, and similarly, gauges installed may need to be replaced. Primarily, this will be the duty of the Assistant Engineer hired by the WUF, who, with the assistance of the *tandails*, will monitor the discharge at the head regulator regularly.

The AE of this distributary will advise the WUF about the average discharge received from the AWB in writing, **as well as** his comments about whether agreed amounts of abiana should be paid in full, or certain deductions are to be made for short delivery *in lieu* thereof. In case of short delivery of water at certain intervals, the AE will be responsible for agreement, in writing, with the concerned **AWB** person.

The WUF Finance Secretary, based on the recommendation of the AE, and after obtaining approval from the WUF, will, at the end of each cropping season, deposit the agreed amount of up-stream abiana into the Government treasury. Subsequently, he will present a status report in the first next meeting of the WUF.

5.6 CONFLICT RESOLUTION

These may involve purely administrative issues. The WUF will have to act in accordance with its by-laws; however, certain issues may involve financial matters. Some of these issues, and the remedial actions to be taken, are suggested as follows:

5.6.1 Theft of Water

The irrigation system in Chile is considered a very good example to be cited for farmer-managed irrigation systems. In Chile, the water users groups are **known as Comunidad de Aguas (CA)**, according to a report titled "Irrigation Water Management in the Irrigation System of the Diguillin River, Chile" (Ineke M. Kalwij, **1994**). Water theft is the major cause of conflicts at canal, **as well as** field levels. The role of the **CA** in conflict management is limited. The president of the canal sometimes goes to the police and the judge for assistance.

There is a reasonable chance that this situation may also take place in this command area. Settling such conflicts **through** police and the judiciary requires both, time and money, therefore the Bareji Distributary's WUF is suggested to consider this act

very seriously, **as** this will mean breach of trust, which each water user has towards the other. The *darogha*, who is supposed to make a round of the distributary on bicycle 3 to 4 times a day, and *baidars* working in the three reaches of this distributary should be able to notice it immediately, even if the theft takes place in the middle of the night. In such instances, a WUO meeting should be called immediately, and the farmer involved should be asked to explain his position. **An** estimate of the loss to the other farmer, due to this act, should be made, and after levying a surcharge equal to 100% of the loss assessed, the accused farmer should be penalized. The penalized farmer, however, should have a right to appeal to the WUF, which, in such cases, should hold an open inquiry and confirm, or may rescind, the decision of the WUO.

The SIDA act explains the Powers and Duties of the AWB under Chapter VI to this act, while it explains Powers and Duties of FOs under Chapter VII to this act. Interestingly, both these chapters are silent on this issue of water theft. However, Clause 6 of Section 26 under Part C, captioned “Functions and Powers of FOs”, states that “Any other power and function not being inconsistent with the functions and powers given above which may be vested in the FO’s under the By-laws and Regulations framed by the Authority”. Since the FO’s are responsible for obtaining water from SIDA, or the AWB, and supply the same to its members, and are also responsible to collect the agreed water charges / other dues, if any, from its members under the SIDA act. Therefore, in order to stop water theft, it is suggested that the Bareji Distributary WUF obtain approval of its By-laws, with necessary clauses legalizing any actions that may be required to curb water theft.

5.6.2 Theft of Trees on the Inspection Paths

Certain areas around this distributary is supposed to be the property of the GoS, where the inspection path is also situated. Some instances of the theft of trees planted along the distributary, and besides the inspection path, have taken place in the past. Upon the transfer of this distributary to the farmers, the WUF will be responsible, for safeguarding this property.

The WUF should hire the *darogha* for this distributary to keep a record of these trees, and to report any unauthorized cutting of trees to the AE immediately. The AE should inform the WUF, which should **ask** the WUO of that respective area to hold an inquiry and present its findings to the WUF. The farmer thus found guilty should be penalized for the market value of the trees, plus a fine equivalent to 100% of the market value of the trees.

5.6.3 Other Issues

The WUF should follow a strict policy of non-interference in the affairs of the WUOs. Any conflicts arising among the farmers of a watercourse should be the responsibility of the concerned WUO, and the WUF should encourage settlement of the disputes at the local level. However, the right of appeal to the WUF should be given to the farmers.

5.6.4 Honorarium to the **Office** Bearers of the **WUO**'s and the **WUF**

The elected **WUO**, and **WUF**, office bearers will spend their time and efforts to maintain this distributary; logically, they should be compensated for their time and efforts. However, experiences in other parts of the world are different, and normally, the office bearers work on an honorary basis. The reasons may not be possible to quantify, as these are qualitative in nature. These reasons are explained as follows:

1. The office bearers have been elected, on the basis of their previous records, by the farmers, such **as**, their involvement and ability in the settlement of disputes, they are socially respected and have been involved in the social development of this command area, without expecting any monetary benefits in return. Hence, recognition is an incentive for these office bearers.
2. The office bearers ,elected have a voice in system management, i.e., feeling of importance, which is an incentive in itself.
3. The office bearers are elected **from** the grassroots level, if their performance is good, they can be elected as members to the **AWB** of the main canal also. This is another incentive for them.
4. **On** the basis of their performance, they can run for the parliament elections, which, to date has only been possible for people who are born with a golden spoon in their mouths.

Therefore, **an** honorarium to the office bearers of the **WUOs** and the **WUF** is not suggested. Furthermore, if the farmers are not satisfied with the performance of any of the office bearers, they should have the right to remove such office bearer by calling a general meeting **of** the concerned **WUOs**, or the **WUF**, **as** the case may be.

5.6.5 Equitable Distribution of Water

This is an issue, which, if not addressed properly, may result in the failure **of** the **FOs** and in turn, the whole financial framework in the future, despite system rehabilitation, or upgrading of physical facilities. Reduced costs to the farmers; in spite of the fact that *abiana* rates tend to increase, especially if proper O&M is undertaken; but, system transfer will reduce the need for side payments **to** the agency staff, resulting in a reduction in the costs of irrigation facilities. Better irrigation facilities, services, or even "voice" in system management, and most important, the ownership of the irrigation system, are very powerful incentives for the farmers to participate in the irrigation system's management and upkeep.

However, in the long run, the farmers of the Bareji Distributary would certainly like to see a return to their investment of time, material and enhanced *abiana* rates in a more rational manner, which can be only in the form of **an** equitable water supply. The **IBIS** in Pakistan is not demand-based; rather, it is a supply-based irrigation system, therefore, equitable water distribution will take place only when water available at the head of the Bareji Distributary is distributed among the farmers in proportion to their

Table 50. Cash Flow Projections for Bareji Distributary for a Period of 10 Years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Particulars	(Rs.)									
Abiana Rate per CCA acre	100	111	124	138	154	172	191	212	236	263
Receipts										
Membership fee	119240	119240	178860	178860	238480	238480	298100	298100	357720	357720
Abiana Collected	1192400	1323564	1478576	1645512	1836296	2050928	2277484	2527888	2814064	3136012
Penalties/Surcharge	5000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Bank Profit	13825	15402	28969	38946	61810	94230	59615	99415	129596	184435
Cash inflow	1330465	1461206	1689405	1866318	2139586	2386638	2638199	2928403	3304380	3681167
Expenditure										
Abiana paid to AWB	524656	572352	643896	715440	786984	870452	965844	1073160	1180476	1311640
Salaries to staff	360000	405000	455625	512578	576650	648731	729822	821050	923681	1039141
Supplies & Services	51600	56760	63855	71837	80817	90919	102284	115070	129454	145636
Travel	16800	18480	20328	22360	24596	27056	29762	32738	36012	39613
Material for O&M	40603	44663	49129	54042	59446	65391	71930	79123	87035	95739
Machinery rent for O&M	114307	125738	138312	152143	167357	184093	202502	222752	245027	269530
Labor 1/3 of estimated cost	25598	28158	30974	34071	37478	41226	45349	49884	54872	60359
Consultancy fees	20000	15000	10000	10000	10000	25000	10000	10000	10000	10000
Audit fee	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000
Miscellaneous expenses	25000	25000	25000	25000	25000	600000	25000	25000	25000	25000
Transferred to WUO's	51196	56316	61948	68143	74957	82453	90698	99768	109745	120720
Capital Purchase	93600	Nil	105000	Nil	Nil	99600	Nil	135000	Nil	Nil
Cash outflow	1328360	1353467	1611067	1673614	1852285	2744921	2284191	2675545	2814302	3131378
Net Cash Flow	2105	107739	78338	192704	287301	-358283	354008	252858	490078	549789
Open. cash & bank balance	0	2105	109844	188182	380886	668187	309904	663912	916770	1406848
Clos. Cash & bank balance	2105	109844	188182	380886	668187	309904	663912	916770	1406848	1956637

Table 51. Projected Income and Expenditure Accounts for Bareji Distributary for a Period of 10 Years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Particulars	(Rs.)									
Income										
Abiana Collected	1192400	1323564	1478576	1645512	1836296	2050928	2277484	2527888	2814064	3136012
Penalties/Surcharge	5000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Bank Profit	13825	15402	28969	38946	61810	94230	59615	99415	129596	184435
Profit on disposal of Assets						23400		25000		
Gross Income	1211225	1341966	1510545	1687458	1901106	2171558	2340099	2655303	2946660	3323447
Expenditures										
Abiana paid to the AWB	524656	572352	643896	715440	786984	870452	965844	1073160	1180476	1311640
Transferred to WUO's	51196	56316	61948	68143	74957	82453	90698	99768	109745	120720
Salaries to Staff	360000	405000	455625	512578	576650	648731	729822	821050	923681	1039141
Supplies & Services	51600	56760	63855	71837	80817	90919	102284	115070	129454	145636
Travel	16800	18480	20328	22360	24596	27056	29762	32738	36012	39613
M&I expenses	180508	198559	218415	240256	264281	290710	319781	351759	386934	425628
Consultancy fees	20000	15000	10000	10000	10000	25000	10000	10000	10000	10000
Depreciation	18720	18720	39720	39720	39720	45600	45600	56600	56600	56600
Audit fee	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000
Miscellaneous Expenses	25000	25000	25000	25000	25000	600000	25000	25000	25000	25000
Total expenses	1253480	1372187	1545787	1713334	1892005	2690921	2329791	2597145	2870902	3187978
Retained Earnings/(Loss)	-42255	-30221	-35242	-25876	9101	-519363	10308	58158	75758	135469

Table 52. Projected Balance Sheets for Bareji Distributary for a Period of 10 Years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)
Fixed Capital Expenditure										
Fixed Assets										
MotorBike	70000	70000	70000	70000	70000	91700	91700	91700	91700	91700
Bicycle	3000	3000	3000	3000	3000	3950	3950	3950	3950	3950
Furniture & Fixture	15000	15000	15000	15000	15000	19650	19650	19650	19650	19650
Field Equipment	5600	5600	5600	5600	5600	7700	7700	7700	7700	7700
Computer & Allied			105000	105000	105000	105000	105000	160000	160000	160000
Total Fixed Assets at Cost	93600	93600	198600	198600	198600	228000	228000	283000	283000	283000
Cash & Bank Balances										
Cash-in-hand	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Cash-at-Bank	-895	106844	185182	377886	665187	306904	660912	913770	1403848	1953637
Total Cash & Bank Balances	2105	109844	188182	380886	668187	309904	663912	916770	1406848	1956637
Total:	95705	203444	386782	579486	866787	537904	891912	1199770	1689848	2239637
Funds & Liabilities										
Accumulated Depreciation										
MotorBike	14000	28000	42000	56000	70000	18340	36680	55020	73360	91700
Bicycle	600	1200	1800	2400	3000	790	1580	2370	3160	3950
Furniture & Fixture	3000	6000	9000	12000	15000	3930	7860	11790	15720	19650
Field Equipment	1120	2240	3360	4480	5600	1540	3080	4620	6160	7700
Computer & Allied			21000	42000	63000	84000	105000	32000	64000	96000
Total Accum. Depreciation	18720	37440	77160	116880	156600	108600	154200	105800	162400	219000
Fund Balances										
Opening Balance		76985	166004	309622	462606	710187	429304	737712	1093970	1527448
Add: Membership fee	119240	119240	178860	178860	238480	238480	298100	298100	357720	357720
Less: Ret. Earnings/(Loss)	-42255	-30221	-35242	-25876	9101	-519363	10308	58158	75758	135469
Total Fund Balance	76985	166004	309622	462606	710187	429304	737712	1093970	1527448	2020637
Total:	95705	203444	386782	579486	866787	537904	891912	1199770	1689848	2239637

6 SUMMARY OF MAIN FINDINGS

6.1 SOCIO-ECONOMIC SETUP

The population along this distributary is about 6,800. The climate is arid and sub-tropical. There are a number of castes residing in this command area, out of which 11 castes are considered to noticeably affect the socio-economic relations and power balance. Potential water users amount to about 1,141, and include *zumindurs*, owner-operators, lessees, *kamdars* and tenants. The average land holding size in this area is 46 acres. The literacy rate among farmers is 70%. The farmers follow a *Pacci Warabandi*. This area is primarily considered to be a cotton zone, although wheat is also very commonly sown by the farmers.

The main villages in this area are provided with electricity and schools (both, for girls and boys), and telephone facilities are also available in some villages. Health facilities are very modest, and people have to go to Mirpurkhas City for medical treatment.

Therefore, the socio-economic conditions of this area can be considered comparable with that of the people living in the suburbs of large cities.

6.2 CREDIT FACILITIES

Loans and credit facilities are available in this area through the Agricultural Development Bank of Pakistan. However, only a few *zumindurs* benefit from this facility, as most of the small landowning farmers find it very difficult to complete the required paper work. NRSP provides different loan and credit scheme packages. Mirpurkhas Sugar mills also provide loan and credit facilities to interested sugarcane growers in this command area.

6.3 EFFECT OF TILE DRAINAGE SYSTEM ON CROP YIELD, CROPPED AREA AND NET INCOME

Various studies have been conducted to evaluate the impact of drainage on crop yield, cropped area and net income. The ultimate objective of the LBOD project is to improve the soil productivity and increase per acre yield of crops through this drainage system.

The result of private tile drainage unit installed near Mirpurkhas reveals that cropped area has increased about 65% of total and the average net farm income has increased from 333% to 488%.

6.4 DRAINAGE INFRASTRUCTURE

The drainage network in this command area is quite comprehensive, and is in working condition. There are two types of drainage facilities available in this command area; surface drains, with four surface drains, and subsurface tile drainage, with **13** pumps installed.

6.5 TAX COLLECTION AND TAX ASSESSMENT PROCEDURES

In this report, the *abiana* payable for the *rabi 96-97* and *kharif 97* seasons amounts to **Rs. 62** per acre. The average *abiana* assessed during the previous 5 years, as per the records of the Revenue Department, is Rs. **16.11** per acre, while *abiana* assessed in **1995-96** was **Rs. 23.10** per acre; the *abiana* recovery rate is in the range of **68%** to **75%** of the assessed amount. Certainly, the present procedures cannot be termed as effective. It is interesting to note that the cropping intensity as per record of the Revenue Department is in the range of 80% to **82%** whereas actual cropping intensity was observed as **90.59%**.

6.6 IRRIGATION DEPARTMENT RECORDS

During the field surveys, it has been noted that names of certain *zamindars* who have died are still appearing in the records of the Irrigation Department. Hence, there is need to update the records of the Irrigation Department.

After the installation of the drainage network, the maps of the Revenue Department of the Bareji Distributary were not updated. The Irrigation Department should take steps to update the maps.

6.7 WATERLOGGED, SALINIZED AND ABANDONED TRACTS OF LAND

The farmers consider tracts of land with groundwater on the surface as waterlogged (133 acres), tracts of land on which layers of white salts are visible as salinized (**798** acres), and tracts of land with sand dunes as abandoned (**3,938** acres). The effect of waterlogging and salinity on the soil is unknown. Therefore, a comprehensive survey of these tracts of land should be undertaken in order to determine the extent of waterlogged and salinized areas, and to propose remedial measures to reclaim these tracts of land. With a drainage network already in place, the answer probably lies in the availability of additional water to leach the salts from the soil profile of the affected lands.

The installation of tubwells, surface drains and tile drains (subsurface drains) can control waterlogging, but soil salinity remains a problem and in many places. Sodicity is a main concern, which needs chemical amendments and leaching for reclamation. This means that a hydrological approach alone is not sufficient for effective control of salinity, alongwith waterlogging. For this purpose, the farmers should be made adequately aware of employing chemical amendments, like gypsum, or treatment of irrigation water with

sulfuric acid and biological (e.g., salt tolerant crops) techniques and leaching requirements for reclaiming salt-affected lands, besides lowering the water table through training measures’.

The assumption is that the present cropping pattern estimated loss in net agriculture revenue to this distributary due to waterlogging, salinity and abandoned lands, is Rs. **65.464** million per annum.

6.8 CROP YIELDS

The crop yields for sugarcane, rice and wheat for the *kharif 97 rabi 96/97* along this command area are better than the average yields for the same crops of Pakistan. The yield for cotton is on the lower side. The survey reveals that the crop yields for the five major crops, among **24** watercourses of this distributary, vary between **1.7** times to **3.6** times, and that about **25%** of the watercourses have yields less than the mean yield of this distributary. Efficient cultural, agronomic and irrigation practices can also bridge this difference.

6.9 GROSS AGRICULTURE REVENUE

The **gross** agriculture revenue of the Bareji Distributary is Rs. 10,804 per acre. When compared with national figures (Rs. **3,644** per acre), or **LBOD** baseline figures (Rs. **5,263** per care), the gross revenue seems to be on the higher side. Various IIMI-Pakistan surveys have concluded **gross** revenue in the range of Rs. **3,240** to **Rs. 10,120** per acre, therefore, the mean **gross** agriculture revenue for this distributary indicates that the incomes of farmers are very reasonable.

6.10 NET REVENUE FROM CROPS

Return on investment from the sugarcane crop is the highest (Rs. **19,680** per acre). However, this is an annual crop. A combination of the chilies and wheat crops earn (Rs. **15,521.60** per acre), less profitable for the farmers of this distributary. Farmers prefer sugarcane crop due to two other reasons: (1) negligible danger of pest attack, hence, it is a low risk investment; and (2) roots of this crop can be used as seed for a period of two to three years, therefore, less average cost of plantation and seed bed preparation is needed.

6.11 NET AGRICULTURE INCOME

The farmers of the Bareji Distributary earn a mean farm agriculture income, after taxes, of **Rs. 13,445** per cropped acre, or **Rs. 6,266** per **CCA** acre. The cost of agriculture land in this area was estimated at **Rs. 70,000** per acre, thus, their return on investment is **19.21%**(13,445/70,000). This percentage is far better than investing this amount in a

¹ “Personal Communication”. Dr. Muhammad Aslam.

fixed deposit scheme, which generates interest at the rate of **17.5%** nonetheless; however, after considering the time value of money and taxes, this drops to **2.44%**.

The net farm income in percentage to the farm revenue, is **57.99%**, which is very good, and much better than the small and medium scale business concerns in the cities, whose percentages are between **25** and 30%. Considering that the socio-economic conditions of this distributary are comparable with the suburb areas of the big cities (see Section 6.1.), farmers in this command area can be considered **as** economically comfortable.

6.12 EXPENDITURE ON THE PROVINCIAL IRRIGATION DEPARTMENT

The GoS spends a total of Rs. **1,236.691** million (**Rs. 93.73** per acre) on the Provincial Irrigation Department, out of which 71% (**Rs. 66.16** per acre) **is** spent on the irrigation establishment, while the rest, i.e., **29%** (**Rs. 27.57** per acre) is spent on maintenance activities.

In **1986**, Nespak prepared a Maintenance Yardstick for the Irrigation Department. This yardstick, updated to **1996-97** price levels, requires an amount of **Rs. 924.96** million (**Rs. 68** per acre) per annum for maintenance activities; in IIMI-Pakistan's opinion, these figures are a minimum level.

In order to maintain the irrigation infrastructure to meet the system adequately **so** that the design service **can** be provided on an ongoing basis, the total O&M cost amounts to **Rs. 134.16** per acre, and consists of **Rs. 66.16** per acre **as** establishment cost, and **Rs. 68** per acre **as** maintenance and improvement cost. Hence, the Irrigation Department will under-spend by **59%** on the maintenance activities during the year **1997-98**.

6.13 SIDA ACT

On **15 September 1997**, the Sindh Assembly passed a bill to provide for the establishment of the Irrigation and Drainage Authority (SIDA). The authority is intended for the management of equitable distribution of irrigation water and effective drainage and flood control, sustainable on a long term basis through participation of beneficiaries in the operation and management of the irrigation drainage network, and to provide for matters connected therewith, or incidental thereto. The salient features of this act are as follows:

1. SIDA will supply water to the AWB at rates that will make provision for meeting the O&M cost of the system within a period of **7** to 10 years.
2. The components of O&M to be recovered from fanners in the form of *abiana* will be the full cost for Irrigation Canals and Secondary Canals.
3. FOs will collect water charges from its members, and for the supply of irrigation water to the concerned AWB, or SIDA.

4. FOs may hire, engage or employ any consultants, advisors and employees **as** may be deemed necessary, for the due and effective performance of **various** powers and functions.
5. FOs will submit to government within a period of 7 months, at the end of each financial year, a report on the conduct of their affairs for that year, including a financial statement for the year in question.

6.14 ABIANA MECHANISM

Of the three mechanisms in practice, namely: (1) crop-based charge; (2) volumetric charge; and (3) flat rate charge, the simple mechanism of charging a flat rate is suggested. The success of this method will depend on equitable distribution of water among the water users.

6.15 STAFFING REQUIREMENTS OF THE BAREJI DISTRIBUTARY

The following set of employees is suggested to the Bareji Distributary WUF in the initial stages:

Assistant Engineer	1	Administrative Assistant	1
<i>Darogha</i>	1	<i>Tandail</i>	2
Baildar	3		

Based on the above-stated staff and their logistic needs, the operational budget estimate for the first year amounts to **Rs. 0.438** million (Rs. **36.77** per acre). This amount has been considered **as** the downstream establishment cost for the Bareji Distributary.

6.16 MAINTENANCE COSTS FOR THE DISTRIBUTARY

The maintenance costs for this distributary are estimated at Rs. 0.231 million (Rs. **19.43** per acre) per annum. These estimates are based on the maintenance surveys conducted by the IIMI-field staff. This amount has been considered **as** the downstream maintenance cost for the Bareji Distributary.

6.17 SUGGESTED ABIANA

The estimated total O&M cost comes to Rs. **134.16** per acre for the Sindh Provincial Irrigation Department. The water consumed for non-agricultural purposes is about **9.17%** of the water available for consumption to the province of Sindh (see Chapter **4** for details). As the non-agricultural use of water generates high economic returns, therefore, it has been assumed that this use be charged twice the rate for agricultural purposes. Thus, the cost of water to the farmers amounts to **Rs. 108** per acre. Considering the experiences in Mexico and Senegal, wherein the staff complement was decreased upon transfer of the irrigation system to the farmers, a flat rate of Rs. 100 per acre (Establishment **Rs. 48** and maintenance Rs. **52**) is suggested **as** the rate for *abiana* to be charged to the farmers.

The FOs will pay Rs. 56 per acre (Establishment Rs. 37 and maintenance Rs. 19) as downstream cost, while they will pay the AWB Rs. 44 per acre (Establishment Rs. 33 and maintenance Rs. 33) as downstream cost.

In order to meet the O&M costs in future, an increase of 10.25% in the per annum rate of abiana is suggested.

In addition to the abiana, the farmers will pay Rs. 10 per acre as annual membership fee to the federation. This fee will be increased subsequently by **Rs. 5** per acre after every two years.

6.18 COLLECTION AND PAYMENT OF ABIANA

The same principle as that of the two-tier system should be adopted, which has been used to organize the farmers of this canal command, and abiana should be collected by the relevant WUOs from its members and deposited with the WUF. The abiana should be collected in advance at the start of each cropping season. The WUF should deposit abiana to the **AWB** at the end of each cropping season. This is in line with the current practice, wherein the assessment and collection of **abiana** takes place at the end of each cropping season.

The farmers should deposit their share of abiana into the bank, for which the relevant finance secretaries should issue them bank challan forms, in triplicate, in advance.

Certain time limits should be given to the farmers within which to deposit this amount; a period of 10 days is suggested, and failure to meet this deadline will result in the farmers at default being penalized at Rs. 50 per day per acre.

6.19 CONFLICT RESOLUTION

The WUF should follow a strict policy of non-interference into the affairs of the WUOs, and should encourage settlement of disputes at the level of the concerned WUOs. However, the farmers should have a right to appeal to the WUF. Theft of water should be taken seriously as it means breach of trust; and based on the experiences in Chile, it is suggested that the WUF should insert necessary clauses in its by-laws so that it has the legal cover to settle these issues. **Thus**, the aggrieved farmers do not have to waste their time and money by seeking justice through the police and judicial system.

6.20 HONORARIUM TO OFFICE BEARERS

The recognition, and feeling of being important and their chances to run for parliament and the AWB membership for good performance, are considered very strong qualitative incentives in return for their investment of time and effort. Therefore, no honorarium to the office bearers of the farmer organizations is suggested.

6.21 EQUITY IN WATER DISTRIBUTION

In the long run, it will be difficult to satisfy the majority of farmers with incentives like system rehabilitation, reduced costs by exterminating side payments to the agency staff, or even “voice” in system management and ownership of the irrigation system, or by keeping them involved in different activities. They would certainly like to see a return to their investment of time, material and enhanced *abiana* rates in a more rational manner and tangible form. Only better water supply in an equitable manner will satisfy the majority, and can convert these FOs into sustainable organizations and guarantee the success of a Business Plan.

The IBIS in Pakistan is not demand-based, rather it is a supply-based irrigation system, therefore, equitable water distribution will take place only when water available at the head of the Bareji Distributary is distributed among the farmers in proportion to their individual land holdings. This distribution of water will require re-sizing and re-calibration of the *moghas* (modules or outlets), keeping in mind the allowance of water required at the start, and at the end, of their *warabandi* turns.

6.32 BOOKS OF ACCOUNTS AND INFORMATION IT CAN PROVIDE

Initially, a double entry book-keeping system, consisting of one single column cash book and a ledger, on cash basis, is suggested. All transactions should be through the bank, and in no manner should cash transactions take place except for an imprest to be kept with the administrative assistant of the WUF. Cheques should require at least two signatories, and proper supporting documents for expenditures incurred should be kept.

The relevant finance secretaries should balance their books of accounts and draw trial balances at the end of each month. In each monthly meeting, they should present the accounts report, consisting of position of cash-imprest and cash-at-bank, recoveries in default, collection of receipts and expenditure incurred during the period.

The projected cash-flow statement, income and expenditure account, and the balance sheet for a period of 10 years have been prepared and are contained under Section 5.8 of this report.

The projected income and expenditure accounts reveal that each year the Bareji Distributary WUF, on average, will incur a loss of **Rs. 36,416**. Therefore, it will not be possible to levy income tax on this federation in the near future. The federation will cover this loss by collecting membership fees from its members.

The cash flow projection statements give a good liquidity position for this federation over the period of 10 years. The farmers will be able to finance the expected major overhaul of the irrigation infrastructure of their distributary by incurring an estimated cost of **Rs. 600,000** in Year 6.

6.23 COST BENEFIT ANALYSIS

The arguments below indicate that it is not possible to quantify the benefits of transfer of irrigation management to the farmers. Further, an alternative approach and likely benefits arising thereto, **are** discussed.

6.24 REVIEW OF AVAILABLE LITERATURE

The **main** justification for transfer of irrigation management to farmer organizations appears to be to reduce the cost of irrigation management to the government. Agency budget stringency has contributed to this movement, **as well as** the belief that farmers organizations can better manage irrigation systems, at least at the lower levels (Vermillion, 1997).

In order to evaluate the success, or failure, of irrigation management properly, researchers need a measure of irrigation performance. Unfortunately, there is not **a** single agreed upon standard measure of irrigation performance. Not only does it depend on the perspective of the viewer, but also on the importance of certain variables in the context. Success to a farmer may mean reducing cost of water, while maintaining a certain level of service.

One² researcher has used adequacy of water supply, level of system maintenance and degree of rule conformance **among** cultivators. Another³ used cropping intensity, status of infrastructure, and water availability (Herb Blank, paper presented in National Workshop on South Africa Water Law).

As a result of management transfer, an increase in fee collection is often observed. Farmer organizations become more involved in making financial decisions, farmers are given more voice when determining expenditures, and often, there is more transparency **in** financial matters. The available evidence shows that where there is a subsidy, turnover increases cost to farmers (Dr. Vermillion).

Therefore, in the short run, benefits for farmers organizations may not be expressed quantitatively in the farmers' favor. However, the GoS appears to gain in economic terms **as** a result of management transfer; the abiana recovered from the Bareji Distributary during the year 1995/96 **was** Rs. **23.10** per acre, while the estimated abiana suggested in this report amounts to Rs. 100 per acre. Hence, the expenditure by the GoS on Non-development Budget (NDB) may be reduced by about Rs. 0.793 million, **thus**, in return, reducing the overall budgetary deficit.

² "Institutions and Collective Action: Self-governance in Irrigation" by shui Yan Tang. San Francisco, California, USA: Institute for Contemporary Studies Press, 1992.

³ "Institutions, Incentives and Irrigation in Nepal by Paul Benjamin, Wai Fung Lam, Elinor Ostrom, and Ganesh Shivakoti. Decentralization, Finance and Management Project, Burlington, Vermont, USA, Associates in Rural Development, 1994.

6.24.1 A Possible Alternative Approach

The authors believe that the benefits to the farmers, as a result of management transfer, are more likely possible to quantify in the area of water resource management, especially when seen in the context of a worldwide concern that exists about the sustainability of the natural water resources, as well as the emphasis for a more efficient use of these resources⁴. To elaborate further, a few paragraphs from the World Bank Operations Evaluation Study are reproduced as follows:

The World Bank is encouraging Water Resource Management because it is widely believed that farmers and irrigation-system operators will be facing increasing competition in the future for water from aquifers, streams, and lakes. Irrigators account for at least 70 percent of the water withdrawn from these sources today, but water almost invariably has a higher marginal value product for competing users, especially people who drink it and wash with it, and power companies that use it to generate electricity. Competition for water is already intense in the Middle East, in Central Asia, in North Africa, in growing parts of South, Southeast, and East Asia, and in Europe, and in western South and Meso-America.

Meanwhile, prospective sources of new irrigation water are becoming fewer. In general, the best dam and pumping sites have already been developed. Prospective sites for new dams, weirs, and pumps have become less attractive in economic terms. This means that larger dam and longer canals are needed per unit of water and per unit of land irrigated. Deeper drilling for pumping over greater vertical distances also becomes necessary. Like plant breeding and fertilizer use, irrigation faces the law of diminishing returns. At the same time, prices of foods and fibers that agriculture helps to produce, are at historic lows.

This new environment is considerably different from that of the 1960s and early 1970s. Therefore, future emphasis should be on upgrading existing irrigation, a process that uses engineering and social science intensively to improve irrigation service to people, lower unit costs, and conserve water where it is scarce.

This does not mean simply rehabilitating irrigation systems to standards designed for an environment that no longer exists. This approach recognizes that irrigation serves a changing world. This growing emphasis, a challenge for engineers, agriculturists, economists, and other social scientists, is consistent with the thrust of the Water Resources Management Policy Paper (William I. Jones, The World Bank and Irrigation, A World Bank Operations Evaluation Study).

6.24.2 Findings of Alternative Approach

Having organized and management transfer is not the end product, rather, it is the start of a new era. The farmers should learn about the strength of being organized, and

⁴ "Personal Communication", Ineke M. Kalwij.

how they can use it to their benefit. Many constraints remain within the farming system, e.g., lack of proper farm machinery, lack of good and timely availability of seed, fertilizers and pesticides, lack of agricultural produce storage facilities, and most important of all, efficient management of the present threat of scarce water resources⁵.

Studies show that there tend to be a greater intensification of production after turnover (Dr. Vermillion). Based on his findings, a hypothesis was made that after having achieved equity (Section 6.23), the farmers, especially those whose water duty will be reduced, are likely to look for more efficient cultural, agronomic and irrigation management practices in order to retain their agriculture incomes at the present levels,

Research conducted by IIMI-Pakistan has revealed that by using improved methods of irrigation for the cotton crop, savings in water application can be achieved between 15% to 30%, hence, a farmer can irrigate more land during his *warabandi* turn, and crop yields may increase by 10% to 20% (some studies have shown 40% to 60%). Further, for wheat, fodder and oil-seed corrugations (furrow), methods of irrigation are expected to increase crop yields by 5% to 15%, and savings in water application is possible between 10% to 20%.

Although these are interim results, the research is continuing, and final recommendations will take some time. Considering the importance of water resource management in the post-equity period due to the reasons stated in the previous paragraphs, certain calculations based on these interim results were made. To be on the conservative side, percentage increase in yield, and more land irrigated due to savings made in the water application, are taken as the starting point of the given ranges. The results of these computations are given in Table 53.

Table 53. Expected Increase in Net Agriculture Income by Adopting Improved Water Management Techniques.

Particulars	Cotton	Sugarcane	Wheat	Fodder	Chilies	Total
Total Cropped Land (acres)	2,786.85	1,160.94	2,303.00	549.48	570.95	--
Mean Yield per acre (kgs.)	674.17	32,800.00	990.00	2,447.09	665.00	--
Net Income before Tax per kgs. (Rs)	11.99	0.60	0.74	0.13	22.24	--
Net Income of Distributary (Rs)	22,470,575.55	21,784,579.20	1,687,177.80	174,801.51	8,444,122.12	54,561,256.18
Projected Cropped Land (acres)	3,204.88	1,217.63	2,533.30	604.43	628.05	--
Projected Mean Yield per acre (Kgs.)	741.59	34,440.00	1,039.50	2,569.44	698.25	--
Net Income before Tax per kgs. (Rs)	11.96	0.60	0.74	0.13	22.24	--
Projected Net Income of Distributary (Rs)	28,425,415.23	25,161,106.32	1,948,690.36	201,896.06	9,753,038.69	65,490,146.66
Increase in Net Income (Rs.)	5,954,839.68	3,376,527.12	261,512.56	27,094.55	1,308,916.57	10,928,890.48
Increase in Income per CCA acre (Rs)	499.40	283.17	21.93	2.27	109.77	916.54

⁵ "Personal Communication", Ineke M. Kalwij

The following assumptions have been made for the above calculations:

- Cotton cropped area will increase by 15%, while cotton yield will increase by 10%; the net revenue per acre has been kept at the current level.
- For the other crops in this table area, cropped area has been increased by 10%, while their yields have been increased by 5%; net revenues remain unchanged from the current price level.
- Orchards, sugarcane crop and the vegetable crops have not been considered in these computations.

Thus, by evolving improvements in on-farm water management, the Bareji Distributary WUF may increase the mean agriculture income of the farmers of this command area by **Rs. 917** per acre. Similarly, arrangements for proper farm machinery, good and timely availability of seed, fertilizers and pesticides by the farmers using their strength of being organized, will result in practicing intensive agriculture⁶. This area needs more data to calculate the change in the level of the agriculture incomes of the farmers, and may be considered during the preparation of the interim business plan.

Farmers lose a considerable amount of their revenues to the grain market agents. This happens with them around the world, and seemingly, farmers cannot get out of this circle. The Bareji Distributary WUF can maximize the profits of its members by constructing storage facilities. Although agents will still remain involved, the fanners will be able to obtain higher prices for their produce by selling them in the agriculture off-season. This area also needs more data to calculate change in the level of the agriculture incomes of the farmers.

Environmental Sustainability is another area in which the impact of the Bareji Distributary WUF needs to be evaluated. “Only a few studies refer to impacts of management transfer on the environment. The problems that have been mentioned, for example, are waterlogging and salinization due to poor management practices of new and inexperienced *kamdars* hired by farmer associations” (Dr. Vermillion).

In Pakistan, at the turn of the century, the groundwater was usually more than **20** meters (**62** feet) below the ground surface. Today, about **40** percent of the irrigated land has a groundwater table within 1.8 meters (10 feet) of the ground surface, with half of this land having the water table within **6** feet of the ground (WAFDA 1994).

In the Bareji Distributary command area, the average groundwater table depth from the surface is within **4.42** feet. A drainage network is installed and is in working condition. The SIDA act speaks of the recovery of **full** O&M costs for the irrigation and drainage network from the fanners. By using the installed drainage network, with reasonable care, certainly the fanners can enhance the life of this network, which will result in the distribution of its capital cost over a period of more years, thus, reducing the annual burden on the farmers.

⁶ “Personal Communication”, Prof. Gaylord V. Skogerboe



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ANNEXURES

ANNEXURE 2. JAMRAO CANAL STAFF.

S. No.	Designation	BPS	No. of Positions
1.	Executive Engineer	18	1
2.	Assistant Engineer	17	2
3	Sub- Engineers	11 & 16	21
4.	Divisional Accounts Officer	17	1
5.	Head Clerk	11	1
6.	Divisional Head Draftsman	13	1
7.	Divisional Draftsman	10	1
8.	Tracer	5	1
9.	Accounts Clerk	9	1
10.	Senior Clerk	7	4
11.	Junior Clerk	5	17
12.	Canal Assistants	6	5
13.	<i>Abdar</i>	5	52
14.	Telephone Operator/Signaler	5	45
15.	<i>Darogha</i>	4	56
16.	Naib Qasid	1	17
17.	<i>Darogha P.M.P</i>	4	21
18.	Govt. Mason	5	6

ANNEXURE 3. WORKED CHARGED REGULAR ESTABLISHMENT.

S. No.	Designation	BPS	No. of Positions
1.	Cook	5	1
2.	Head <i>Malhi</i>	5	3
3.	Plumber	5	1
4.	Assistant <i>Tandail</i>	1	1
5.	Garden colly	1	11
6.	Sweeper	1	7
7.	<i>Malhi</i>	2	24
8.	Regulation <i>Baildar</i>	1	20
9.	<i>Khalasi</i>	1	27
10.	Chowkidar	1	39
11.	Skilled <i>Jamadar</i>	2	5
12.	Boat man	1	2
13.	Chowkidar-cum-cook	2	2
14.	Fero printer	5	1
15.	Post runner	1	1
16.	Gate keeper	1	7
17.	<i>Baildar</i>	1	266
18.	Sub- <i>Darogha</i>	2	19
19.	Gauge Reader	3	6
20.	Driver	4	7
21.	<i>Tandail</i>	2	42
22.	Electrician	5	1
23.	Lab. Assistant	6	1
24.	Launch Driver	4	1
25.	Assistant Launch Attendant	1	1
26.	Fero <i>Khalasi</i>	1	1
27.	Store Cooly	1	1

ANNEXURE 4. SUBDIVISION MIRPURKHAS STAFF.

Sr. No.	Designation	No. of Positions
1	Assistant Executive Engineer	1
2.	Assistant Engineer	2
3.	Sub-Engineer	2
4.	<i>Darogha</i>	7
5.	<i>Abdar</i>	8
6.	P.W.D Mate	4
7.	<i>Tandail</i>	4
8.	<i>Khalasi</i>	5
9.	Senior <i>Jamadar</i>	1
10.	Gate keeper	3
11.	<i>Baildar</i>	28
12.	<i>Malhi & Malhi</i> cooly	12
13.	Plumber	1
14.	Electrician	1
15.	Cook	1
16.	Mason (<i>Mistry</i>)	1
17.	Govt. Mason (<i>Mistry</i>)	1
18.	Junior clerk	1
19.	Telephone	3
20.	Chowkidar	5
21.	Sweeper	3
22.	Driver	2

**ANNEXURE 5. DETAIL OF LIFT MACHINES AT THE VARIOUS OUTLETS OF
BAREJI DISTRIBUTARY, MIRPURKHAS .**

Sr. No.	WC #	Name of Land owner	Number of the Machine	Land irrigate acres	Running hours per week	Cost of fuel per week Rs.	other cost per season Rs.	HP
1.	11L	Irzi Khan	2762	75	90	1200	7000	16.5
2.	12L	Manjhi Khan	148	80	128	1650	6500	16
3.	8L	G.Rasool	SEL2891	17	2	20	6000	16.5
4.	10L	Yusif Bhangar	SD1105	70	69	1900	7000	18
5.	10L	Yusif Jhulan	-	16	10	180	3000	12
6.	10L	Ghulam Dal	-	150	99	1550	8000	16
7.	9R	Ch. Saeed	-	35	28	650	4000	12
8.	9R	Ch. Javed	-	15	12	250	3000	12
9.	9R	M. Bashir	-	15	12	250	3000	12
10	9R	G. Shabir	-	33	28	650	4000	12
11	10R	Agidino	-	100	147	3000	8000	12
12	10R	Ch. Rashid	195	20	13	225	3500	16
13	9L	H.Gh. Huss	786/6	130	66	2100	8000	22
14	9L	H. Peroz	188/08	32	20	700	4000	12
15	7L	Gul Mohd	-	34	12	400	3000	12
16	7L	H. Imam bux	-	12	4	50	1000	-

LO= Land owner, HP= Horse power.

ANNEXURE 6. NAME OF GENERAL BODY.

S.#	Watercourse #	Name of WUF Member	
1	1L	Ch. Arif Bashir	Ghulam Mustafa Laghari
2	2L	H. Dem Chandio	Imtiaz Panhwar
3	3L	Hajan Sahto	Faqir Usman Mangrio
4	4L	Ramzan Rajar	Allah Jurio Rajar
5	5L	Inayat Hussain Shah	Seetal Das
6	6L	Yar Muhammad Makrani	Khan Muhammad Marani
7	7L	Banhon Khan Lashari	Haji Imam Bux
8	8L	Ghulam Rasool Lashari	Khalil Ahmed Shar
9	9L	Haji Ghulam Hussain Lashari	Gul Muhammad Jhulan
10	10L	Muhammad Yousaf Bhangar	Ghulam Dal
11	11L	Ghulam Haider Lashari	Imdad Ali Lashari
12	12L	Manjhi Khan Lashari	Muhammad Saleh
13	13L	Muhammad Saleem Panhwar	Muhammad Hassan Lashari
14	1R	Abdul Ghafoor Mehar	Ali Akber Sodo
15	2R	Haji Iqbal Siddiqui	Arif Iqbal Siddiqui
16	3R	Aziz Makrani	A. Hameed Makrani
17	4R	Masoom Rajput	Teekam Das
18	5R	Mocharo Mangrio	Faiz Muhammad Mangrio
19	6R	Mehar Ali Lashari	Sajan Rajar
20	7R	Muhammad Halepoto	Muhammad Jaffer Jhulan
21	8R	Sher Khan Shar	Ch. Javed
22	9R	Misri Khan Shar	Ch. Saeed
23	10R	Muhammad Soomar Dal	Ch. Abdul Rashid
24	11R	Jamal Khan Lashari	Ghulam Rasool Lashari

**ANNEXURE 7. NAME AND DESIGNATION OF OFFICE BEARER OF WATER
USERS FEDERATION (WUF) SELECTED FOR BAREJI
DISTRIBUTARY.**

S.#	Name of the Office Bearer	Position	Land Holding at Watercourse #
1	Yar Muhammad Makrani	President	6-L
2	Manjhi Khan Lashari	Vice President	12-L
3	Haji Ghulam Hussain Lashari	General Secretary	9-L
4	Faiz Muhammad Mangrio	Joint Secretary	5-R
5	Arif Iqbal Siddiqui	Finance Secretary	2-R
6	Imtiaz Panhwar	Executive Member	2-L
7	Haji Daem Chandio	Executive Member	2-L
8	Muhammad Ramzan Chandio	Executive Member	4-L
9	Saleem Panhwar	Executive Member	13-L
10	Gul Muhammad Jhulan	Executive Member	9-L
11	Ghulam Mustafa Laghari	Executive Member	1-L

ANNEXURE 8. PROFILE OF WATER USER FEDERATION.

Particulars	No.	%	
Location of Nominee at Watercourse Level	Head	19	43
	Middle	11	24
	Tail	15	33
Age of Nominees	< 30 years	12	25
	31-60 years	35	73
	> 60 Years	1	2
Age of Experience in Irrigation Agriculture	< 20 Years	39	81
	21-24 Years	8	17
	> 41 Years	1	2
Education level of nominees	Illiterate	3	6
	Primary	17	36
	Matric	14	29
	College	14	29
Annual Income	800-25000	1	2
	25001-50000	5	10
	50001-75000	5	10
	75001-100000	6	13
	> 100000	31	65
Tenancy Status	Land Owner	37	77
	Owner operator	5	11
	Lessee	3	6
	Tenant	1	2
	Manager	2	4
Family Members	1- 10 members	33	69
	10-20 members	13	27
	21- 30 members	02	4
Land Holding	00 - 25 acres	22	46
	26 - 50 acres	7	15
	51 - 75 acres	8	17
	76 - 100 acres	1	2
	101 - 250 acres	8	19

ANNEXURE 9. DETAIL OF PUMP STATION.

Sr. No.	Pump Station	CCA of sump house (acres)	Design discharge (cfs)	Length of collector lines (fts)	Length of lateral lines in (fts)	Deh covered
1	3L-26	733	2.5	23520	76340	229
2	SD-19	750	2.5	22484	57080	224
3	SD-24	701	2.5	22324	60740	227
4	3L 25 A	587	2.5	15810	56000	240
5	SD-22	747	2.50	22690	50160	226
6	3L 22 B	533	1.5	15390	39100	239
7	SD 21 A	491	1.5	17080	49490	225
8	3L 22 A	758	2.5	21070	63530	238
9	3L 20	1078	1.5+1.5	35220	104180	238
10	3L 17	1023	1.5+1.5	33350	103490	236
11	3l 21 B	1045	1.5+1.5	27406	73070	240
12	3L 23	877	2.5	23256	56459	239
13	3L 24	550	1.5	12660	59430	240

Bareilly Distributary, Mirpurkhas
Gross Agriculture Revenue
For Kharif 1997

Area Cultivated for Kharif 1997 (in acres)

W/C #	10L	10R	11L	11R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total
Cotton	102.01	123.89	128.89	128.89	108.23	99.33	150.39	150.39	28.43	44.35	42.70	27.20	355.68	172.43	152.20	103.73	120.80	31.68	102.63	82.63	113.28	108.03	2,161.83
Rice	8.00	1.85	3.00	3.00	12.72	4.88	11.85	28.82	3.10	1.45	2.70	27.50	27.50	1.50	2.63	41.30	33.85	3.00	3.00	12.56	13.00	2.80	1,184.81
Sugarcane	51.00	19.83	2.00	2.00	19.23	29.73	17.42	39.50	17.62	10.35	10.35	85.13	64.00	45.68	156.21	74.65	110.00	33.10	33.10	12.56	7.24	10.82	1,082.84
Orchard	81.88	25.83	16.45	2.78	28.83	6.28	4.25	11.52	11.52	2.25	7.10	3.63	49.88	2.00	20.95	42.55	17.25	17.00	34.35	0.40	22.83	68.20	370.83
Onion	36.25	4.05	12.13	17.73	13.25	8.00	3.80	10.83	10.83	7.55	13.72	6.88	21.25	1.25	7.75	17.06	12.60	8.25	31.35	20.23	20.23	337.74	
Vegetable	1.75	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	349.43
Fodder	3.70	5.33	9.00	22.73	9.73	17.20	22.73	36.88	24.93	26.85	4.88	13.40	26.85	82.30	33.08	22.00	40.73	7.33	19.40	24.43	36.08	1.00	1,124.51

Yield per acre (in mound)

W/C #	10L	10R	11L	11R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Mean
Cotton	20.00	13.00	25.00	25.00	18.00	16.00	18.00	18.00	14.00	16.00	16.00	22.00	18.00	20.00	18.00	17.00	15.00	17.00	18.00	18.00	25.00	7.00	15.00
Rice	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50
Sugarcane	1,000.00	820.00	820.00	820.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00
Orchard	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Onion	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Vegetable	150.00	100.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
Fodder	61.50	80.00	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50	61.50
Wheat	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00

Farmgate Price per mound (in Rupees)

W/C #	10L	10R	11L	11R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Mean
Cotton	640.00	830.00	600.00	600.00	780.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00	800.00
Rice	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80	170.80
Sugarcane	34.00	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20	37.20
Orchard	15,825.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00	15,235.00
Onion	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
Vegetable	1,510.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00	1,180.00
Fodder	142.75	33.87	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75	142.75
Wheat	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90	255.90

Gross Agriculture Revenue for Kharif 1997 (in Rupees)

W/C #	10L	10R	11L	11R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total
Cotton	1,714,020	1,337,690	2,577,800	1,174,691	1,714,284	315,010	1,733,157	880,708	1,415,240	1,088,920	751,830	282,880	5,444,038	2,127,770	1,051,722	413,859	1,402,963	413,859	1,402,480	1,402,480	602,623	1,354,289	34,183,704
Rice	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075	14,075
Sugarcane	272,000	56,432	578,931	578,931	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871	228,871
Orchard	752,570	238,531	85,825	85,825	4,41,440	658,695	2,399,499	1,245,000	1,650,872	3,121,119	3,214,740	2,213,440	1,844,408	4,787,013	2,208,440	5,008,000	2,213,440	2,213,440	2,213,440	2,213,440	2,213,440	2,213,440	2,213,440
Onion	849,229	57,178	295,186	334,958	310,408	1,353,587	59,529	99,129	47,720	219,349	373,021	184,032	1,133,035	1,133,035	83,708	245,125	430,738	381,376	619,628	10,784	1,477,273	3,402,444	12,924,893
Vegetable	8,533	7,845	17,642	35,574	18,724	36,839	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053	53,053
Fodder	1,474,483	1,374,201	3,516,483	3,444,288	3,210,918	6,018,818	3,210,918	7,427,233	3,821,222	1,489,281	1,489,281	4,748,273	2,451,444	3,102,828	1,457,088	4,038,478	5,033,248	1,239,847	3,287,848	3,438,433	3,418,828	1,105,838	88,004,644

Gross Agriculture Revenue
For Kharif 1997

Area Cultivated for Rabi 1996-97 (in acres)

W/C #	10L	10R	11L	11R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total
Cotton	33	51	56	84	78	147	113	101	55	157	101	39	32	291	152	97	95	180	42	104	117	107	2,093
Rice	12	15	15	24	8	46	9	10	5	10	16	9	17	33	32	32	25	28	2	16	24	16	388
Onion	9	2	10	17	4	5	27	5	38	28	15	5	5	80	60	30	17	20	2	11	32	12	489

Gross Agriculture Revenue For Rabi 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total	
Cotton	251,311	261,011	422,235	481,982	489,005	1,316,806	687,301	73,305	588,610	281,490	642,821	143,776	248,903	1,489,338	767,700	499,446	536,831	1,023,610	428,912	823,988	784,408	440,103	16,278,483	
Rice	751,134	422,544	385,655	453,540	187,618	1,187,744	255,684	481,808	1,139,537	861,081	483,840	138,180	401,808	1,139,537	292,643	506,875	506,875	506,875	506,875	506,875	506,875	506,875	506,875	16,424,893
Onion	91,832	14,620	104,308	207,132	48,237	156,553	485,738	69,821	281,785	53,714	386,600	282,232	148,221	621,842	38,992	385,328	166,613	20,874	114,805					

**Bareji Distributary, Mirpurkhas
Gross Agriculture Revenue
For the Year 1996-97**

Gross Agriculture Revenue for the Year 1996-97 (in Rupees)

WIC #	10L	10R	11L	11R	12L	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Onion (Kharif)	1,714,020	1,327,890	2,877,600	1,174,601	1,242,320	3,515,125	1,714,284	878,010	1,233,157	860,706	1,416,240	1,084,920	761,520	282,980	5,444,898	2,827,770	1,896,456	1,051,772	1,487,893	473,658	1,480,860	1,806,188	602,623	1,354,299	36,193,708	
Rice (Kharif)	-	-	14,075	-	-	1,828	64,391	22,871	54,879	150,797	23,927	7,741	19,118	2,346	-	35,188	12,315	191,759	139,311	-	14,075	-	-	-	-	768,114
Sugarcane (Kharif)	272,000	56,432	578,051	-	458,200	362,415	1,441,440	858,855	2,398,498	1,284,000	5,247,040	1,656,675	315,718	3,234,750	2,233,440	1,885,408	4,767,013	2,209,640	2,508,000	-	1,224,700	381,300	396,552	76,280	33,428,426	
Onion (Rabi)	792,570	739,551	95,625	-	640,000	3,806	152,637	-	22,808	-	183,068	482,676	-	690,827	245,020	54,868	142,917	222,461	43,750	-	23,438	23,438	52,773	140,228	4,882,896	
Chickpea (Kharif)	2,827,144	372,076	241,025	52,436	601,054	715,178	10,144	20,289	58,837	47,728	219,549	373,021	184,032	113,465	1,183,035	41,876	425,045	865,127	349,981	381,276	613,628	10,764	1,477,527	1,740,464	12,924,805	
Onion (Kharif)	849,229	57,178	283,146	334,858	210,408	1,359,587	-	50,529	967,125	-	-	-	126,520	389,781	283,760	536,869	93,708	245,725	430,758	318,332	-	144,467	792,035	882,417	8,468,515	
Vegetable (Kharif)	-	5,335	-	28,336	-	24,581	-	-	-	-	-	-	-	-	-	-	4,389	-	36,652	50,478	-	-	-	-	149,966	
Fodder (Kharif)	18,533	7,945	17,042	56,514	16,724	36,639	106,488	56,068	82,385	53,095	57,196	56,823	8,301	28,545	61,403	120,853	62,252	49,793	95,805	18,864	41,326	52,083	-	1,990	1,174,519	
Wheat (Rabi)	252,341	261,018	422,235	481,092	499,005	1,316,208	827,501	78,305	568,510	281,490	842,821	775,377	249,503	183,776	1,489,338	767,700	486,446	524,831	1,623,600	429,912	823,598	798,408	449,405	802,389	14,274,403	
Onion (Rabi)	281,174	47,354	361,655	453,540	187,416	1,187,744	25,294	21,380	273,315	194,158	354,044	483,640	136,180	481,885	1,159,627	381,081	999,552	792,863	658,875	50,529	299,174	249,888	806,346	496,775	10,424,669	
Fodder (Rabi)	93,532	14,820	104,366	207,132	48,737	156,553	465,738	80,321	281,795	93,714	396,006	292,232	168,271	52,184	51,842	38,992	385,576	188,513	202,618	20,874	114,805	62,154	234,746	116,977	4,231,827	
Total	7,191,892	2,894,188	4,763,722	2,746,610	6,096,074	8,039,657	4,907,888	2,036,280	5,942,211	2,465,687	8,448,088	5,263,084	1,848,111	3,468,128	12,627,361	6,683,623	9,288,625	6,334,282	6,966,343	1,749,862	4,635,773	3,520,914	4,708,724	5,414,789	126,822,950	

Annexure 12b

Agriculture Input Costs For Kharif 1997

Total Land Preparation Cost (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total	
Cotton	132,833	148,770	183,313	145,013	83,408	376,948	108,226	59,325	150,385	51,233	126,480	67,490	42,700	64,400	284,700	137,940	182,840	82,235	157,288	26,340	102,825	74,100	90,820	129,680	2,896,128	
Sugarcane	10,400	7,134	21,958	-	16,400	24,488	80,060	28,725	78,415	38,650	172,600	39,800	11,937	78,813	189,200	45,875	180,237	111,875	143,000	-	33,100	14,417	14,893	2,883	1,284,447	
Rice	-	-	2,250	-	-	244	19,294	3,658	8,741	17,175	3,828	1,238	3,068	375	-	5,625	1,980	30,875	30,285	-	2,250	-	-	-	121,958	
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Onion	47,125	3,240	14,650	10,408	14,875	30,835	-	1,893	33,488	-	-	-	-	-	-	20,117	3,900	8,200	16,141	11,828	-	-	7,480	28,878	28,250	322,888
Chilies	106,488	25,825	24,878	4,165	30,088	36,601	608	1,818	2,845	2,850	10,928	19,690	7,100	6,893	39,900	2,000	21,277	38,285	17,828	-	-	-	480	73,983	81,840	388,282
Vegetable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fodder	8,570	4,260	5,848	8,818	3,363	10,849	29,872	16,345	24,385	15,727	18,828	13,338	2,805	8,482	18,182	37,380	19,845	13,700	20,375	4,820	12,237	15,422	26,860	600	338,288	
Total	308,185	184,328	261,888	175,480	148,833	486,884	188,734	117,980	398,379	122,520	330,736	137,435	75,148	158,100	818,828	348,737	408,588	282,880	384,688	66,488	184,782	111,818	238,114	243,233	8,852,689	

Total Seed Cost (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total	
Cotton	10,203	18,586	18,331	11,801	11,374	25,037	13,528	11,845	22,558	6,893	28,290	8,425	4,270	2,720	71,178	43,106	18,220	10,373	30,244	9,335	8,254	37,050	16,991	27,013	437,254	
Sugarcane	28,640	9,089	62,189	-	51,800	48,322	148,148	87,985	232,108	131,635	838,820	165,868	35,418	242,806	313,620	135,011	524,773	169,488	487,508	-	84,335	42,775	44,498	8,285	8,285	3,884,187
Rice	-	-	203	-	-	22	826	328	787	2,147	344	111	276	34	-	806	177	2,788	2,048	-	203	-	-	-	16,821	
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Onion	14,800	1,215	3,031	3,845	4,285	18,283	-	644	11,380	-	-	-	3,020	2,780	3,230	8,500	985	3,100	5,498	2,520	-	7,400	10,091	11,300	115,317	
Chilies	10,375	7,778	4,133	555	6,838	11,346	181	322	933	1,620	2,185	3,815	2,840	1,830	19,950	800	6,743	17,020	6,552	2,400	6,870	480	23,441	27,280	174,644	
Vegetable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fodder	3,490	2,130	3,287	13,633	3,363	7,281	19,518	8,070	18,372	10,532	11,387	10,870	1,870	8,873	12,203	29,864	14,002	8,800	24,480	3,101	8,213	10,251	10,823	400	338,811	
Total	71,188	35,788	82,333	29,238	80,337	110,371	182,881	105,818	284,148	151,448	677,808	188,789	48,230	264,878	418,878	218,015	549,794	283,844	474,753	15,386	147,008	86,289	103,984	74,184	4,882,888	

Total Fertilizer Cost (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	183,240	188,380	367,284	188,518	183,024	375,648	232,884	115,884	283,281	130,881	280,835	184,288	53,375	43,820	843,089	338,239	296,789	120,486	229,481	50,680	221,874	128,838	741,884	210,688	3,456,811
Sugarcane	25,890	9,331	64,847	-	62,200	48,875	188,188	78,771	290,136	128,400	673,140	218,808	35,418	242,806	281,718	135,011	524,773	169,488	487,508	-	84,335	42,775	44,498	8,285	3,884,187
Rice	-	-	4,800	-	-	620	21,880	7,800	18,848	45,900	9,160	3,640	8,520	800	-	12,000	4,200	68,000	53,880	-	4,800	-	-	-	16,821
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Onion	33,486	13,005	1,312	-	8,248	164	-	-	2,873	-	6,052	27,700	-	44,034	12,081	2,824	8,871	10,288	2,384	-	1,148	1,312	4,758	7,101	184,888
Chilies	83,378	6,910	30,313	22,156	42,400	171,160	-	4,187	19,482	-	-	-	12,080	31,825	16,748	44,271	6,280	19,375	35,521	26,250	-	13,875	85,313	84,975	717,213
Vegetable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fodder	6,561	4,783	6,033	7,854	2,384	12,872	35,484	21,015	28,187	18,798	20,249	24,088	4,208	18,106	21,739	56,070	20,872	19,800	28,825	5,324	14,631	18,438	26,154	900	418,188
Total	300,545	284,287	521,881	225,880	342,225	683,100	483,819	228,857	658,808	349,258	1,021,741	468,855	122,880	388,820	1,372,189	608,105	815,800	512,050	1,053,242	115,604	421,883	218,239	434,712	425,218	13,193,482

Total Pesticides Cost (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	255,883	86,180	386,825	145,013	113,738	280,365	162,338	88,988	225,378	170,775	151,740	101,100	34,180	16,320	1,087,825	258,638	228,200	81,880	362,825	28,340	257,883	129,875	90,820	182,078	4,886,228
Sugarcane	4,080	828	8,475	-	7,000	6,183	25,025	14,883	39,208	19,780	86,300	24,875	5,176	42,863	42,300	32,838	78,138	37,325	56,800	-	16,580	6,280	6,800	1,280	893,479
Rice	-	-	1,500	-	-	183	8,883	2,438	5,828	14,313	2,650	825	2,038	290	-	3,780	1,313	20,850	16,875	-	1,500	-	-	-	88,883
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Onion	35,800	9,813	1,000	-	4,000	125	-	-	2,180	-	6,138	27,313	-	33,883	8,880	2,000	8,838	7,825	1,825	-	875	1,000	3,625	5,413	148,883
Chilies	183,780	38,888	41,125	2,775	37,772	44,844	638	1,225	3,888	4,845	13,110	18,575	8,053	4,880	83,881	2,400	28,711	54,281	21,884	8,800	34,280	840	92,852	102,300	782,124
Vegetable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fodder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	448,313	148,805	439,725	147,788	182,508	303,759	200,825	107,813	278,500	208,683	258,838	167,488	40,428	97,285	1,183,166	288,625	341,298	283,031	458,588	32,140	510,238	137,785	103,397	271,038	8,441,218

Total Labor Cost (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	81,218	48,350	128,875	72,508	106,195	270,384	87,403	54,876	78,183	61,233	85,518	67,490	48,870	17,880	320,288	172,425	121,780	67,421	108,878	28,824	82,843	82,825	39,848	81,038	2,318,318
Sugarcane	16,000	4,447	45,848	-	33,800	36,238	80,080	53,885	211,721	84,800	345,200	158,713	24,877	285,375	203,040	123,323	378,818	148,300	188,000	-	122,470	30,845	31,248	6,008	3,888,183
Rice	-	-	810	-	-	88	3,708	1,318	3,147	7,728	1,377	448	1,100	138	-	2,028	709	11,161	8,088	-	810	-	-	-	48,833
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Onion	29,325	11,389	1,180	-	4,800	144	6,827	288	2,518																

Barejl Distributory, Mirpurkhas
Agriculture Input Costs
For Rabi 1996-97

Area cultivated for Rabi 1996-97 (in Acres)

W/C No.	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	20L	20R	Total		
Wheat	33.00	51.00	55.00	84.00	78.00	147.00	113.00	17.00	101.00	35.00	137.00	101.00	39.00	32.00	291.00	125.00	87.00	83.00	168.00	42.00	82.00	104.00	117.00	107.00	2393
Orchard	51.00	19.83	2.00	-	0.00	0.25	11.53	0.50	4.38	-	12.28	42.73	-	67.13	19.30	4.00	13.88	15.85	3.85	-	1.75	2.90	7.28	10.53	287
Onion	12.00	3.00	15.00	24.00	8.00	49.00	1.00	9.00	10.00	5.00	10.00	18.00	6.00	17.00	33.00	23.00	32.00	25.00	26.00	2.00	12.00	16.00	24.00	16.00	386
Fodder	9.00	2.00	10.00	17.00	4.00	15.00	42.00	5.00	27.00	5.00	38.00	29.00	15.00	5.00	50.00	4.00	30.00	17.00	20.00	2.00	11.00	5.00	32.00	12.00	495

Land Preparation (Rate per Acre in Rupees)

W/C No.	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	20L	20R	Mean		
Wheat	1,100.00	800.00	800.00	1,100.00	1,100.00	700.00	800.00	1,100.00	1,000.00	750.00	1,000.00	800.00	800.00	900.00	800.00	1,000.00	1,000.00	800.00	800.00	1,000.00	1,000.00	600.00	800.00	861.25	
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Onion	1,300.00	800.00	1,200.00	1,100.00	1,100.00	700.00	846.67	846.67	846.67	750.00	846.67	846.67	1,000.00	900.00	750.00	846.67	1,200.00	800.00	846.67	846.67	800.00	800.00	846.67	1,000.00	846.67
Fodder	1,100.00	800.00	630.77	300.00	500.00	630.77	630.77	700.00	630.77	630.77	630.77	500.00	600.00	630.77	630.77	800.00	600.00	600.00	800.00	630.77	630.77	800.00	600.00	630.77	

Seeds (Rate per Acre in Rupees)

W/C No.	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	20L	20R	Mean	
Wheat	600.00	500.00	600.00	300.00	600.00	600.00	600.00	300.00	600.00	450.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	1,000.00	500.00	600.00	600.00	577.00
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Onion	400.00	2,100.00	400.00	400.00	400.00	2,800.00	550.00	650.00	400.00	400.00	650.00	650.00	500.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	650.00
Fodder	400.00	400.00	423.33	600.00	600.00	423.33	423.33	200.00	423.33	423.33	423.33	400.00	400.00	423.33	423.33	480.00	423.33	400.00	600.00	423.33	423.33	423.33	300.00	423.33

Fertilizers (Rate per Acre in Rupees)

W/C No.	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	20L	20R	Mean		
Wheat	1,850.00	1,600.00	1,800.00	1,850.00	1,250.00	1,600.00	1,800.00	1,250.00	1,600.00	1,250.00	1,600.00	1,600.00	1,250.00	1,250.00	1,600.00	1,822.51	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,582.51	
Orchard	858.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	658.00	
Onion	2,300.00	2,200.00	2,600.00	1,250.00	3,200.00	3,080.00	2,083.33	2,083.33	550.00	1,850.00	2,083.33	2,083.33	1,800.00	2,300.00	1,950.00	2,083.33	2,083.33	2,500.00	2,083.33	2,083.33	2,150.00	1,600.00	2,083.33	2,300.00	2,083.33
Fodder	754.17	800.00	754.17	350.00	350.00	754.17	754.17	900.00	754.17	754.17	754.17	900.00	900.00	754.17	754.17	900.00	625.00	900.00	700.00	754.17	754.17	754.17	725.00	800.00	754.17

Pesticides (Rate per Acre in Rupees)

W/C No.	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	20L	20R	Mean	
Wheat	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00
Orchard	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
Onion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fodder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Labor (Rate per Acre in Rupees)

W/C No.	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	20L	20R	Mean		
Wheat	875.00	780.00	1,105.00	910.00	1,007.50	1,202.50	975.00	871.00	919.00	1,174.00	805.00	975.00	1,040.00	780.00	780.00	868.00	910.00	993.00	877.50	1,170.00	1,200.00	975.00	750.00	862.00	928.78
Orchard	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	575.00	
Onion	600.00	800.00	2,100.00	1,250.00	1,800.00	1,750.00	1,373.44	1,373.44	1,400.00	1,850.00	1,373.44	1,373.44	1,800.00	1,725.00	1,850.00	1,373.44	1,800.00	1,780.00	1,373.44	1,373.44	1,600.00	1,000.00	1,373.44	1,600.00	1,373.44
Fodder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

**Bareji Distributary, Mirpurkhas
Agriculture Input Costs
For Rabi 1996-97**

Total Land Preparation Cost (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	36,300	40,800	44,000	103,400	85,800	102,900	90,400	18,700	101,000	41,250	157,000	80,800	31,200	28,800	222,800	126,000	97,000	76,000	128,000	25,200	92,000	104,000	70,200	85,600	#####
Orchard																									
Onion	15,600	2,400	18,000	26,400	8,600	34,300	847	8,520	9,467	3,750	9,467	15,147	6,000	15,300	24,750	21,775	20,400	20,000	24,613	1,893	9,600	12,000	22,720	16,000	388,647
Fodder	9,800	1,800	8,300	5,100	2,000	9,462	26,492	3,500	17,031	3,154	23,869	14,000	9,000	3,154	31,629	2,400	18,000	10,200	10,000	1,262	6,938	3,154	25,600	7,200	250,862
Total	61,800	44,800	68,300	134,800	96,400	146,602	117,838	39,720	127,497	48,154	190,436	109,947	48,200	47,254	289,688	149,173	153,400	106,200	162,613	28,395	108,538	119,954	119,320	108,800	#####

Total Seeds Cost (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	19,800	25,500	33,000	26,200	46,800	86,200	67,800	7,650	60,600	33,000	94,200	80,800	22,400	19,200	174,800	75,000	58,200	57,000	48,000	25,200	55,200	104,000	56,500	64,200	#####
Orchard																									
Onion	4,800	6,300	6,000	9,600	3,200	122,500	650	5,850	4,000	2,000	6,500	10,400	4,000	6,800	13,200	14,950	12,600	10,000	16,800	1,300	4,800	6,400	15,600	8,000	296,350
Fodder	3,800	800	4,233	19,200	2,000	6,350	17,760	1,000	11,430	2,117	16,087	11,200	6,000	2,117	21,187	1,920	12,700	6,800	12,000	847	4,657	2,117	9,600	4,800	171,520
Total	28,200	32,600	43,233	48,600	52,000	217,050	84,238	14,500	76,036	37,117	118,787	82,280	33,400	28,117	208,967	93,876	83,700	73,800	78,800	27,347	64,657	112,517	83,700	77,000	#####

Total Fertilizers Cost (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	84,350	81,600	104,500	183,300	97,500	235,200	180,800	21,250	161,800	68,000	251,200	161,800	62,400	40,000	363,750	200,000	153,513	132,000	268,000	67,200	147,200	166,400	187,200	171,200	#####
Orchard	32,456	13,005	1,312		6,248	184	7,466	326	2,873		6,052	27,700		44,034	12,861	2,624	8,971	10,266	2,304		1,148	1,312	4,756	7,101	194,966
Onion	27,800	6,600	37,500	30,000	28,600	147,000	2,083	18,750	5,500	9,750	20,633	33,333	12,800	39,100	64,350	47,817	66,867	62,500	84,187	4,167	25,800	24,000	50,000	36,800	892,817
Fodder	6,788	1,800	7,542	5,950	1,400	11,313	31,875	4,500	20,363	3,771	28,658	25,200	13,500	3,771	37,708	3,600	18,750	15,300	14,000	1,809	8,296	3,771	23,200	10,800	303,163
Total	132,184	103,005	139,634	219,250	129,748	393,677	222,118	44,828	189,336	101,521	308,744	247,133	88,700	126,905	478,469	254,141	247,991	248,866	326,361	72,875	182,444	189,483	263,198	229,901	#####

Total Pesticides Cost (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	52,800.0	61,600.0	88,000.0	150,400.0	124,800.0	235,200.0	180,800.0	27,220.0	161,600.0	68,000.0	261,200.0	161,800.0	62,400.0	51,200.0	465,600.0	200,000.0	155,200.0	152,000.0	258,000.0	67,200.0	147,200.0	166,400.0	187,200.0	171,200.0	#####
Orchard	25,500.0	9,912.5	1,000.0		4,000.0	125.0	5,762.5	250.0	2,190.0		6,137.5	21,112.5		33,562.5	9,850.0	2,000.0	8,827.5	7,825.0	1,825.0		875.0	1,000.0	3,625.0	5,412.5	#####
Onion																									
Fodder																									
Total	78,300.0	91,812.5	89,000.0	150,400.0	128,800.0	335,325.0	186,562.5	27,450.0	163,790.0	68,600.0	267,337.5	182,712.5	62,400.0	84,762.5	475,250.0	202,000.0	164,027.5	159,825.0	267,825.0	67,200.0	148,075.0	167,400.0	190,425.0	178,600.0	#####

Total Labor Cost (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	32,176	36,780	46,775	85,540	78,585	176,762	110,175	14,807	82,719	64,570	126,542	98,475	40,560	24,960	226,980	107,250	88,270	81,390	140,400	49,140	119,600	101,400	91,280	102,834	#####
Orchard	28,326	11,398	1,150		4,600	144	6,827	288	2,519		7,058	24,279		38,597	11,098	2,300	7,863	8,999	2,099		1,005	1,150	4,169	6,224	179,883
Onion	7,200	2,400	31,500	30,000	12,000	85,750	1,173	12,367	14,000	5,280	13,734	21,976	8,000	29,326	44,550	31,569	51,200	43,750	25,709	2,747	18,000	16,000	32,963	25,600	378,977
Fodder																									
Total	68,700	52,978	83,425	115,540	95,185	262,661	118,173	27,451	99,238	69,820	147,339	144,729	48,560	92,862	282,626	141,129	147,333	144,199	178,206	51,887	138,606	118,550	129,391	134,738	#####

Agriculture Input Costs for Rabi 1996-97 (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Land Preparation	61,800	44,800	68,300	134,800	96,400	146,602	117,838	39,720	127,497	48,154	190,436	109,947	48,200	47,254	289,688	149,173	153,400	106,200	162,613	28,395	108,538	119,954	119,320	108,800	#####
Seeds	28,200	32,600	43,233	48,600	52,000	217,050	84,238	14,500	76,036	37,117	118,787	82,280	33,400	28,117	208,967	93,876	83,700	73,800	78,800	27,347	64,657	112,517	83,700	77,000	#####
Fertilizers	132,184	103,005	139,634	219,250	129,748	393,677	222,118	44,828	189,336	101,521	308,744	247,133	88,700	126,905	478,469	254,141	247,991	248,866	326,361	72,875	182,444	189,483	263,198	229,901	#####
Pesticides	78,300	91,812.5	89,000	150,400	128,800	335,325	186,562.5	27,450	163,790	68,600	267,337.5	182,712.5	62,400	84,762.5	475,250	202,000	164,027.5	159,825	267,825	67,200	148,075	167,400	190,425	178,600	#####
Labor	68,700	52,978	83,425	115,540	95,185	262,661	118,173	27,451	99,238	69,820	147,339	144,729	48,560	92,862	282,626	141,129	147,333	144,199	178,206	51,887	138,606	118,550	129,391	134,738	#####
Total	369,184	323,497	444,828	668,990	502,323	1,353,374	739,826	144,933	636,861	344,611	1,029,639	767,421	261,260	379,926	1,734,402	839,323	784,371	724,038	1,081,968	247,663	642,320	719,893	786,382	723,872	#####

Barejli Distributary, Mirpurkhas
Net Agriculture Income
For the Year 1996-97

Agriculture input Costs for the Year 1996-97 (in Rupees)

WIC No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Land Preparation	367,066	229,129	329,887	310,390	243,433	833,625	316,593	142,680	425,877	170,463	521,172	247,382	123,348	206,354	807,127	387,810	582,988	369,080	547,201	83,643	283,309	231,773	356,634	352,032	6,279,398
Seeds	89,398	84,385	195,466	77,336	132,337	327,421	268,911	129,216	390,178	168,563	784,592	270,889	79,830	292,783	428,844	309,885	633,494	338,844	551,853	42,703	211,666	208,006	187,694	151,184	6,478,888
Fertilizers	832,738	387,472	612,335	445,230	471,875	1,078,776	788,038	274,885	849,842	450,780	1,330,465	718,688	211,850	513,825	1,880,658	862,248	1,182,401	752,117	1,378,804	168,478	804,308	411,722	888,868	651,120	17,314,245
Pesticides	528,513	240,418	528,725	398,188	291,309	639,084	387,188	135,283	440,280	297,892	817,175	350,200	112,875	182,048	7,658,416	481,825	503,338	362,858	718,394	98,340	458,413	306,185	384,422	447,880	18,274,622
Labour	279,878	130,288	286,237	205,286	278,387	669,081	308,387	139,874	423,093	225,481	588,225	489,227	136,489	419,088	883,201	461,244	672,809	424,633	524,886	108,853	382,845	251,748	289,593	323,406	8,225,724
Total	1,897,591	1,051,472	1,902,739	1,337,349	1,415,489	3,345,887	1,865,116	812,918	2,499,388	1,223,189	3,761,649	1,894,483	963,829	1,614,983	2,827,845	2,828,808	3,535,888	2,248,239	3,729,947	529,218	1,859,338	1,489,219	1,814,813	1,825,483	51,193,788

Bareji Distributory, Mirpurkhas
Agriculture Land Taxes
For Kharif 1997

Area Cultivated for Kharif 1997 (in acres)

W/C #	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total				
Cotton	84.03	114.40	128.88	96.68	75.83	280.12	89.20	59.33	149.26	56.83	124.45	66.38	42.70	15.70	344.40	170.45	148.88	101.72	118.93	31.66	102.85	90.65	108.63	101.48	2,881.82
Sugarcane	8.00	1.85	18.95	-	14.00	18.33	60.05	29.73	77.92	39.60	172.60	49.75	10.35	89.85	84.60	45.69	184.40	89.00	110.00	-	33.10	12.50	13.00	2.50	1,174.84
Rice	-	-	3.00	-	-	0.33	13.73	4.88	11.66	28.63	6.10	1.65	4.98	0.50	-	-	4.63	41.26	33.65	-	3.00	-	-	-	131.91
Orchard	51.00	19.83	2.00	-	8.00	0.25	11.53	0.50	4.38	-	12.28	42.23	-	87.13	10.30	4.00	13.88	16.65	-	-	1.75	2.00	7.25	10.83	297.21
Onion	36.25	4.05	12.13	17.73	13.25	57.05	-	2.00	35.39	-	-	-	7.65	7.25	8.08	21.25	3.00	7.75	17.05	12.80	-	8.25	31.35	28.25	331.21
Chilies	81.38	25.93	16.45	2.78	29.63	35.25	0.50	1.00	2.90	3.80	10.93	19.58	7.10	5.65	45.93	2.00	20.94	40.55	17.25	17.00	34.35	0.60	72.83	68.20	583.98
Vegetable	-	1.75	-	3.00	-	2.80	-	-	-	-	-	-	-	-	-	-	0.50	-	4.18	5.75	-	0.25	-	-	18.23
Fodder	6.70	5.33	8.00	22.73	6.73	17.20	44.55	23.35	36.18	34.93	26.65	26.68	3.66	13.40	28.83	82.30	33.08	22.80	40.76	7.33	19.40	24.45	38.08	1.00	543.46
Total	279.35	173.13	189.40	142.90	147.43	379.32	219.55	120.78	317.67	163.78	352.20	205.25	75.45	169.48	532.13	313.15	377.80	297.88	345.45	74.35	194.43	136.60	288.53	212.25	5,881.86

Area liable for Agriculture Tax (in acres)

W/C #	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total				
Cotton	84.03	114.40	122.28	77.70	75.83	193.29	80.88	59.70	133.63	66.93	108.95	65.38	34.80	15.70	344.05	139.85	128.08	80.65	105.25	23.48	91.75	79.05	78.90	92.48	2,315.92
Sugarcane	8.00	1.85	18.50	-	14.00	18.33	49.85	29.73	72.12	39.60	152.60	49.75	9.35	89.35	71.90	41.16	135.60	84.38	107.25	-	31.60	12.50	12.00	2.50	888.39
Rice	-	-	3.00	-	-	0.33	13.73	4.88	11.66	28.63	5.10	1.65	4.98	0.50	-	-	4.63	40.78	33.65	-	3.00	-	-	-	139.58
Orchard	51.00	19.83	2.00	-	8.00	0.25	11.53	0.50	4.38	-	12.28	42.23	-	87.13	12.33	4.00	13.88	10.65	1.80	-	0.75	2.00	5.80	8.83	277.68
Onion	36.25	4.05	12.13	10.83	13.25	35.80	-	2.00	35.39	-	-	-	7.95	7.25	8.08	20.25	3.00	6.00	17.05	11.00	-	8.25	25.35	28.75	299.51
Chilies	81.38	25.93	16.45	2.53	29.63	22.25	0.50	1.00	1.80	3.80	8.93	19.58	6.80	6.65	42.35	1.75	19.95	39.55	17.25	7.90	32.33	0.10	64.68	63.70	517.85
Vegetable	-	1.75	-	3.00	-	2.80	-	-	-	-	-	-	-	-	-	-	0.50	-	4.18	5.43	-	0.25	-	-	17.86
Fodder	6.70	5.33	8.00	22.73	6.73	17.20	47.05	23.35	38.88	24.93	21.35	26.68	2.43	13.40	25.08	89.30	30.93	19.45	39.25	8.08	19.40	24.45	17.78	1.00	484.31
Total	279.35	173.13	182.45	116.78	147.43	275.17	174.75	104.65	283.39	153.78	309.20	205.25	76.45	167.98	443.78	272.83	332.25	270.45	325.46	53.85	176.83	127.60	283.80	197.25	5,851.81

Area Cultivated for Kharif 1997 including Intercropped (in acres)

W/C #	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total				
Cotton	102.03	123.90	128.88	96.68	76.83	280.37	108.23	59.33	150.39	56.83	126.45	64.25	42.70	2.20	355.88	172.43	182.20	103.73	120.88	31.66	102.83	92.63	113.26	108.05	3,115.85
Sugarcane	8.00	1.85	18.95	-	14.00	18.33	60.05	29.73	78.42	39.60	172.60	49.75	10.35	89.35	84.60	45.66	156.26	74.95	110.00	-	33.10	12.50	13.00	2.50	1,188.84
Rice	-	-	3.00	-	-	0.33	13.73	4.88	11.66	28.63	5.10	1.65	4.98	0.50	-	-	4.63	41.26	33.65	-	3.00	-	-	-	161.61
Orchard	51.00	19.83	2.00	-	8.00	0.25	11.53	0.50	4.38	-	12.28	42.23	-	87.13	12.33	4.00	13.88	10.65	1.80	-	0.75	2.00	5.80	8.83	297.21
Onion	36.25	4.05	12.13	17.73	13.25	57.05	-	2.00	35.39	-	-	-	7.95	7.25	8.08	20.25	3.00	6.00	17.05	11.00	-	8.25	25.35	28.75	317.85
Chilies	81.38	25.93	16.45	2.78	29.63	35.25	0.50	1.00	2.90	3.80	10.93	19.58	7.10	5.65	42.35	1.75	19.95	39.55	17.25	7.90	32.33	0.10	64.68	63.70	517.85
Vegetable	-	1.75	-	3.00	-	2.80	-	-	-	-	-	-	-	-	-	-	0.50	-	4.18	5.75	-	0.25	-	-	18.23
Fodder	6.70	5.33	8.00	22.73	6.73	17.20	47.05	23.35	38.88	24.93	21.35	26.68	2.43	13.40	25.08	89.30	30.93	19.45	39.25	8.08	19.40	24.45	17.78	1.00	484.31
Total	287.65	182.70	189.40	142.90	147.43	378.67	231.02	120.78	321.80	153.78	354.20	224.13	76.45	214.75	546.55	315.15	382.30	307.63	347.50	74.35	194.43	141.68	273.78	218.83	5,828.88

Abiana (Rate per Acre in Rupees)

W/C #	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R				
Cotton	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88	80.88
Sugarcane	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13
Rice	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18	77.18
Orchard	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54
Onion	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54
Chilies	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49	65.49
Vegetable	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54	123.54
Fodder	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60

Agriculture Tax (Rate per Acre in Rupees)

W/C #	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R				
Cotton	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Sugarcane	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Rice	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Orchard	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
Onion	300.00	300.00	300.00</																					

Annexure 15b

**Bareji Distributary, Mirpurkhas
Agriculture Land Taxes
For Kharif 1997**

Total Abiana (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	7,606	9,253	10,423	7,819	6,133	20,229	6,023	4,798	12,072	4,804	10,066	5,286	3,454	1,270	27,855	13,764	12,017	8,228	9,819	2,562	8,316	7,330	8,737	8,207	217,690
Sugarcane	1,285	293	2,997	-	2,214	2,581	7,814	4,760	12,321	6,248	27,293	7,867	1,637	9,484	13,378	7,223	24,573	10,911	17,394	-	5,234	1,877	2,056	395	189,933
Rice	-	-	232	-	-	25	1,059	376	900	2,209	394	127	315	39	-	579	203	3,188	2,597	-	232	-	-	-	12,473
Orchard	6,301	2,449	247	-	988	31	4,424	62	541	-	1,516	5,216	-	8,293	2,384	494	1,689	1,933	451	-	218	247	896	1,337	36,717
Onion	4,478	500	1,498	2,190	1,837	7,048	-	247	4,371	-	-	-	933	896	998	2,625	371	957	2,106	1,567	-	1,143	3,873	3,490	40,918
Chilies	5,329	1,698	1,077	182	1,940	2,309	33	65	190	249	715	1,282	465	370	3,073	131	1,372	2,656	1,190	1,113	2,250	38	4,769	4,466	36,904
Vegetable	-	216	-	371	-	346	-	-	-	-	-	-	-	-	-	-	62	-	516	710	-	31	-	-	2,252
Fodder	301	184	277	786	233	595	1,541	808	1,252	862	929	923	127	464	997	2,156	1,144	761	1,410	253	671	846	1,248	35	18,804
Total	25,279	14,593	16,751	11,347	13,145	33,164	19,995	11,057	31,846	14,171	40,913	20,703	8,930	20,794	48,685	26,991	41,431	28,634	35,223	6,196	16,919	11,612	21,579	17,931	535,689

Total Agriculture Tax (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	7,052	8,580	9,178	5,828	5,887	14,497	4,566	3,803	10,022	4,269	8,171	4,903	2,596	1,178	21,304	10,489	9,456	6,901	7,894	1,781	6,881	5,929	5,916	6,936	173,694
Sugarcane	600	139	1,388	-	1,050	824	3,716	2,154	5,414	2,963	11,445	3,731	701	4,376	5,393	3,013	10,170	4,828	8,044	-	2,370	938	900	188	74,144
Rice	-	-	80	-	-	10	412	101	350	859	153	50	122	15	-	225	79	1,223	1,010	-	90	-	-	-	4,787
Orchard	15,300	5,948	600	-	2,400	-	3,456	-	1,314	-	3,683	12,868	-	20,138	3,898	1,200	4,103	3,195	480	-	225	600	1,650	2,648	83,304
Onion	10,875	1,215	3,638	3,248	3,975	10,650	-	800	10,616	-	-	-	2,265	2,175	2,423	6,075	900	1,800	5,115	3,300	-	2,775	7,805	8,025	87,273
Chilies	3,255	1,037	658	101	1,185	890	20	40	76	152	357	783	284	226	1,694	70	798	1,582	690	316	1,293	4	2,563	2,628	20,682
Vegetable	-	525	-	900	-	840	-	-	-	-	-	-	-	-	-	-	150	-	1,253	1,628	-	75	-	-	5,370
Fodder	348	133	320	909	269	507	1,543	754	1,370	997	854	1,067	97	536	1,003	2,372	1,237	738	1,570	243	776	978	711	40	19,372
Total	37,430	17,578	15,871	10,985	14,566	28,918	13,714	7,452	29,161	9,240	24,863	13,201	6,045	28,643	35,513	23,444	26,892	20,166	26,055	7,247	11,635	11,298	19,347	20,464	468,626

Total Local Cess (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	940	1,144	1,289	967	758	2,501	992	593	1,493	569	1,245	654	427	157	3,444	1,704	1,485	1,017	1,189	317	1,028	906	1,060	1,015	26,915
Sugarcane	80	19	190	-	140	163	501	297	779	395	1,726	498	104	599	846	457	1,554	690	1,100	-	331	125	130	25	10,746
Rice	-	-	147	-	-	16	673	239	571	1,403	250	81	200	25	-	368	129	2,024	1,649	-	147	-	-	-	7,919
Orchard	2,550	991	100	-	400	13	576	25	219	-	614	2,111	-	3,356	965	200	684	783	183	-	68	100	363	541	14,860
Onion	1,848	207	618	904	676	2,910	-	102	1,805	-	-	-	385	370	412	1,084	153	395	870	643	-	472	1,599	1,441	16,892
Chilies	4,232	1,348	855	144	1,541	1,833	26	52	151	198	568	1,018	369	294	2,440	104	1,086	2,108	897	884	1,786	31	3,787	3,546	29,302
Vegetable	-	93	-	159	-	148	-	-	-	-	-	-	-	-	-	-	27	-	221	305	-	13	-	-	966
Fodder	87	53	80	227	67	172	446	234	362	249	269	267	37	134	288	623	331	220	408	73	194	245	361	10	5,435
Total	9,738	3,854	3,279	2,401	3,582	7,756	3,213	1,542	5,379	2,914	4,871	4,828	1,521	4,934	8,395	4,539	5,452	7,237	6,516	2,221	3,574	1,892	7,319	6,578	113,035

Total Usher (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	13,227	19,075	16,915	15,999	9,952	33,771	14,496	9,017	30,416	7,471	17,450	10,570	6,471	3,193	70,489	23,123	24,632	15,973	19,120	4,564	33,496	17,151	20,864	16,328	433,731
Sugarcane	1,620	375	3,837	-	2,835	3,306	10,338	6,222	22,955	7,999	34,952	11,026	2,298	15,958	21,592	9,755	37,651	19,286	26,320	-	6,703	2,734	4,455	1,013	253,228
Rice	288	67	682	-	504	588	1,802	1,124	2,895	1,422	6,214	1,791	373	2,837	3,048	1,644	5,618	3,016	3,960	-	1,192	450	466	90	40,068
Orchard	6,825	2,602	263	-	1,050	33	1,513	131	608	-	1,811	5,542	-	8,810	3,645	525	3,288	2,054	860	-	230	525	1,313	1,552	42,978
Onion	1,118	228	341	548	373	1,805	-	56	1,248	-	-	-	212	341	342	598	113	330	747	368	-	316	920	987	16,767
Chilies	19,015	6,070	3,800	845	6,843	8,143	116	231	715	878	2,539	4,522	1,648	1,652	11,703	486	4,939	9,738	4,111	3,955	7,935	140	17,223	15,847	132,872
Vegetable	-	82	-	164	-	131	-	-	-	-	-	-	-	-	-	-	47	-	196	285	-	23	-	-	928
Fodder	546	335	450	1,590	378	1,121	2,693	1,384	3,185	1,407	1,951	1,547	261	754	2,279	3,504	2,099	1,554	2,728	430	1,091	2,008	2,056	56	35,673
Total	42,838	28,833	28,288	18,945	21,935	48,997	30,927	16,165	81,999	19,172	64,416	34,998	11,282	33,545	113,094	39,616	76,380	51,951	58,038	9,602	30,646	23,348	47,898	35,853	950,246

Agriculture Land Taxes for Kharif 1997

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Abiana	25,279	14,593	16,751	11,347	13,145	33,164	19,995	11,057	31,846	14,171	40,913	20,703	8,930	20,794	48,685	26,991	41,431	28,634	35,223	6,196	16,919	11,612	21,579	17,931	535,689
Agriculture Tax	37,430	17,578	15,871	10,985	14,566	28,918	13,714	7,452	29,161	9,240	24,863	13,201	6,045	28,643	35,513	23,444	26,892	20,166	26,055	7,247	11,635	11,298	19,347	20,464	468,626
Local Cess	9,738	3,854	3,279	2,401	3,582	7,756	3,213	1,542	5,379	2,914	4,871	4,828	1,521	4,934	8,395	4,539	5,452	7,237	6,516	2,221	3,574	1,892	7,319	6,578	113,035
Usher	42,838	28,833	28,288	18,945	21,935	48,997	30,927	16,165																	

Annexure 16b

Bareji Distributary, Mirpurkhas
Agriculture Land Taxes
For Rabi 1996-97

Total Abiana (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	1,518	2,346	2,530	4,324	3,588	6,762	5,198	782	4,646	2,530	7,222	4,646	1,794	1,472	13,386	5,750	4,482	4,370	7,380	1,932	4,232	4,784	5,382	4,922	105,938
Onion	1,482	371	1,853	2,985	988	8,053	124	1,112	1,235	616	1,235	1,977	988	2,100	4,077	2,841	3,953	3,089	3,212	247	1,482	1,977	2,985	1,977	48,922
Fodder	311	69	346	588	138	519	1,453	173	934	173	1,315	989	519	173	1,730	138	1,038	588	692	69	381	173	1,107	415	14,013
Orchard	6,301	2,449	247	-	888	31	1,424	82	541	-	1,516	5,216	-	8,293	2,384	494	1,689	1,933	451	-	216	247	896	1,337	36,717
Total	9,812	5,235	4,976	7,877	5,703	13,365	8,199	2,129	7,357	3,321	11,289	12,808	3,301	12,038	21,577	9,224	11,143	9,980	11,715	2,248	6,311	7,181	10,350	8,651	205,590

Total Usher (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	5940	9180	9900	16920	14040	26460	20340	3060	18180	9900	28260	18180	7020	5760	52380	22500	17460	17100	28800	7560	16560	18720	21060	19260	414,540
Onion	675	169	844	1,350	450	2,756	56	506	563	281	583	900	450	956	1,856	1,294	1,800	1,406	1,463	113	675	900	1,350	900	22,275
Fodder	1,013	225	1,125	1,913	450	1,688	4,725	563	3,038	583	4,275	3,150	1,688	563	5,625	450	3,375	1,913	2,250	225	1,238	563	3,600	1,350	45,563
Orchard	13,388	5,204	525	-	2,100	66	3,025	131	1,150	-	3,222	11,084	-	17,620	5,088	1,050	3,590	4,108	958	-	458	525	1,903	2,842	78,016
Total	21,015	14,778	12,394	20,183	17,040	30,969	28,147	4,260	22,930	10,744	36,320	33,314	9,158	24,899	64,928	25,294	26,225	24,527	33,471	7,898	18,932	20,708	27,913	24,352	560,394

Total Agriculture Tax (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	3,761	4,576	4,895	3,108	3,033	7,732	2,435	2,028	5,345	2,277	4,358	2,615	1,384	628	11,362	5,594	5,043	3,627	4,210	939	3,670	3,162	3,156	3,699	92,637
Total	3,761	4,576	4,895	3,108	3,033	7,732	2,435	2,028	5,345	2,277	4,358	2,615	1,384	628	11,362	5,594	5,043	3,627	4,210	939	3,670	3,162	3,156	3,699	92,637

Total Local Cess (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	330	510	550	940	780	1,470	1,130	170	1,010	550	1,570	1,010	390	320	2,910	1,250	970	950	1,600	420	920	1,040	1,170	1,070	23,030
Onion	120	30	150	240	80	490	10	90	100	50	100	160	80	170	330	230	320	250	260	20	120	160	240	160	3,960
Fodder	90	20	100	170	40	150	420	50	270	50	380	290	150	50	500	40	300	170	200	20	110	50	320	120	4,050
Orchard	510	198	20	-	80	3	115	5	44	-	123	422	-	671	193	40	137	157	37	-	18	20	73	108	2,872
Total	1,050	758	820	1,350	980	2,113	1,675	315	1,424	650	2,173	1,872	620	1,211	3,933	1,580	1,727	1,527	2,097	480	1,168	1,270	1,803	1,458	34,012

Agriculture Land Taxes for Rabi 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Abiana	9,812	5,235	4,976	7,877	5,703	13,365	8,199	2,129	7,357	3,321	11,289	12,808	3,301	12,038	21,577	9,224	11,143	9,980	11,715	2,248	6,311	7,181	10,350	8,651	205,590
Agriculture Tax	3,761	4,576	4,895	3,108	3,033	7,732	2,435	2,028	5,345	2,277	4,358	2,615	1,384	628	11,362	5,594	5,043	3,627	4,210	939	3,670	3,162	3,156	3,699	92,637
Local Cess	1,050	758	820	1,350	980	2,113	1,675	315	1,424	650	2,173	1,872	620	1,211	3,933	1,580	1,727	1,527	2,097	480	1,168	1,270	1,803	1,458	34,012
Usher	21,015	14,778	12,394	20,183	17,040	30,969	28,147	4,260	22,930	10,744	36,320	33,314	9,158	24,899	64,928	25,294	26,225	24,527	33,471	7,898	18,932	20,708	27,913	24,352	560,394
Total	35,438	25,347	23,085	32,518	26,756	54,179	40,455	8,732	37,055	16,991	54,139	50,609	14,463	36,776	101,800	41,672	44,137	39,860	51,492	11,545	30,081	32,320	45,221	38,160	892,632

Annexure 17

**Bareji Distributary, Mirpurkhas
Agriculture Land Taxes
For the Year 1996-97**

Agriculture Land Taxes for the Year 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Abiana	34,891	19,828	21,727	19,225	18,848	46,530	28,194	13,185	39,003	17,491	52,202	33,511	10,231	32,832	70,252	36,215	52,574	38,614	46,938	8,444	23,230	18,793	31,929	26,562	741,279
Agriculture Tax	41,191	22,152	20,766	14,093	17,599	35,749	16,149	9,480	34,506	11,517	29,021	25,816	7,429	29,271	46,875	29,038	31,935	23,793	30,265	8,186	15,305	14,460	22,503	24,163	561,282
Local Cess	10,788	4,613	4,099	3,751	4,562	9,868	4,688	1,857	6,803	3,464	6,844	6,500	2,141	6,145	12,328	6,099	7,179	8,764	8,612	2,681	4,741	3,162	9,122	8,036	147,047
Usher	63,653	43,610	38,682	39,127	38,975	79,666	59,074	22,425	84,929	29,916	100,736	68,312	20,420	58,444	178,022	64,909	104,604	76,478	91,509	17,499	49,578	44,055	75,811	60,205	1,510,640
Total	150,523	90,203	85,274	76,196	79,984	171,814	106,304	46,948	165,241	62,388	188,802	134,140	40,221	126,692	307,488	136,262	196,291	147,649	177,324	36,811	92,855	80,471	139,364	118,988	2,980,226

Analysis of Sugarcane for Kharif 1997 of Bareji Distributary, Mirpurkhas

W/C #	10L	10R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Mean	
Yield per acre (kg)	40000.00	32800.00	32800.00	32800.00	32000.00	24000.00	32000.00	24000.00	36000.00	32000.00	36000.00	32800.00	40000.00	32000.00	36000.00	32800.00	32000.00	24000.00	32800.00	32800.00	32800.00	32800.00
Farmgate price per Kg (Rs)	6.85	0.93	0.93	0.93	1.03	0.93	0.90	0.93	0.85	1.00	0.95	0.93	0.93	0.95	0.83	1.03	0.93	0.93	0.93	0.93	0.93	0.93
Gross Agriculture Revenue per acre (Rs)	34000.00	30504.00	30504.00	30504.00	32800.00	22200.00	28800.00	22200.00	30600.00	32000.00	30400.00	33300.00	30504.00	38000.00	26400.00	36900.00	30504.00	29600.00	22800.00	30504.00	37000.00	30504.00
Land Preparation per acre (Rs)	1300	1153	1153	1153	1100	1500	1000	1000	1000	900	1000	800	1153	900	2000	1000	1153	1500	1300	1152	1000	1153
Seed per acre (Rs)	3330	3281	3281	3281	3700	2950	2980	2960	2960	3330	3700	3330	3281	2960	1700	2980	3281	2960	3700	3281	3700	3281
Fertilizer per acre (Rs)	3200	3422	3422	3422	4800	3000	3700	2650	3700	3200	3900	4400	3422	2650	3330	3350	3422	2150	4250	3422	2850	3422
Pesticides per acre (Rs)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Labor per acre (Rs)	2000	2404	2404	2404	2400	2404	1800	1800	2700	2400	2000	3160	2404	3000	2400	2700	2404	2000	1800	2404	3700	2404
Total Agriculture Input Costs per acre (Rs)	10330	10760	10760	10760	12500	10384	9760	8910	10860	10330	11100	12180	10760	10210	11830	10510	10760	9110	11550	10760	11750	10760
Net Agriculture Income per acre (Rs)	23670	19744	19744	19744	20300	11836	19040	13290	19740	21670	19300	21120	19744	27790	14470	26390	19744	20490	11250	19744	25250	19744

W/C #	18L	18R	11L	11R	12L	12R	13L	13R	14L	14R	15L	15R	16L	16R	17L	17R	18L	18R	19L	19R	Total Mean
Area Cultivated per w/c (Acres)	0.00	1.85	18.95	0.00	14.00	16.33	60.05	29.73	78.42	39.50	172.60	39.800	49.75	10.35	85.13	84.80	45.66	156.28	74.65	110.00	0.00
Gross Agriculture Revenue per w/c (Rs)	272,000	56,432	578,051	-	459,200	362,415	1,441,440	859,895	2,356,499	1,264,000	5,247,040	1,656,875	315,716	3,234,750	2,233,940	1,685,408	4,767,013	2,209,640	2,502,000	-	1,224,700
Cost Inputs																					
Land Preparation per w/c	10,400	2,134	21,856	-	15,400	24,488	50,050	29,725	78,415	35,550	172,600	39,800	11,937	76,613	169,200	45,675	180,237	111,975	143,000	-	33,100
Seed per w/c	26,640	6,069	62,159	-	51,800	48,322	148,148	87,985	232,108	131,535	638,820	165,658	33,955	251,870	313,020	136,198	512,686	220,964	407,000	-	122,470
Fertilizer per w/c	25,800	6,331	64,847	-	67,200	48,975	185,185	78,771	290,136	126,400	673,140	218,600	35,418	242,606	281,718	153,011	534,773	180,498	467,500	-	94,335
Pesticides per w/c	4,000	925	9,475	-	7,000	8,163	14,863	39,208	19,750	86,300	24,875	5,175	42,563	42,300	22,838	78,138	37,325	55,000	-	-	16,580
Labor per w/c	16,000	4,447	45,548	-	23,600	39,238	80,080	53,505	211,721	94,800	345,200	158,713	24,877	255,375	203,040	123,323	375,618	149,300	199,000	-	122,470
Total Agriculture Cost Inputs per w/c	82,640	19,905	203,854	-	175,000	169,186	488,486	264,850	851,587	408,035	1,915,860	608,955	111,362	869,126	1,009,278	480,044	1,681,452	680,662	1,276,500	-	388,926
Taxes																					
Adiana per w/c	1,265	293	2,997	-	2,214	2,581	7,914	4,700	12,321	6,245	27,293	7,867	1,637	9,464	13,378	7,223	24,373	16,911	17,394	-	5,234
Agriculture Tax per w/c	600	139	1,388	-	1,050	824	3,716	2,154	5,414	2,963	11,445	3,731	701	4,376	5,393	3,013	10,170	4,828	8,044	-	2,370
Local Cess per w/c	80	19	190	-	140	163	501	297	779	395	1,728	498	104	599	846	457	1,554	890	1,100	-	331
Utter per w/c	1,820	375	3,837	-	2,835	3,306	10,338	6,222	22,955	7,099	34,652	11,026	2,288	15,958	21,592	9,785	37,851	18,286	20,320	-	8,703
Total Agriculture Land Taxes per w/c	3,565	824	8,411	-	6,239	6,675	22,459	13,374	41,469	17,602	75,476	23,122	4,740	30,357	41,208	20,448	73,948	35,715	52,858	-	14,658
Net Agriculture Income per w/c	185,793	35,783	365,746	-	277,961	186,355	850,483	381,671	1,506,443	856,365	3,235,760	1,027,398	188,610	2,333,237	1,182,954	1,184,915	3,011,612	1,493,866	1,184,642	-	821,137

Analysis of Chilies for Kharif 1997 of Bareji Distributary, Mirpurkhas

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Mean	
Yield per acre (Kg)	1200.00	480.00	480.00	640.00	665.00	665.00	665.00	665.00	665.00	665.00	400.00	640.00	640.00	800.00	480.00	800.00	720.00	665.00	680.00	665.00	720.00	580.00	800.00	665.00	800.00	665.00
Farmgate price per Kg (Rs)	28.78	29.90	30.53	29.53	30.51	30.51	30.51	30.51	30.51	31.40	31.40	29.78	32.40	30.90	29.66	29.15	30.51	29.90	30.51	31.15	31.90	29.90	30.51	31.90	30.51	31.90
Gross Agriculture Revenue per acre (Rs)	34530.00	14352.00	14652.00	18986.00	20288.73	20288.73	20288.73	20288.73	20288.73	12560.00	20096.00	19056.00	25820.00	14832.00	23720.00	20988.00	20288.73	20332.00	20288.73	22428.00	17864.00	17840.00	20288.73	25520.00	20288.73	25520.00
Land Preparation per acre (Rs)	1,300	1,000	1,500	1,500	1,016	1,016	1,016	1,016	1,016	750	1,000	800	1,000	900	800	1,000	1,016	900	1,016	800	1,000	800	1,016	1,200	1,016	
Seed per acre (Rs)	200	300	250	200	322	322	322	322	322	400	200	200	400	200	400	400	322	400	322	400	200	200	800	322	400	
Fertilizer per acre (Rs)	2,300	2,425	2,850	2,650	2,093	2,093	2,093	2,093	2,093	1,950	1,950	1,800	1,800	1,800	1,950	1,950	2,093	2,500	2,093	1,950	2,500	1,500	2,093	1,950	2,093	
Pesticides per acre (Rs)	2,000	1,500	2,500	1,000	1,275	1,275	1,275	1,275	1,275	1,275	1,200	1,000	1,275	600	1,275	1,200	1,275	1,275	1,275	400	1,000	1,400	1,275	1,500	1,275	
Labor per acre (Rs)	900	360	792	800	792	792	792	792	792	500	800	800	1,000	480	1,200	900	792	850	792	900	792	600	792	1,000	792	
Total Agriculture Input Costs per acre (Rs)	6,700	5,585	7,892	6,150	5,497	5,497	5,497	5,497	5,497	4,875	5,150	4,400	5,275	4,040	5,625	5,450	5,497	5,925	5,497	4,250	5,492	5,100	5,497	6,050	5,497	
Net Agriculture Income per acre (Rs)	27,830	8,767	6,760	12,746	14,791	14,791	14,791	14,791	14,791	7,685	14,946	14,656	20,645	10,792	18,095	15,538	14,791	14,407	14,791	18,178	12,372	12,840	14,791	19,470	14,792	

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total/ Mean
Area Cultivated per w/c (Acre)	81.88	25.93	16.45	2.78	29.63	35.25	0.50	1.00	2.90	3.80	10.93	19.58	7.10	7.65	49.88	2.00	20.95	42.55	17.25	17.00	34.35	0.60	72.83	68.20	576.95
Gross Agriculture Revenue per w/c (Rs)	2,827,144	372,076	241,025	52,438	601,054	715,178	10,144	20,289	58,837	47,728	219,549	373,021	184,032	113,465	1,183,035	41,976	425,049	885,127	349,961	381,275	613,628	10,764	1,477,527	1,740,464	538,534
Cost Inputs																									
Land Preparation per w/c	106,438	25,925	24,675	4,163	30,088	35,801	508	1,016	2,945	2,850	10,925	15,660	7,100	6,885	39,900	2,000	21,277	38,296	17,520	13,600	34,350	480	73,963	81,840	24,925
Seed per w/c	16,375	7,778	4,113	555	9,536	11,346	161	322	933	1,520	2,185	3,915	2,840	1,530	18,950	800	6,743	17,020	5,552	3,400	6,870	480	23,441	27,280	7,277
Fertilizer per w/c	188,313	62,868	46,883	7,354	62,000	73,772	1,046	2,093	6,069	7,410	21,304	31,320	11,380	14,229	97,258	3,900	43,844	106,375	36,101	33,150	85,875	900	152,409	132,990	51,201
Pesticides per w/c	163,750	38,888	41,125	2,775	37,772	44,944	638	1,275	3,698	4,845	13,110	19,575	9,053	4,590	63,581	2,400	26,711	54,251	21,994	6,800	34,350	840	92,852	102,300	33,005
Labor per w/c	73,688	9,333	13,031	2,220	23,467	27,923	396	792	2,297	1,900	8,740	15,660	7,100	3,672	58,650	1,800	16,595	36,168	13,664	15,300	27,210	360	57,688	68,200	20,294
Total Agriculture Cost Inputs per w/c	548,563	144,791	129,826	17,066	162,862	193,785	2,749	5,497	15,943	16,525	56,264	86,130	37,453	30,906	280,547	10,800	115,172	252,109	94,831	72,250	166,655	3,060	400,352	412,610	136,702
Taxes																									
Axiana per w/c	5,329	1,698	1,077	182	1,940	2,309	33	65	190	249	715	1,282	465	370	3,073	131	1,372	2,658	1,130	1,113	2,250	39	4,769	4,466	1,534
Agriculture Tax per w/c	3,255	1,037	658	101	1,185	890	20	40	76	152	357	763	264	226	1,694	70	798	1,582	690	316	1,293	4	2,563	2,628	862
Local Cess per w/c	4,232	1,348	855	144	1,541	1,833	26	52	151	198	568	1,018	369	294	2,440	104	1,089	2,109	897	684	1,786	31	3,787	3,546	1,221
Usner per w/c	19,015	6,070	3,800	645	6,843	8,143	116	231	715	878	2,539	4,522	1,648	1,652	11,703	466	4,939	9,738	4,111	3,955	7,935	140	17,223	15,847	5,536
Total Agriculture Land Taxes per w/c	31,831	10,153	6,391	1,072	11,509	13,174	194	388	1,132	1,476	4,180	7,905	2,748	2,541	18,910	771	8,199	16,084	6,827	6,268	13,264	215	28,342	26,488	9,157
Net Agriculture Income per w/c	2,248,751	217,131	104,809	34,298	426,883	508,218	7,201	14,403	41,763	27,727	159,105	276,287	143,833	80,017	883,578	30,305	301,678	596,834	248,322	302,758	411,710	7,489	1,048,833	1,301,566	392,675

Analysis of Fodder for Kharif 1997 of Bareji Distributary, Mirpurkhas

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Mean
Yield per acre (Kg)	2447.09	1714.00	2447.09	2856.80	2856.80	2447.09	2600.00	2856.80	2447.09	2447.09	2447.09	2447.09	2285.80	2447.09	2447.09	2285.80	2856.80	2600.00	2447.09	2447.09	2447.09	2447.09	1720.00	2285.80	2447.09
Farmgate price per Kg (Rs)	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Gross Agriculture Revenue per acre (Rs)	2130.19	1492.04	2130.19	2486.84	2486.84	2130.19	2283.30	2486.84	2130.19	2130.19	2130.19	2130.19	1989.81	2130.19	2130.19	1989.81	2486.84	2283.30	2130.19	2130.19	2130.19	2130.19	1497.26	1989.81	2130.19
Land Preparation per acre (Rs)	1,100	800	831	300	500	631	631	700	631	631	631	500	800	631	631	600	600	600	500	631	631	631	800	600	631
Seed per acre (Rs)	400	400	423	600	500	423	423	200	423	423	423	400	400	423	423	480	423	400	600	423	423	423	300	400	423
Fertilizer per acre (Rs)	754	900	754	350	350	754	754	900	754	754	754	900	900	754	754	900	625	900	700	754	754	754	725	900	754
Pesticides per acre (Rs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labor per acre (Rs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Agriculture Input Costs per acre (Rs)	2,254	2,100	1,808	1,250	1,350	1,808	1,808	1,800	1,808	1,808	1,808	1,800	1,900	1,808	1,808	1,980	1,648	1,900	1,800	1,808	1,808	1,808	1,625	1,900	1,808
Net Agriculture Income per acre (Rs)	(124)	(608)	322	1,237	1,137	322	455	687	322	322	322	330	90	322	322	10	839	363	330	322	322	322	(328)	90	322

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total/ Mean
Area Cultivated per w/c (Acre)	8.70	5.33	8.00	22.73	6.73	17.20	47.05	23.35	38.68	24.93	26.85	26.68	4.88	13.40	28.83	62.30	33.08	22.00	40.75	7.33	19.40	24.45	36.08	1.00	549.48
Gross Agriculture Revenue per w/c (Rs)	18,533	7,945	17,042	56,514	16,724	36,639	106,488	58,088	82,385	53,095	57,196	56,823	9,301	28,545	61,403	123,953	82,252	49,793	86,805	15,804	41,326	52,083	54,014	1,990	48,938
Cost Inputs:																									
Land Preparation per w/c	9,570	4,280	5,046	6,818	3,363	10,649	29,678	16,345	24,395	15,722	16,936	13,338	2,805	8,452	18,182	37,380	19,845	13,200	20,375	4,820	12,237	15,422	28,860	600	14,096
Seed per w/c	3,480	2,130	3,387	13,635	3,363	7,261	19,918	4,870	16,372	10,552	11,387	10,670	1,870	5,673	12,203	29,904	14,002	8,800	24,450	3,101	8,213	10,351	10,823	400	9,859
Fertilizer per w/c	6,561	4,793	6,033	7,954	2,354	12,972	35,484	21,015	29,187	18,798	20,249	24,008	4,208	10,106	21,739	56,070	20,872	19,800	28,525	5,524	14,631	18,439	26,154	900	17,340
Pesticides per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labor per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Agriculture Cost Inputs per w/c	19,811	11,183	14,466	28,406	9,079	31,102	85,079	42,030	69,935	45,071	48,532	48,015	8,883	24,231	52,123	123,354	54,519	41,800	73,350	13,246	35,080	44,212	65,837	1,900	41,294
Taxes:																									
Abiana per w/c	301	184	277	786	233	595	1,541	808	1,252	882	929	923	127	464	997	2,156	1,144	781	1,410	253	671	846	1,248	35	784
Agriculture Tax per w/c	348	133	320	909	289	507	1,543	754	1,370	997	854	1,067	97	536	1,003	2,372	1,237	738	1,570	243	776	978	711	40	807
Local Cess per w/c	87	53	80	227	67	172	446	234	382	249	289	267	37	134	288	623	331	220	408	73	194	245	361	10	228
Usher per w/c	548	335	450	1,590	378	1,121	2,693	1,384	3,185	1,402	1,851	1,547	281	754	2,279	3,504	2,093	1,554	2,726	430	1,091	2,008	2,656	56	1,486
Total Agriculture Land Taxes per w/c	1,282	705	1,127	3,513	947	2,395	6,223	3,179	6,148	3,511	3,702	3,804	522	1,887	4,587	8,655	4,805	3,273	6,113	999	2,732	4,077	4,976	141	3,303
Net Agriculture Income per w/c	(2,380)	(3,943)	1,449	24,595	6,698	3,142	12,186	12,859	6,302	4,513	4,941	5,004	(103)	2,426	4,712	(8,058)	22,928	4,718	7,342	1,359	3,513	3,794	(16,798)	(51)	4,340

Analysis of Wheat for Rabi 1996-97 of Bareji Distributary, Mirpurkhas

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Mean
Yield per acre (Kg)	1200.00	800.00	1200.00	800.00	1000.00	1400.00	1200.00	720.00	880.00	800.00	640.00	1200.00	1000.00	800.00	800.00	990.00	800.00	880.00	1000.00	1600.00	1400.00	1200.00	600.00	880.00	990.00
Farmgate price per Kg (Rs)	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40
Gross Agriculture Revenue per acre (Rs)	7677.00	5118.00	7677.00	5118.00	6397.50	8956.50	7677.00	4606.20	5629.80	5118.00	4094.40	7677.00	6397.50	5118.00	5118.00	6141.60	5118.00	5629.80	6397.50	10236.00	8956.50	7677.00	3838.50	5629.80	6333.53
Land Preparation per acre (Rs)	1,100	800	800	1,100	1,100	700	800	1,100	1,000	750	1,000	800	800	900	800	1,000	1,000	800	800	600	1,000	1,000	600	800	881
Seed per acre (Rs)	800	500	800	300	800	600	600	450	600	600	600	600	600	600	600	600	600	600	600	300	600	600	1,000	500	577
Fertilizer per acre (Rs)	1,950	1,600	1,900	1,950	1,250	1,600	1,600	1,250	1,600	1,600	1,600	1,600	1,600	1,250	1,250	1,600	1,583	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,583
Pesticides per acre (Rs)	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Labor per acre (Rs)	975	780	1,105	910	1,008	1,203	975	871	819	1,174	808	975	1,040	780	858	910	962	962	878	1,170	1,300	975	780	962	958
Total Agriculture Input Costs per acre (Rs)	6,225	5,280	6,005	5,860	5,558	5,703	5,575	5,271	5,619	5,724	5,606	5,575	5,640	5,130	5,030	5,858	5,693	5,582	5,178	5,370	6,100	6,175	5,080	5,562	5,599
Net Agriculture Income per acre (Rs)	1,452	(162)	1,672	(742)	840	3,254	2,102	(665)	11	(606)	(1,512)	2,102	758	(12)	68	484	(575)	68	1,220	4,666	2,857	1,502	(1,242)	68	734

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total/ Mean	
Area Cultivated per w/c (Acre)	33.00	51.00	55.00	94.00	78.00	147.00	113.00	17.00	101.00	55.00	157.00	101.00	39.00	32.00	291.00	125.00	97.00	95.00	160.00	42.00	92.00	104.00	91.00	107.00	2303.00	
Gross Agriculture Revenue per w/c (Rs)	253,341	281,018	422,235	481,092	499,005	1,316,606	867,501	78,305	588,610	281,490	642,821	775,377	249,503	163,778	1,489,338	787,700	496,446	534,831	1,023,600	426,912	823,998	798,408	449,105	602,389	594,850	
Cost Inputs:																										
Land Preparation per w/c	36,300	40,800	44,000	303,400	85,800	102,900	90,400	18,700	101,000	41,250	157,000	80,800	31,200	28,800	232,800	125,000	97,000	76,000	128,000	25,200	92,000	104,000	70,200	85,600	63,256	
Seed per w/c	19,800	25,500	33,000	26,200	46,800	88,200	67,800	7,850	60,800	33,000	94,200	60,600	23,400	19,200	174,600	75,000	58,200	57,000	48,000	25,200	55,200	104,000	58,500	64,200	55,327	
Fertilizer per w/c	84,350	81,600	104,500	183,300	97,500	235,200	180,800	21,250	151,600	88,000	251,200	161,600	62,400	40,000	363,750	200,000	153,513	152,000	256,000	67,200	147,200	166,400	187,200	171,200	149,907	
Pesticides per w/c	52,800	81,600	88,000	150,400	124,800	235,200	180,800	27,200	161,600	88,000	251,200	161,600	62,400	51,200	485,800	200,000	155,200	152,000	256,000	67,200	147,200	166,400	187,200	171,200	153,533	
Labor per w/c	32,175	39,780	60,775	85,340	78,585	176,768	110,175	14,807	82,719	64,570	126,542	98,475	40,560	24,980	226,980	107,250	88,270	91,390	140,400	49,140	119,600	131,400	91,260	102,934	89,794	
Total Agriculture Cost Inputs per w/c	205,425	269,280	330,275	550,840	433,485	838,268	629,875	69,607	567,519	314,820	880,142	563,075	219,980	164,180	1,463,730	707,250	552,183	528,390	828,400	233,940	561,200	642,200	584,360	595,134	531,817	
Taxes:																										
Abiana per w/c	1,518	2,346	2,530	4,324	3,588	6,762	5,198	782	4,648	2,530	7,222	4,648	1,794	1,472	13,386	5,750	4,462	4,370	7,360	1,932	4,232	4,784	5,382	4,922	4,414	
Agriculture Tax per w/c	3,761	4,578	4,896	3,106	3,033	7,732	2,435	2,028	5,345	2,277	4,358	2,615	1,384	828	11,362	5,594	5,043	3,627	4,210	939	3,670	3,162	3,156	3,899	3,860	
Local Cess per w/c	330	510	550	940	780	1,470	1,130	170	1,010	550	1,570	1,010	390	320	2,910	1,250	970	950	1,600	420	920	1,040	1,170	1,070	960	
Usher per w/c	5,940	9,180	9,900	16,920	14,040	26,460	20,340	3,060	18,180	9,900	28,260	18,180	7,020	5,760	52,360	22,500	17,480	17,100	28,800	7,560	16,560	18,720	21,060	19,280	17,273	
Total Agriculture Land Taxes per w/c	11,549	16,612	17,875	25,292	21,441	42,424	29,103	6,040	29,181	15,257	41,410	26,451	10,588	8,180	80,038	35,084	27,935	26,047	41,970	10,851	25,382	27,706	30,768	28,951	26,506	
Net Agriculture Income per w/c	36,367	(24,674)	74,085	(95,040)	44,079	435,914	208,423	(17,342)	(28,090)	(48,587)	(278,731)	185,851	16,855	(8,564)	(54,430)	25,356	(83,672)	(19,606)	153,250	185,121	237,416	128,502	(176,024)	(21,666)	36,527	

**Bareji Distributary, Mirpurkhas
Net Agriculture Income
For Kharif 1997**

Gross Agriculture Revenue for Kharif 1997 (in Rupees)

WIC #	10L	10R	11L	11R	12L	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Cotton	1,714,020	1,337,890	2,377,800	1,174,601	1,243,530	3,515,125	1,714,284	878,010	1,233,157	860,708	1,418,240	1,094,920	751,820	262,880	5,444,888	2,827,770	1,899,456	1,051,772	1,487,993	473,858	1,480,880	1,806,188	602,823	1,354,299	36,193,708	
Rice			14,075			1,525	64,391	22,871	54,679	150,787	23,827	7,741	19,118	2,348		35,186	12,315	193,759	139,311		14,075					786,114
Sugarcane	272,000	66,432	626,051		458,200	362,415	1,441,440	659,895	2,399,499	1,264,000	5,247,040	1,856,875	316,718	3,234,750	2,233,440	1,893,408	4,767,013	2,209,640	2,508,000		1,324,700	381,300	366,552	76,250	33,429,426	
Onion	782,570	739,551	95,925		640,000	3,806	152,837		22,808		183,084	492,676		690,827	245,020	64,688	142,917	222,461	43,750		23,438	23,438				4,862,896
Onions	2,827,144	372,676	241,925	52,436	801,094	715,178	10,144	20,289	58,837	47,728	219,549	373,021	184,032	113,485	1,183,035	41,876	425,049	865,127	349,881	381,276	613,828	10,784	1,477,527	1,740,464	12,924,893	
Onion	849,229	67,178	293,146	334,956	310,408	1,359,587		30,520	987,125				128,520	389,761	283,760	538,889	83,708	245,725	430,758	318,332		44,487	792,038	882,617	6,468,319	
Vegetable		5,335		26,336		24,581										4,389		36,652	50,478							149,966
Fodder	18,822	7,045	17,047	56,514	18,724	36,839	106,488	58,088	82,385	53,085	57,188	55,823	9,301	28,545	8,403	123,853	82,252	49,793	86,805	15,604	41,326	52,083	54,614	1,950	1,174,319	
Total	6,473,483	2,376,207	3,816,483	1,644,846	3,278,816	6,018,836	3,489,344	1,889,861	6,818,482	2,376,328	7,147,833	3,831,836	1,466,896	4,742,273	8,451,844	3,963,849	7,427,899	6,838,276	3,083,248	1,239,547	3,597,846	2,628,433	3,419,328	4,193,658	99,990,848	

Agriculture input Costs for Kharif 1997 (in Rupees)

WIC No.	10L	10R	11L	11R	12L	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Land Prep	306,165	184,329	281,689	175,480	145,833	486,864	188,754	111,960	299,379	122,628	338,736	137,435	75,148	159,100	518,038	249,737	409,568	262,880	384,588	55,488	184,762	111,819	238,114	243,233	3,652,640	
Seeds	71,198	35,788	92,233	29,326	80,337	110,371	182,681	105,816	284,148	151,445	677,806	188,289	48,230	284,676	419,578	218,015	548,794	263,044	474,753	15,356	14,008	98,269	103,084	74,184	4,682,880	
Fertilizers	500,545	294,267	521,481	328,080	342,225	883,100	482,818	229,857	659,808	349,258	1,021,741	468,865	122,980	388,920	1,372,189	608,105	915,500	512,050	1,053,342	15,604	421,863	218,238	434,712	425,218	12,388,536	
Pesticides	448,513	148,805	429,725	147,788	192,509	305,759	200,825	107,813	276,500	209,883	259,838	167,488	50,425	87,285	1,183,166	288,625	341,298	203,031	458,566	32,140	310,339	137,766	193,587	271,028	6,441,218	
Labor	201,876	76,688	202,512	80,856	181,172	406,390	188,211	112,518	323,856	155,667	450,880	264,497	87,899	328,184	800,574	320,105	525,275	280,494	346,888	56,886	244,039	133,188	157,202	188,647	5,822,808	
Total	1,528,187	738,876	1,517,948	689,458	813,876	1,998,483	1,234,191	667,864	1,842,489	888,578	2,741,818	1,227,893	382,683	1,234,163	6,093,544	1,644,588	2,741,437	1,321,580	2,717,846	273,854	1,388,810	885,310	1,127,619	1,202,231	23,063,873	

Agriculture Land Taxes for Kharif 1997 (in Rupees)

WIC #	10L	10R	11L	11R	12L	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Abiana	25,278	14,503	16,751	11,347	13,145	33,184	19,995	11,057	31,646	14,171	40,813	20,703	6,930	20,284	48,685	26,991	41,431	26,834	35,223	6,190	15,819	11,612	21,579	17,831	533,888	
Agriculture Tax	57,430	17,578	15,871	10,985	14,566	28,016	13,714	7,452	29,161	9,240	24,863	23,201	8,045	28,843	35,513	23,444	26,092	20,166	26,055	7,247	11,635	11,288	19,347	20,484	465,826	
Local Cess	9,738	3,854	3,279	2,401	2,582	7,755	3,213	1,842	5,379	4,824	4,824	1,821	4,824	4,824	8,385	4,535	4,552	7,237	6,518	2,221	3,674	1,882	7,318	6,578	113,031	
Usher	27,835	28,833	26,288	18,649	27,835	48,827	30,827	18,185	61,995	19,172	64,418	34,888	11,282	33,845	113,084	39,816	78,380	51,951	58,038	8,602	30,646	23,348	47,898	35,553	896,246	
Total	115,884	64,896	62,189	43,873	63,238	117,835	67,849	38,216	128,186	45,396	134,883	63,331	25,758	87,818	263,888	84,890	152,154	107,949	125,632	25,266	62,774	46,151	96,143	80,826	2,087,596	

Net Agriculture Income for Kharif 1997 (in Rupees)

WIC #	10L	10R	11L	11R	12L	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Gross Agriculture Revenue	6,473,483	2,376,207	3,816,483	1,644,846	3,278,816	6,018,836	3,489,344	1,889,861	6,818,482	2,376,328	7,147,833	3,831,836	1,466,896	4,742,273	8,451,844	3,963,849	7,427,899	6,838,276	3,083,248	1,239,547	3,597,846	2,628,433	3,419,328	4,193,658	99,990,848	
Agriculture Input Costs	1,528,187	738,876	1,517,948	689,458	813,876	1,998,483	1,234,191	667,864	1,842,489	888,578	2,741,818	1,227,893	382,683	1,234,163	6,093,544	1,644,588	2,741,437	1,321,580	2,717,846	273,854	1,388,810	885,310	1,127,619	1,202,231	23,063,873	
Agriculture Land Taxes	115,884	64,896	62,189	43,873	63,238	117,835	67,849	38,216	128,186	45,396	134,883	63,331	25,758	87,818	263,888	84,890	152,154	107,949	125,632	25,266	62,774	46,151	96,143	80,826	2,087,596	
Net Agriculture Income	4,830,212	1,711,327	2,236,345	911,718	2,401,702	3,919,353	2,187,344	1,183,781	4,847,817	1,462,354	4,371,282	2,544,265	1,058,455	3,420,292	2,094,402	2,235,571	4,602,612	2,637,819	2,989,762	935,427	1,163,917	1,506,083	1,225,376	1,906,601	76,840,979	

Detail Analysis (in Rupees)

WIC #	10L	10R	11L	11R	12L	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Total Cropped Area	278	173	189	143	147	379	220	121	318	134	332	203	75	169	522	213	378	286	184	345	74	184	141	269	213	5,034
Total CCA	330	784	297	551	334	976	592	219	749	213	622	746	142	292	1,536	569	393	448	503	135	350	748	328	430	11,924	
Gross Agriculture Revenue per Cropped acre	23,173	14,839	20,156	11,470	22,187	17,868	15,893	13,990	15,166	15,493	20,285	17,782	10,864	27,962	17,762	16,843	18,859	18,237	14,719	16,672	17,476	17,200	12,720	16,875	17,573	
Gross Agriculture Revenue per CCA	18,611	3,271	12,860	4,883	8,237	10,453	5,896	7,739	6,434	11,178	11,485	4,897	9,893	18,263	6,178	9,013	12,526	10,907	9,150	6,898	3,231	10,579	8,624	8,624	8,378	
Agriculture Input Costs per Cropped acre	5,471	4,268	8,014	4,868	6,183	5,248	5,713	5,531	5,800	6,429	7,783	9,976	5,072	7,382	7,683	5,379	7,254	5,166	7,646	3,706	6,728	4,843	4,199	5,834	6,169	
Agriculture Input Costs per CCA	4,829	940	3,115	1,809	2,578	3,457	2,119	3,056	2,466	4,850	4,484	1,840	2,688	4,232	2,676	2,862	4,623	3,296	3,383	2,834	3,733	928	3,523	2,750	2,841	
Agriculture Land Taxes per Cropped acre	412	374	324	305	361	318	308	316	404	295	382	407	341	518	387	362	403	362	364	340	323	342	358	378	364	
Agriculture Land Taxes per CCA	349	82	218	123	198	284	115	175	171	214	216	112	181	301	134	16										

**Bareji Distributary, Mirpurkhar
Net Agriculture Income
For Rabi 1996-97**

Gross Agriculture Revenue For Rabi 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Wheat	253,341	261,018	422,235	481,092	499,005	1,316,806	897,501	78,305	589,610	281,490	842,621	775,377	246,503	183,776	1,489,338	767,700	496,446	534,831	1,023,600	429,912	823,998	795,408	449,105	602,389	14,276,405
Oman	281,124	42,354	362,855	453,540	187,418	1,167,744	25,264	227,380	273,315	154,198	252,644	463,540	136,180	481,685	1,159,637	581,081	999,552	762,663	656,875	50,529	288,124	249,888	606,346	499,776	10,424,889
Fodder	93,932	14,620	104,366	207,132	48,737	156,552	465,738	60,821	261,795	53,714	396,600	292,232	146,221	52,184	521,842	38,992	365,828	182,513	202,619	20,874	114,805	52,184	234,748	116,677	4,231,827
Total	628,397	317,992	889,259	1,141,764	735,158	2,640,802	1,358,503	386,606	1,123,726	489,381	1,292,665	1,551,149	531,884	697,646	3,170,817	1,387,774	1,661,326	1,316,887	1,863,084	501,315	1,237,927	1,190,480	1,290,196	1,219,142	28,932,902

Agriculture Input Costs for Rabi 1996-97 (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Land Preparation	81,800	44,800	88,308	114,900	96,600	146,662	117,838	30,720	127,487	48,184	190,436	109,947	48,200	47,254	289,080	149,173	153,400	106,200	162,613	28,355	103,536	116,954	118,520	108,600	2,617,758
Seeds	28,200	32,600	43,233	48,000	52,000	217,050	56,230	14,500	76,030	37,117	116,787	82,200	33,400	25,117	238,967	91,670	83,700	73,800	76,900	27,347	64,657	112,617	83,700	77,000	1,785,826
Fertilizers	132,184	103,005	150,854	219,250	129,744	393,677	222,119	44,828	190,335	101,521	308,744	247,833	88,700	126,905	478,469	254,141	247,901	240,056	326,561	72,875	182,444	195,483	255,156	225,801	4,948,709
Pesticides	78,300	91,513	89,600	150,400	128,800	235,325	186,563	27,450	163,780	88,000	257,336	182,713	62,400	84,763	475,250	202,000	182,038	159,825	267,825	67,200	148,075	167,400	190,825	176,613	3,533,403
Labor	68,100	93,679	93,425	115,540	85,185	262,661	116,175	27,455	98,238	68,820	147,335	144,720	48,580	92,682	282,628	141,139	147,323	144,139	178,208	61,887	138,606	118,550	128,391	134,788	2,992,924
Total	369,194	329,497	444,920	689,080	582,333	1,255,374	736,826	144,853	496,891	344,611	1,620,839	767,423	381,280	378,920	1,734,402	838,323	794,371	724,038	1,802,108	287,663	642,320	713,803	788,592	735,672	16,098,713

Agriculture Land Taxes for Rabi 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Abiana	9,612	5,235	4,976	7,877	5,703	13,365	8,199	2,129	7,357	3,321	11,289	12,806	3,301	12,036	21,677	9,224	11,143	9,980	17,715	2,248	6,311	7,161	10,380	8,637	293,599
Agriculture Tax	3,761	4,676	4,895	3,108	3,033	7,732	2,435	2,028	5,345	3,272	4,358	2,815	1,384	628	11,362	5,594	5,043	3,427	4,210	839	3,670	3,162	3,156	3,699	82,637
Legal Case	1,050	768	620	1,350	980	2,113	1,675	315	1,424	650	2,173	1,872	620	1,211	3,833	1,566	1,727	1,527	2,097	460	1,188	1,803	1,458	1,458	24,012
Usner	21,015	14,776	12,384	20,183	17,040	30,989	26,147	4,260	22,630	10,744	36,320	33,314	9,158	24,899	64,828	25,294	26,226	24,127	33,471	7,898	18,932	20,708	27,613	24,352	566,394
Total	35,438	29,347	23,883	32,518	28,756	54,179	40,455	8,732	37,859	16,991	54,159	50,889	14,463	38,716	101,869	41,672	44,137	39,660	51,692	11,545	30,681	32,320	43,221	38,168	892,632

Net Agriculture Income for Rabi 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Gross Agriculture Revenue	628,397	317,992	889,259	1,141,764	735,158	2,640,802	1,358,503	386,606	1,123,726	489,381	1,292,665	1,551,149	531,884	697,646	3,170,817	1,387,774	1,661,326	1,316,887	1,863,084	501,315	1,237,927	1,190,480	1,290,196	1,219,142	28,932,902
Agriculture Input Costs	369,194	329,497	444,920	689,080	582,333	1,255,374	736,826	144,853	496,891	344,611	1,620,839	767,423	381,280	378,920	1,734,402	838,323	794,371	724,038	1,802,108	287,663	642,320	713,803	788,592	735,672	16,098,713
Agriculture Land Taxes	35,438	29,347	23,883	32,518	28,756	54,179	40,455	8,732	37,859	16,991	54,159	50,889	14,463	38,716	101,869	41,672	44,137	39,660	51,692	11,545	30,681	32,320	43,221	38,168	892,632
Net Agriculture Income	223,765	(12,852)	421,354	411,157	208,069	1,331,349	587,122	212,921	429,774	127,738	217,287	723,119	236,181	278,951	1,334,613	507,178	1,825,017	722,316	829,494	242,106	345,326	354,237	480,262	437,910	11,941,356

Detail Analysis (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Total Cropped Area	238	106	125	148	111	263	141	46	223	110	429	265	72	186	487	329	276	268	326	53	174	148	183	193	4,570
Total CCA	234	781	297	351	354	576	592	219	749	213	822	746	142	282	1,339	389	892	448	505	135	350	749	320	436	11,924
Net Agriculture Income per CCA																									
Cropped Agriculture Input Costs per CCA																									
Net Agriculture Income CCA				83	76	94	87	88	49	80	64	102	133	67	71	1	1	102	85	80	43	133	1	75	
CCA																									

Bareilly Distributory, Mirpurkhas
Net Agriculture Income
For the Year 1996-97

Gross Agriculture Revenue for the Year 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Colon (Kharif)	1,714,020	1,337,590	2,577,590	1,174,601	1,243,530	3,615,125	1,714,284	8,75,010	1,233,157	860,708	1,416,240	1,064,920	751,520	282,880	5,444,558	2,827,770	1,899,458	1,051,772	1,487,993	473,658	1,480,680	1,805,188	803,623	1,354,799	38,183,708
Rice (Kharif)			14,675			525	64,391	22,871	54,679	150,797	23,927	7,741	19,118	2,345		35,186	12,316	193,759	139,311		4,075				736,114
Sugarcane (Kharif)	272,000	56,432	578,051		459,200	362,415	1,441,440	659,855	2,359,499	1,264,000	5,247,040	1,856,876	3,15,716	3,234,750	2,233,440	1,685,408	4,767,012	2,205,640	2,508,000		1,224,700	381,300	396,552	76,260	33,429,428
Onion (Kharif)	762,570	739,551	85,625		640,000	2,906	152,837		22,808	183,984	490,676		690,527	245,070	54,688	142,917	222,651	43,750		23,438	23,438	92,773	140,222		6,802,896
Onion (Kharif)	2,847,144	2,102,076	241,025	52,436	801,054	715,178	10,144	20,280	58,837	47,728	2,19,549	373,021	184,032	113,465	1,183,035	41,876	425,049	865,127	349,981	381,276	613,628	10,764	1,477,527	1,740,464	12,324,803
Onion (Kharif)	848,229	57,178	293,146	234,958	210,408	1,369,887			50,526	957,125			128,520	385,761	283,760	536,885	93,708	245,725	430,758	318,332		144,467	792,039	882,417	8,488,515
Vegetable (Kharif)		5,335	26,336			24,561											4,389		36,652	50,478		2,195			149,965
Wheat (Kharif)	18,533	7,945	17,042	56,514	16,724	36,639	106,486	58,068	87,385	53,085	57,196	58,825	9,301	28,535	6,403	123,980	84,252	45,793	86,805	15,604	41,326	52,083	54,074	1,990	1,174,919
Wheat (Rabi)	253,341	26,618	425,235	48,392	499,005	1,316,605	867,501	78,305	582,810	281,497	642,821	75,577	249,303	183,773	1,488,338	767,100	498,448	534,831	1,023,800	429,912	823,998	798,408	445,105	802,345	14,274,495
Onion (Rabi)	781,724	42,364	362,655	453,540	187,416	1,187,744	23,264	21,380	213,315	154,130	251,644	483,540	136,100	481,885	1,155,037	591,081	399,557	75,662	656,875	50,529	299,124	245,898	602,346	499,776	10,424,888
Wheat (Rabi)	91,925	4,620	104,368	207,132	48,737	156,933	495,736	50,921	281,795	45,714	398,600	281,237	144,221	52,184	38,955	385,828	181,513	202,619	20,874	114,805	52,184	234,746	116,977	4,231,427	
Total	7,101,892	2,884,199	4,705,122	2,786,610	4,806,874	8,659,857	4,847,888	2,056,268	5,842,211	2,865,897	8,440,000	4,203,004	1,940,111	5,440,120	12,622,381	6,693,823	9,288,623	6,354,282	6,968,343	1,740,882	4,835,773	3,520,914	4,705,724	3,414,789	128,832,950

Agriculture Input Costs for the Year 1996-97 (in Rupees)

W/C No.	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Land Preparation	367,965	229,129	329,897	210,390	243,433	633,525	316,593	142,680	425,877	170,883	521,172	247,382	122,348	206,354	807,127	397,910	567,966	369,080	547,201	80,843	293,300	231,773	356,634	353,033	8,278,988
Seeds	99,398	68,388	135,466	77,336	123,237	327,421	269,911	72,318	380,178	186,863	794,592	270,985	79,630	292,792	528,844	309,885	633,494	335,844	551,953	42,703	211,066	208,806	187,694	151,194	6,478,800
Fertilizers	632,728	357,272	672,335	445,230	471,973	1,076,776	705,038	274,685	849,942	450,780	1,332,485	718,688	211,660	513,825	1,850,658	862,246	1,183,401	742,117	1,379,804	188,476	604,306	411,722	699,958	451,120	17,314,243
Pesticides	576,613	240,418	828,725	288,188	291,309	639,084	381,188	133,263	440,290	287,883	517,175	350,202	112,825	182,040	1,858,416	491,625	503,336	362,856	76,394	95,340	458,413	308,165	384,422	447,650	10,274,622
Labour	277,678	130,268	296,227	206,398	276,357	689,051	306,387	139,974	423,093	225,481	596,225	405,227	136,459	419,066	883,201	461,244	672,609	424,633	524,896	108,855	362,645	251,748	285,693	323,408	8,425,724
Water	1,897,371	1,665,473	1,962,755	1,377,542	1,435,409	3,245,857	1,855,116	812,918	2,499,380	1,333,189	3,761,649	1,904,485	963,923	1,614,065	5,877,946	2,722,909	3,535,608	2,245,530	3,720,047	673,518	1,950,330	1,409,213	1,814,211	1,925,403	81,183,768
Total	7,101,892	2,884,199	4,705,122	2,786,610	4,806,874	8,659,857	4,847,888	2,056,268	5,842,211	2,865,897	8,440,000	4,203,004	1,940,111	5,440,120	12,622,381	6,693,823	9,288,623	6,354,282	6,968,343	1,740,882	4,835,773	3,520,914	4,705,724	3,414,789	128,832,950

Agriculture Land Taxes for the Year 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Agriana	34,591	19,820	21,717	19,253	18,848	45,530	26,194	13,340	39,093	17,491	52,202	33,511	10,221	32,832	70,242	36,215	52,574	38,614	46,938	8,444	23,230	18,793	31,929	26,582	741,279
Land Revenue Tax	41,191	27,152	20,746	14,093	17,599	35,749	16,149	8,480	34,508	11,517	29,021	25,816	7,429	29,271	48,275	29,036	31,635	22,793	30,265	1,806	15,305	14,465	22,503	24,163	561,262
Local Fees	10,769	4,613	2,092	4,562	9,859	4,888	857	4,888	6,802	3,464	6,844	6,500	2,141	6,145	12,328	6,099	1,179	8,764	8,612	2,881	4,741	3,162	9,122	8,016	147,047
Water	83,653	43,610	38,882	35,127	38,575	79,668	59,074	11,425	84,620	39,018	106,316	68,312	20,420	58,444	178,622	64,925	104,604	76,478	91,509	17,499	49,578	24,055	5,811	80,205	1,510,640
Total	15,521	90,203	85,274	76,196	79,884	171,814	108,304	48,948	185,241	82,388	268,802	134,140	40,221	126,692	307,488	135,292	147,645	177,224	36,811	92,855	60,471	139,364	118,986	2,960,228	

Net Agriculture Income for the Year 1996-97 (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Gross Agriculture Revenue	7,101,892	2,884,199	4,705,122	2,786,610	4,806,874	8,659,857	4,847,888	2,056,268	5,842,211	2,865,897	8,440,000	4,203,004	1,940,111	5,440,120	12,622,381	6,693,823	9,288,623	6,354,282	6,968,343	1,740,882	4,835,773	3,520,914	4,705,724	3,414,789	128,832,950
Agriculture Input Costs	1,897,371	1,665,473	1,962,755	1,377,542	1,435,409	3,245,857	1,855,116	812,918	2,499,380	1,333,189	3,761,649	1,904,485	963,923	1,614,065	5,877,946	2,722,909	3,535,608	2,245,530	3,720,047	673,518	1,950,330	1,409,213	1,814,211	1,925,403	31,163,768
Agriculture Land Taxes	150,823	90,203	85,274	76,196	79,884	171,814	108,304	48,948	185,241	82,388	268,802	134,140	40,221	126,692	307,488	135,292	147,645	177,224	36,811	92,855	60,471	139,364	118,986	2,960,228	
Net Agriculture Income	3,053,778	1,738,523	2,657,093	1,332,872	2,310,481	5,242,187	2,754,467	1,194,402	3,277,590	1,470,110	4,409,551	2,064,389	935,968	3,699,343	6,436,927	4,034,622	5,506,626	3,961,103	3,068,972	1,188,893	2,585,588	2,051,329	2,652,149	3,370,410	74,708,933

Detail Analysis (in Rupees)

W/C #	10L	10R	11L	11R	12L	13L	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R	7L	7R	8L	8R	9L	9R	Total
Total Cropped Area	529	378	314	291	258	644	481	187	541	284	781	470	147	335	1,029	642	854	566	673	127	368	289	454	368	10,634
Total CCA	330	788	287	351	354	576	592	219	749	213	422	746	142	202	1,320	589	593	448	503	133	350	749	320	436	11,924
Gross Agriculture Revenue per CCA	25,687	17,659	27,264	19,145	28,810	25,934	21,530	21,980	20,208	19,903	23,307	23,646	26,032	32,186	24,142	21,162	26,403	21,894	20,456	26,131	24,591	24,642	19,694	27,340	23,387
Gross Agriculture Revenue per CCA	21,514	3,875	15,856	7,948	11,313	15,039	8,192	8,407	7,939	12,461	13,367	6,878	10,529	18,656	8,236	11,371	15,663	14,193	13,797	12,650	13,231	4,700	14,712	12,421	10,803
Agriculture Input Costs per CCA	6,947	7,338	11,973	9,103	10,718	9,889	8,745	6,682	8,748																

IIMI-PAKISTAN PUBLICATIONS

RESEARCH REPORTS

Report No.	Title	Author	Year
R-1	Crop-Based Irrigation Operations Study in the North West Frontier Province of Pakistan Volume I: Synthesis of Findings and Recommendations	Carlos Garces-R D.J. Bandaragoda Pierre Slosser	June 1994
	Volume II: Research Approach and Interpretation	Carlos Garces-R Ms. Zaigham Habib Pierre Slosser Tissa Bandaragoda Rana M. Afaq Saeed ur Rehman Abdul Hakim Khan	June 1994
	Volume III: Data Collection Procedures and Data Sets	Rana M. Afaq Pierre Slosser Saeed ur Rehman Abdul Hakim Khan Carlos Garces-R	June 1994
R-2	Salinity and Sodicty Research in Pakistan - Proceedings of a one-day Workshop	J.W. Kijne Marcel Kuper Muhammad Aslam	Mar 1995
R-3	Farmers' Perceptions on Salinity and Sodicty: A case study into farmers' knowledge of salinity and sodicty, and their strategies and practices to deal with salinity and sodicty in their farming systems	Neeltje Kielen	May 1996
R-4	Modelling the Effects of Irrigation Management on Soil Salinity and Crop Transpiration at the Field Level (M.Sc Thesis - published as Research Report)	S.M.P. Smets	June 1996
R-5	Water Distribution at the Secondary Level in the Chishtian Sub-division	M. Amin K. Tareen Khalid Mahmood Anwar Iqbal Mushlaq Khan Marcel Kuper	July 1996
R-6	Farmers Ability to Cope with Salinity and Sodicty: Farmers' perceptions, strategies and practices for dealing with salinity and sodicty in their farming systems	Neeltje Kielen	Aug 1996
R-7	Salinity and Sodicty Effects on Soils and Crops in the Chishlian Sub-Division: Documentation of a Restitution Process	Neeltje Kielen Muhammad Aslam Rafique Khan Marcel Kuper	Sept 1996
R-8	Tertiary Sub-System Management: (Workshop proceedings)	Khalid Riaz Robina Wahaj	Sept 1996
R-9	Mobilizing Social Organization Volunteers: An Initial Methodological Step Towards Establishing Effective Water Users Organization	Mehmoodul Hassan Zafar Iqbal Mirza D.J. Eandarooda	Oct 1996
R-10	Canal Water Distribution at the Secondary Level in the Punjab, Pakistan (M.Sc Thesis published as Research Report)	Steven Visser	act 1996
R-11	Development of Sediment Transport Technology in Pakistan: An Annotated Bibliography	M. Hasnain Khan	Oct 1996

Report NO.	Title	Author	Year
R-12	Modeling of Sediment Transport in Irrigation Canals of Pakistan: Examples of Application (M.Sc Thesis published as Research Report)	Gilles Belaud	act 1996
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