

# Chapter 11

## Water Harvesting Practices in Balochistan

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### 1. INTRODUCTION

#### Background

There is great concern about future supplies of water for irrigation and domestic purposes in the uplands of Balochistan. The principal source of income of populations in the uplands is agriculture. Rainfall is scanty, erratic, and irregular. The only source of irrigation and drinking water is groundwater tapped through tubewells and wells. As a result of extension of electricity, tapping groundwater by tubewells /open surface wells has become cheaper. Irrigated crop areas have expanded making more demands on water supplies. Consequently, the number of tubewells / wells has increased substantially over the past decades. Pressure has increased on the aquifers because discharge has by far overtaken recharge. Water tables in the tubewells and wells have fallen. Extracting water from a depth has increased costs, both investment and operational. Now shortage of water for irrigation of crops and drinking is imminent if appropriate control measures are not adopted. Desertification of arable areas can occur.

Another threat to soil conservation occurs where land is denuded by unscrupulous cutting of bushes / trees for fuel. Land erosion caused by flash floods and wind has been causing considerable damage to agriculture, irrigation sources, and forest lands.

Watersheds are the only continuous and reliable supply of water, providing a lifeline to agricultural activities, the source of employment for the vast majority of the population. The removal of almost all vegetation has negatively affected the water infiltration rate.

During the last 40 years, new villages have been established in the watershed area. Rangelands have been exploited by transhumant flocks and the remaining vegetation has been uprooted for firewood consumption. The removal of almost all vegetation has negatively affected the water infiltration rate and increased soil erosion, with the consequence that little of the original topsoil is left. Faced with a steady decline in the availability of fodder for their herds, transhumant people have set up villages changing their productive system from transhumant grazing to permanent agriculture. The pressure on

land, vegetation, and water has increased to the point that many people can no longer sustain themselves through agricultural production (FAO 1993).

Water harvesting is carried out mainly for two purposes: one for irrigating crops and the other for drinking water. In the study area, two kinds of agriculture are practised. Firstly, crops, orchards, vegetables, and fodder are cultivated and irrigated with water from 'kareze' (which have dried up) and shallow and deep wells operated by electricity. Secondly, wheat, barley, sorghum, and cumin depend on flood- and rain water harvested through dykes, both large and small. Drinking water supplies either come from the tubewells meant for agriculture or the tubewells installed by the government specifically for drinking water supply. Most villagers obtain water for drinking and other purposes from water channels flowing through the village carrying water to fields. Women and children are generally responsible for fetching water.

Most sources of drinking water are of questionable quality and often difficult to access. Since women are mostly responsible for the collection of household water supplies, the distances they need to travel to the source and the primitive means of transportation place a considerable burden in terms of time and effort on their daily work loads. In addition, the poor quality of water collected and the primitive methods of transport and storage perpetuate health problems caused by contaminated water.

The low status of women in the largely traditional societies in Balochistan hinders their access to safe drinking water as well as other social services and limits their decision-making authority within the household and community.

The limited and depleting groundwater sources stand as a basic limiting factor to provision of a sustained water supply. In addition, institutional weakness, lack of adequate planning, and lack of involvement of communities, particularly women, in operation and maintenance of public water schemes have been identified as major constraints in the past.

Women in the rural areas are the prime carriers and users of drinking water, which is used for the family. All the drinking water programmes should therefore ensure that women's crucial role in water management is not undermined.

### **Objectives**

This case study was carried out in Kanak Valley, Noza micro-(sub) watershed area, in five villages covering 30 households. The objectives of this study are to investigate the following aspects.

- Socioeconomic and cultural conditions
- The water supply for irrigation and drinking
- Role of women as users of water and as decision-makers

### **Methodology**

As a first step, a questionnaire containing socioeconomic aspects and in line with the outline agreed upon for the case study was developed. Discussions were held with the Forest Department about selection of a suitable area served by the micro-watershed and about the interview schedule. A female researcher was contracted to carry out the study. The Forest Department had a number of interviewers, both female and male, who helped carry out the interviews in the villages selected.

The micro-watershed selected for the case study is Noza watershed in Kanak Valley, Mastung District. The following five villages and 30 households were selected (Table 11.1).

Table 11.1: **Number of Villages and Households**

Village	Number of Households
Babri	10
Raza Mohammad	5
Nihal Khan	5
Bentary	5
Mohammad Hassan	5
Total	30

## 2. LOCATION AND COMMUNICATION

### Location

Kanak Valley, where the micro-watershed lies, is located in the newly created Mastung District, about 45 km south - west of Quetta. Maps show the location of the study area and micro-watershed. The area commanded by Noza micro-watershed is 8,100 ha.

### Communication

The RCD (Regional Cooperation for Development) highway connects the area with Quetta, Mastung - Nushki. The area has metalled roads connecting villages. The villages in the suburb lie only at a distance ranging from two to 10 km from the main road. The railway line (Quetta - Taftan) also passes through the area and there is a railway station at Dringer. There are local bus services daily for Quetta and Mastung (District Headquarters). The large villages have a telephone exchange and post office.

### Topography

The topography of the area ranges between 1,800 to 2,500 masl from south to north.

### Climate

Kanak Valley, where Noza micro-watershed is located, is situated in the desert belt of Balochistan and its climate is classified as arid, sub - tropical continental highland, with low rainfall, low humidity, frequent winds, severe winters, and mild summers. The cold season starts in early November and ends in March. There are two rainy seasons. The winter season is from December to April with frequent rainfall on the higher mountains and occasional ones in the valley. Between December to February, the area receives snowfall. Summer rains occur in July - August in the form of storms. The mean annual precipitation in the study area is 214 mm. Long dry spells are common. Therefore, dry farming is often risky unless there are years of favourable rainfall.

There is considerable variation in temperatures with the mean winter temperature being about about 24°C. The minimum temperatures are frequently below freezing from mid - November to the end of January. Maximum temperatures in June and July vary between 30° and 50°C (FAO 1993).

The meteorological data for Mastung district are given in Table 11.2.

## 3. SOIL AND WATER RESOURCES

### Soils

Soil formation in the study area consists of parent materials of limestone and shale. Alluvial sorting out and deposition of these materials have been generated from different landforms:

Table 11.2: Meteorological data for Mastung District

Months	Rainfall (mm) Average 1931 / 1960	Rainfall (mm) Average 1991 / 1992	Temperature (Mean)	Humidity %
January	57.1	40.3	3.2	60
February	44.1	63.1	3.6	62
March	39.3	52.5	10.2	54
April	16.0	77.3	13.7	46
May	9.5	20.3	18.4	40
June	2.3	0.3	23.5	43
July	10.9	0.0	25.5	51
August	8.0	0.0	23.8	50
September	0.3	0.8	19.6	41
October	0.8	1.3	13.7	38
November	3.3	9.4	7.8	34
December	22.1	15.7	5.1	64
Total	214.0	281.0		

alluvial forms, piedmont plains, piedmont basins and playas, and stream floodplains. The alluvial soils are of a gravelly loam texture, strongly calcareous, and moderately alkaline. Water infiltration is good with low holding capacity. The piedmont plain soils are loamy to silty, strongly calcareous, moderately alkaline, and have few or no weak fragments in their profile. The average pH is 7.9. In the piedmont basins and playas, the soils are clayey, deeply developed, strongly calcareous, and moderately alkaline. The stream floodplains are moderately to deeply developed, silty, brown / dark brown to yellowish brown, strongly calcareous, and moderately alkaline.

### Land Use

There are three main kinds of land use in the study area.

Irrigated farming is practised on the piedmont plains and stream floodplains. Open surface wells / tubewells are on the permanent sources of water and over time replaced the kareze. Because of continuous lowering of the groundwater table, all the kareze are dry now.

Rainfed farming is of two types in the study area : 'sailaba' and 'khushkaba'. In the sailaba system the lands are irrigated with flood water coming from seasonal small streams and checked by embankments constructed across the stream bed and diverted to the fields. Stream flows are more intense during monsoon and the soil particles carried by the runoff increase soil productivity. The khushkaba lands receive moisture from rainfall of very localised runoff. The bounds are banks of earth with no spillways. Wheat, barley, and beans are sown in winter season.

### Water Resources

The three available sources of water for irrigation are tubewells, open surface wells, and precipitation in the form of rain and snow. Since the average annual rainfall in Mastung district is not more than 214 mm, the farmers in the area have to depend on the first two sources. With existing agricultural practices, the available water sources cannot meet the requirements of the land. Because of the pressure on groundwater resources from agriculture, almost all the kareze have become dry. According to a study undertaken in the

Kanak Valley (FAO 1994), a continuous decline in the groundwater level in the area has been observed. The central parts of the valley have suffered a considerable drop, resulting in drying up of the majority of shallow wells. Tubewells are bored in the bottom of open surface wells. Boring of deep wells not only increases the cost of water but also puts pressure on aquifers from continuous pumping. Presently there is no proper legislation for controlling over-exploitation of groundwater resources in the area.

Evaluation of different water supply sources in terms of acceptable service standards, of quality, quantity, access, and reliability is difficult, but it is presumed that both the public water schemes and the irrigation system meet the minimal criteria for safe and adequate drinking water. The quality of unprotected water sources is generally less satisfactory than that of water from the public system.

#### 4. SOCIOECONOMIC PROFILE

##### Population and Community Structure

The Kanak Valley including the study area has 40 villages that range from having 25 to 500 households. There are approximately 20,000 persons in the valley. The average family size is 7.1 (FAO 1993).

According to the survey undertaken and information gathered from 30 households in five villages in the Noza micro-watershed command area, the following picture emerges (Table 11.3).

The population in the study area consisting of 30 households in five villages totals 313 persons with men dominating. The male female ratio is 1.16:1. Among children 47.4% belong to the age group six – ten years followed by 0 - 5 and 11 - 15 year age groups. The adult

population lies mostly in the age groups from 16 - 25 and from 26 - 35 years. The average family size is 10.4 persons with a range of from 5 - 20 persons per family.

There are two types of family in the study area: nuclear and joint families. The joint family is composed of different brothers with their wives, children, and their grandparents. In this system, the elder brother is the chief who manages all the money contributed by all earning members of the family. In the nuclear family system, the elder plays the role of coordinating the economic activities and social affairs. Individual adults do not have complete autonomy, they are obliged to follow the orders of the chief. The families are exclusively managed by male members. Women have little to say in family affairs.

##### Ethnic Distribution

The population in the study area belongs to the Brahvi linguistic group, and, historically, they are the sons of the soil. The main tribes are the Bengalzai, Babri, Sumalani, and Mengals (Table 11.4).

Table 11.3: Number of Family Members—Distribution by age and gender (N=30)

	Age	Male	Female	Total
<b>Children</b>				
	0 - 5	22	21	43
	6 - 10	40	33	73
	11 - 15	21	17	38
<b>Adults</b>				
	16 - 25	28	34	62
	26 - 35	23	17	40
	36 - 45	12	7	19
	46 - 55	6	9	15
	56 & Above	16	7	23
	Total	168	145	313

Bangalzai, the main tribe, has a Badozai sub-tribe with further division into Guand, Shahanzai, and Gulerzai. The majority of households (70 %) in the study area are Bangalzai, followed by Babri, Sumalani, and Mengal.

### Education

The literacy rate and the standards of education are poor. The following Table (Table 11.5) shows the education status and literacy rates in the study area.

There are 91 persons out of 240 reported to have had some level of education. More than 80% never got beyond primary and middle levels, with 50.5% dropping out at primary level. Nevertheless, the literacy rate in the study area is 29.1% and is as low as 6.2% among women (Table 11.6).

There are five schools in the villages covered, four primary and one middle. There is only one primary school for girls.

This situation is partially related to the conservative attitude of the Brahvi

people. Parents prefer to keep their children at home, especially girls, as they think schools are far from their houses. Above all, the feudal chiefs do not have a positive attitude towards educating their people because they, perhaps, presume that literacy will result in them losing their hold over the people. Lack of schools, particularly for girls, in the study area emphasises the problem.

### Living Conditions

Living conditions in a family household and village are reflected by the construction, space, ventilation, and availability of lighting and heating facilities. Table 11.7 gives the number of households, type of construction, and their facilities.

All houses are *katcha* or constructed with mud and stones. The number of rooms in a house varies from two to seven and is related to the size of family. Only one house has ventilation while 29 households have closed rooms with no window for aeration. Electricity has been supplied to 26 houses and heating during winter is with coal, wood, and bushes. Almost all houses have animal sheds. Sketch maps of two typical houses (Figures 11.1 and 11.2) have been given to show the facilities in the villages in the study area.

### Migration

A few decades ago, most of the population in Mastung and other areas used to migrate to the plains of Sibi, Dhadar, and other locations to survive the harsh cold weather and

Table 11.4: **Ethnic distribution of households by tribe and sub-tribe**

Tribe	Sub - Tribe	Number of Households
Bangalzai	Badozai / Guand	8
	Badozai / Shahanzai	5
	Badozai / Gulerzai	2
	Badozai	6
	sub-total	21
Babri	Anarzai / Kotorzai	4
Sumalani		3
Mengal	Mehmoodzai	2
	Total	30

Table 11.5: **Education by class and gender**

Level	Male	Female	Total	Percentage
Primary	40	6	46	50.5
Middle	27	3	30	33
High	11	-	11	12.01
College	4	-	4	4.4

Table 11.6: **No of schools by class level**

Level	Male	Female	Total
Primary	3	1	4
Middle	1	-	1
Total	4	1	5

Table 11.7: **Number of Households by Mode of Construction, Rooms and Facilities**

Facility	Number
<b>Construction</b>	
Katcha	30
Pacca	-
<b>Number of Rooms</b>	
2	4
3	4
4	6
5	5
6	8
7	3
<b>Aeration</b>	
Ventilation	1
Closed	29
<b>Electricity</b>	26
<b>Heating</b>	
Coal / Wood	30
<b>Animal Shed</b>	29

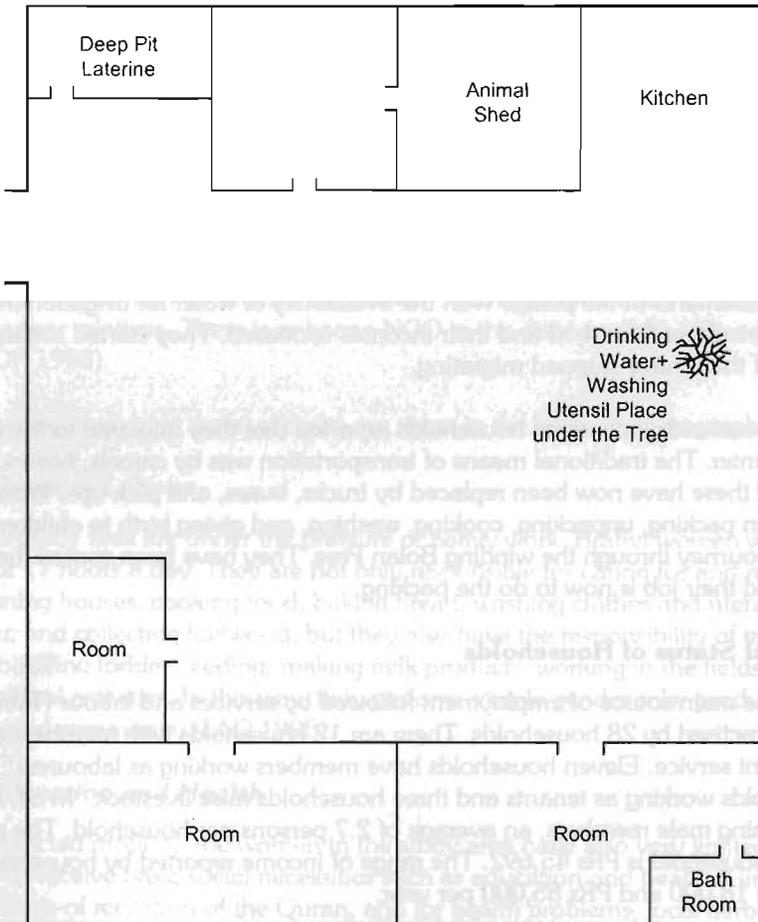


Figure 11.1: **Sketch Map of a House Village: Nihal Khan**

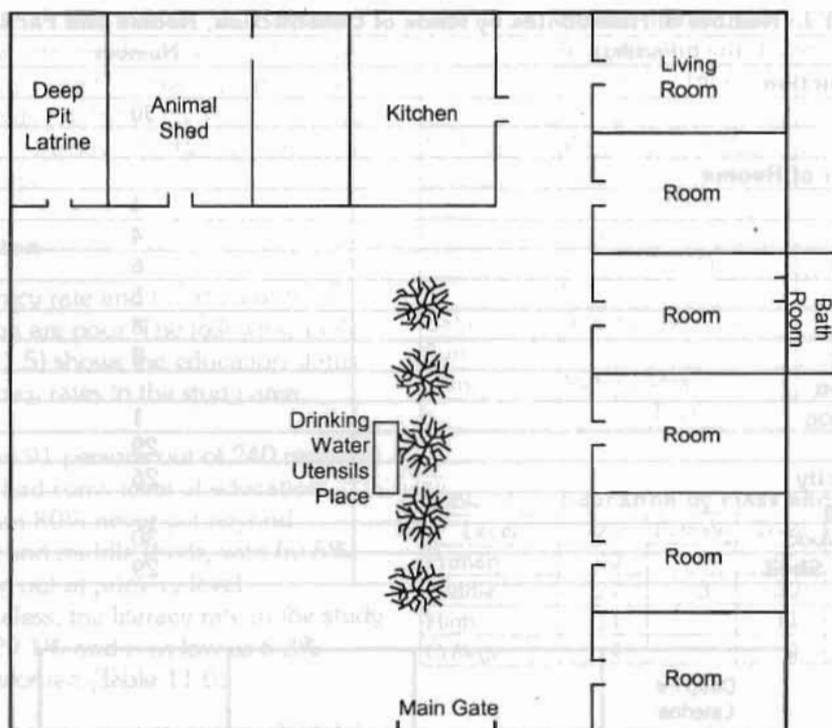


Figure 11.2: Sketch Map of a House  
Village: Mahmud Hassan

inactive season and to look for job opportunities either by offering their services as seasonal labour in the crop production sector or by feeding their goats and sheep. They had temporary settlements in the plains. With the availability of water for irrigation from wells / tubewells, agriculture flourished and their incomes increased. They started settling down. Now, most of them have stopped migrating.

Out of 30 households, only three households reported that they migrated to the plains during the winter. The traditional means of transportation was by camels, horses, or donkeys, but these have now been replaced by trucks, buses, and pick-ups. Women used to be involved in packing, unpacking, cooking, washing, and giving birth to children during a month-long journey through the winding Bolan Pass. They have been spared these hardships and their job is now to do the packing.

**Professional Status of Households**

Farming is the main source of employment followed by services and labour (Table 11.8). Farming is practised by 28 households. There are 12 households with members employed in government service. Eleven households have members working as labourers. There are four households working as tenants and three households raise livestock. In all, households have 81 earning male members, an average of 2.7 persons per household. The average income per household is PRs 45,692. The range of income reported by households is between PRs 18,000 and PRs 85,000 per year.

Table 11.8: **Distribution of households by profession, number of earning members and average income/household**

Profession	Number	% age
Land Owner	28	93
Tenant	4	13
Service	12	40
Livestock	3	10
Labour	11	37
Earning Members	81	2.7 average
Total Income / Household		
	Range (PRs '000)	18 - 85
	Average (PRs)	45,692

## Gender Issues

Gender issues arise as a result of the low status and position of female members in the household as well as in society. Women do not enjoy freedom of movement but only within the village. While going outside the village, a male member of the family has to accompany them. There is no *purdah* inside the village. Women are not involved in any decision-making. Women exclusively perform household chores; however, economic activities in agriculture are shared by both genders. Money is only handled by men. Women generally fetch water and fuel from far - flung areas. Their husbands are responsible for tending animals and crops. Women do the cooking, cleaning, washing, and looking after the children. Women do keep poultry and rabbits besides livestock which are fed orchard waste. Jewellery is the only asset owned by the women. The parents have expectations of financial assistance from their sons in old age as well as that both genders will look after their physical comfort.

Both genders have obligations to live together in all situations. In very rare cases, on the assumption of betrayal, men do divorce their wives. Marriages are mostly arranged with a preference for near relatives. There is only one NGO in the district, which is headed by a woman (UNDP 1998).

Issues confronting women in the study area are given in the following paragraphs.

### Gender Division of Labour

Women in the study area are under the pressure of heavy work. Brahvi women work on average about 17 hours a day. They are not only responsible for caring for and rearing children, cleaning houses, cooking food, baking bread, washing clothes and utensils, and fetching water, and collecting fuelwood, but they also have the responsibility of taking care of animals, collecting fodder, feeding, making milk products, working in the fields, assisting men in agricultural activities. In this way, they perform a triple gender role: productive, reproductive, and community (FAO 1995).

### Access to Education and Health

Because of restricted mobility, the women in the study area have also very limited opportunities to receive basic social necessities such as education and health. Girl's education consists of recitation of the Quran, and for health problems, local herbal medicine practitioners (*hakeem*) or *taveez* from the *mullah* or a visit to some holy shrine have to

provide a solution. Only when life is at stake do women members get taken to Mastung and Quetta.

### **Participation in Decision-making**

Inside the compound women manage everything for the family, but outside the compound walls, the role of women in decision-making is negligible. Even in the house, women have no voice in domestic matters. In the study area, 50% of the women reported that their opinion in household affairs is accepted by the men members.

### **Access to Capital and Credit**

The rural women have no access to capital and credit in general. The marketing of agricultural commodities is exclusively carried out by men members as well as handling all cash.

### **Access to Agricultural Extension and Information**

The access to agricultural extension services and information by women is very poor. Although women participate intensively in agricultural activities, the dissemination of information and techniques is entirely imparted to men. In some cases, training in food and nutrition, health, child care, and home management is provided to women while men are trained in extension services to improve farming practices. Men in the family rarely discuss information with the women (FAO 1995).

### **Organisational Role of Women**

Table 11.9 shows how many households are members in village organizations, organizational functions, and women's participation.

FAO has recently introduced different income-generating schemes and nine households have membership in these organisations. In addition, women by themselves run 20 schemes in savings, credit, tree planting, and other income-generating activities. Eighteen households are participating in credit schemes in poultry and sheep raising with 306 members, each scheme is comprised of 11 to 17 women members. No woman has access to credit other than from the FAO-operated programme (FAO 1997) The women do not own any property; therefore they cannot approach banks for loans or credit as they have no collateral or guarantee.

**Table 11.9: Households with membership in an organisation, function of the organisation and women's participation**

		Number of Households	
a.	Membership in Organization	9	
b.	Separate Women's Organizations in Sewing, Credit, Tree Plantation, and Income generation	20	
c.	Poultry, Sheep Raising, Credit Schemes by Women	Number	Members
		18	306*

\* Includes women from other households in the village not covered by the study.

## Women in Agriculture

Women work in the fields on a seasonal basis. In the spring and summer they plant seedlings and thereafter at intervals they weed the crops. Women clean and store winter wheat. In the fall women go to the fields daily to harvest onions (FAO 1993).

In the study area, women help men with almost all crop management operations. Table 11.10 gives women's participation in agricultural activities.

Women mostly participate in cleaning seeds, sowing crops, weeding, harvesting, threshing, and storing. In weeding and harvesting, 93 % of the women take part, while in storing produce, cleaning seeds, and sowing operations also women do participate.

Table 11.10: **Women's participation in agricultural activities**

Activities	Household	
	Number	(%)
Cleaning Seeds	18	60
Sowing	17	57
Weeding	28	93
Harvesting	28	93
Threshing	2	7
Storing	22	73

## Role of Women in Caring for Livestock

Livestock are the secondary source of income in rural areas and are especially important as far as raising domestic animals is concerned. Sometimes, a family is hired to graze all the sheep and goats in the village. Women from the household milk the animals and feed them in their compounds. Children collect fodder for the animals to eat at night and at other times women bring weeds and onion stalks from the fields for fodder. They generally look after sick animals and assist in delivery of sheep and goats. In raising domestic animals women have a pronounced role. In the study area, there were 119 goats, 111 sheep, and two cows managed by 30 households. Women are generally responsible for raising and managing these animals. Animals are mostly watered at home (23 households). Only five households take their animals to water storage tanks. Animals are watered by women, generally once a day. Activities include health care, milk processing, and preparation of milk products such as butter, local cheese, ghee, and buttermilk. Besides collection of fodder for animals and collection of farmyard manure, hay and silage making are the responsibility of women. In some cases, women also handle the buying and selling of animals (goats and sheep) and their by-products— including hides for water bags and wool for carpets, grain bags, and ropes.

Every household keeps an average of 10 poultry. Through poultry raising women supplement both their incomes and nutrition. In the absence of improved and proper knowhow, such as vaccination and balanced feed, poultry farming is very risky. Sometimes mortality is as high as from 50 to 70%. Poultry is generally raised on kitchen and food-grain wastes. Rabbit farming has also been introduced into the study area.

## Health

Health services are very minimal in the study area. Only one Basic Health Unit exists in Babri Village. Child and maternal mortality are high. Serious health cases are treated either at Mastung (District Headquarters at a distance of 16 km away) or taken to Quetta where specialised health facilities are available (Table 11.11).

Table 11.11: **Incidence of disease in the study area**

Disease	Households
Malaria	29
Diarhoea	8
Typhoid	2

The three major diseases reported were malaria (97 %), diarrhea (27 %), and typhoid (7 %). Most villagers are aware of the relationship between clean water and good health (UNICEF 1984). Bad or unclean water is thought to cause the following complaints.

- Fever
- Stomach pain
- Indigestion, heartburn
- Distension, gas
- Dysentery
- Constipation
- Vomiting
- Lack of appetite
- Cholera
- Pneumonia
- Kidney stones

In addition, a connection was made between bathing in dirty water and a variety of skin ailments, such as rashes and boils, which afflict children especially.

### **Critical Issues**

The main critical issue confronting the study area is the rapid rate of depletion in the water table in the tubewells. The households owning tubewells reported a decline in the water table ranging from 10 - 20 ft annually. This poses a grave threat and can result in drying up of water and consequent desertification and abandonment of land. The other issue is the shortage of social amenities leading to low literacy, poor health, and other related problems. Neglect of women's participation in community affairs has meant that the impetus necessary to uplift the general welfare of families is lacking. Denudation of range and forest areas has constrained the recharge of aquifers and regrowth of fodder for animals.

### **5. PUBLIC SECTOR / NGO ROLE IN SOCIAL INFRASTRUCTURE**

Institutional responsibilities for planning and establishing public water supply schemes rest with two government agencies and their affiliated bodies. The Public Health Engineering Department (PHED), created in 1987, has the mandate to design and construct safe water supply systems in both rural and urban areas. Once established, operation and maintenance of these schemes are supposed to devolve to local communities. For the most part, the focus of the department has been on large drinking water supply schemes. The local Government and Rural Development Department (LGRDD) deals with people at the community, union council, and district levels. Its mandate is to help organise communities and provide basic services in public works—including improvement and development of all rural drinking water supply schemes as well as supervision of water and sanitation projects. The Social Action Programme (SAP), namely SAP - I (1993 - 96) contributed substantially towards improving the existing indicators in education, health, rural water supply and sanitation, and welfare of the population in Balochistan. Building upon the foundation of SAP - I, SAP - II began in 1997 - 98, emphasising community involvement from design to operation and maintenance and working in partnership with NGOs.

According to the survey, there are more than 160 NGOs working in Balochistan in various activities. There are about 10 NGOs working in watershed management, agriculture, rural development, and drinking water supply activities. Most NGOs operate from Quetta and, if

required, extend their activities to other parts of Balochistan. There is only one NGO working in Mastung district.

## 6. LOCAL WATER SUPPLY AND MANAGEMENT SYSTEMS

Water supplies for both drinking and irrigation of crops are predominantly derived from groundwater. The local systems include kareze (which have dried up), springs, open surface wells, and those converted into deep wells / tubewells.

### Sources of Drinking Water

The drinking water in the study area is collected from government and privately-managed tubewells, water channels, and water storage tanks (Table 11.12).

Table 11.12: **Source of drinking water in the study area**

Source	House-holds	Remarks
Government tubewells—piped water	10	Water charges Rs 40/annum
Private tubewells	17	Free, at a distance of from 300 to 1,000 ft
Water channel	3	
Water storage tank	15	Water tank cleaned once a year and 9 households reported it to be full of water plants and fungi

For drinking purposes, there is sufficient water available. As far as quality is concerned, mostly clean and sweet water is available. The households collecting drinking water from the open water channels have chances of drinking contaminated water. The water channels are generally *katcha* and open, and puddles form where water is diverted for irrigation. Water storage tanks are *katcha* (without linings) and some are full of plants. About 15 households collect drinking water from the tanks. The tubewells, both government and private, lie at a distance ranging between 300 and 1,000 ft. The Government supplies drinking water to households in Babri Village (10 households reported collecting water from pipes in the study area) and each household has to pay Rs 40 per annum as water charges. The private tubewell owners do not charge any money and users can collect water free of charge, but individual ownership of the tubewell is resulting in the loss of rights by communities. Individual owners of tubewells in fact prefer to irrigate orchards instead of supplying drinking water to neighbours.

### Means of Water Conveyance

Means used for obtaining drinking water are different for different areas. In order to fetch suitable water, most households are willing to take more time and effort than for other tasks such as washing dishes and laundry. If the source is far away, the men are responsible for collecting water and use animals to carry the water.

However, among the villages covered by the study, Babri village receives water through a pipeline, and this is further distributed by pipes to the households. The households in the other villages use different means to convey or fetch water (Table 11.13).

Most of the households in the study villages use utensils and rubber tubes to fetch water while others use buckets and pitchers. Most of the households fetch water once and twice a day. Five households reported three to four trips for water. Only one household collects water every second day. Women are reported to be responsible for fetching water. The women go to fetch water in groups and on the way, or at the source, they exchange views / news.

Table 11.13: Means used for water conveyance, frequency of water collection

Means Used	Households
Rubber Tubes	10
Buckets	7
Pitcher	6
Utensils	14
<b>Frequency / No of Trips</b>	
Once a day	9
Twice a day	15
3 - 4 times a day	5
Every second day	1

The water is stored generally in water storage tanks which are built alongside or near tubewells. These are mostly owned by tubewell owners. The study households had *katcha* storage tanks. *Katcha* water storage tanks are ideal breeding grounds for water-borne diseases.

### Domestic Water Storage Arrangements

Domestically, water is stored in different ways in the study area (Table 11.14).

The main means of storing drinking water are rubber tubes and pitchers. Households store water for drinking, washing dishes, and bathing in the *hammam* (drums for water fitted with taps) which can store more than 45 gallons of water. The cleanliness of domestic water storage equipment is reflected by the number of times the storage utensils are cleaned. Most households reported cleaning domestic water storage vessels once a week; some households cleaned their vessels daily.

Table 11.14: Household water storage arrangements

Means of Storage	No. of Households
Rubber tubes	27
Pitchers	22
Hammams (drums)	12
Utensils including buckets	5
<b>Frequency of Cleaning</b>	
Daily	10
Every second day	1
Once a week	13
Once in two weeks	

### Water for Irrigation

There are two crop production systems in the study area: irrigated and non-irrigated. Irrigated crop production depends mostly on tubewells where the water table is deep. Tubewells are the predominant source of irrigation for crop production. Non-irrigated crop production is carried out in two conditions. One is the *sailaba*, in which flood water is harvested by constructing large bunds (dykes) with spillways. The other depends directly on the rains. In the rainfed system, flash-flood water is checked by small embankments. The only source of irrigation available in the study area is by tubewell. Crops are irrigated from tubewells that are owned or water is purchased from a tubewell owner (Table 11.15).

There are 11 tubewells owned by households and three tubewells are contracted for supplying water for crops. The quantity of water available from these tubewells is insufficient, and there is a decreasing trend in water tables in the tubewells in the study area, registering a depletion of from 10 to 20 ft annually. Tubewells are owned individually by households. The government maintains tubewells for drinking water supplies. The quality of

water from these tubewells is good and water is fit for irrigation. If the present water table depletion trend continues, salinity will be encountered at some stage. Decrease in the supply of water for irrigation will have an adverse impact on crops irrigated by tubewells, and this will ultimately affect household incomes adversely.

Cost of water from tubewells depends on the discharge of water, depth of the water table, motor, and other factors such as maintenance and electricity charges. The investment needed to install a tubewell with a water table at a depth of from 300 - 500 ft varies between Rs 1.00 - 1.50 million. However, the per hour cost of irrigation from a tubewell with a water table of 300 - 400 ft ranges between Rs 30 and Rs 45. The per acre cost of irrigation for orchards and vegetables is higher than for grain crops as they require far more watering (15 - 22 times) than grain crops (3 - 5 times).

Water is usually stored in *katcha* water tanks dug into the ground. The size and depth of water tank are related to the discharge from the tubewell and area irrigated. Nevertheless, frequent interruption in electricity has necessitated the construction of water storage tanks. The Department of Agriculture, through the On-Farm Water Management Project, has provided subsidies for the construction of *pucca* (built from masonry works) water storage tanks to prevent water from seeping away. All the households owning tubewells have *katcha* storage tanks.

Water for irrigation is carried and distributed to the fields through *katcha* channels. The water loss estimated from *katcha* channels is about 30%.

### Uses of Water

Groundwater is the essential reversible resource. The most important income-generating activities, irrigated and pastoralism, depend mainly on groundwater. Traditionally karez were used to extract groundwater for irrigation agriculture and domestic requirements. Then dugwells were used for irrigation. Dugwells irrigate about 1.5 ha. Diesel wells took over in the 1960s. In the 1970s diesel pumps were replaced by cheaper electric pumps. A standard tubewell provides irrigation for approximately 15 ha. Rain water is checked by constructed dykes and embankments to irrigate a limited area.

The cultivated area owned by households is 198 ha of which 14 ha are rented. The irrigation status of this area is as follows.

-	Irrigated Land	84 acres
-	Unirrigated Land	48 acres
	Total :	132 acres

Only 67% of the total cultivated land owned and rented is used. Table 11.16 gives the crops grown by household and area under crops.

Crops grown on irrigated lands include fruit trees, vegetables, onions, wheat, and fodder. Crops grown on unirrigated land are wheat and barley. Cumin seed is grown both in

Table 11.15: Sources of irrigation by village

Village	Number of Tubewells	
	Owned	Contracted
Babri	4	-
Raza Mohammad	2	2
Nihal Khan	-	1
Bentary	3	-
Mohammad Hassan	2	-
Total	11	3

irrigated and unirrigated conditions. The average cultivated landholding is 4.4ha.

## 7. INSTITUTIONAL ASPECTS

A threat is posed by continuous depletion in water tables. This problem stems from over-exploitation of groundwater and a mushrooming in installation of tubewells over aquifers with limited water supplies. Although there is a law that prohibits installation of tubewells to within specific limits, this law is not followed in true spirit. Interruption in electricity supply and increasing electricity charges have led to adoption of illegal means in the use of electricity. Tubewell installation is undertaken by the Irrigation Department for irrigation and the Public Health Department for drinking water supplies. The Forest Department carries out watershed management programmes. The impact of watershed programmes has not as yet been felt. Unscrupulous uprooting of trees and bushes in the watershed area goes unnoticed. There are very few instances of improvement in the watershed command area. The present effort in rangeland rehabilitation is still in the demonstration stages (FAO 1997).

## 8. CONFLICTS AND THEIR RESOLUTION

There are generally three kinds of conflict in the study area: a) tribal b) water-, and c) land-related. Most of the households reported a prevalence of land-related conflicts (Table 11.17) arising from distribution of land within families, tribal disputes over ownership of land, and illegal confiscation of land. Tribal conflicts result from murder, rape, and elopement. Tribal feuds are the most dangerous and linger on for generations and many innocent people become victims. Very few households reported water-related conflicts; those reported were usually involving the route of the water channel.

## 9. POLICIES (NATIONAL / PROVINCIAL) AND PROGRAMMES

As an adequate and regular supply of water is needed for cultivation of crops, drinking, and other uses. Agriculture is a principal user of water. Most water resources are derived from precipitation in the uplands—including the study area. The main source of water for irrigation is underground aquifers. An increase in the number of tubewells has exerted damaging pressure on these aquifers resulting in less and less water. Discharge is far greater than recharge. Issues relating to water are centred around the following.

- Scarcity of water
- Depletion of groundwater resources
- Wastage of flood water
- Inefficient use of irrigation water
- Absence of control over groundwater abstraction
- Availability and quality of water for drinking purposes
- Involvement of communities, particularly the actual users of drinking water, the women, in the drinking water supply scheme
- Inadequacy of institutions

Table 11.16: **Crops grown by household and area under crops**

Crop	No. of Households	Area in ha
Orchard	8	28
Vegetable	2	2
Onion	15	21
Wheat	29	61
Barley	14	19
Cumin	5	5
Fodder	3	2

Note: the average cultivated landholding is 4.4 ha.

Table 11.17: **Nature of conflicts reported by households**

Nature	Households
Tribal	8
Water-related	2
Land-related	22

National as well as provincial policies relating to water harvesting, for both irrigation and drinking purposes, have been oriented towards improving water supplies, especially in water-scarce areas, to increase the efficiency of usage, introduce and implement programmes to improve water recharge, use flood water for non-irrigated agriculture, and improve access to drinking water by involving communities in the drinking water supply programme. The institutions involved in improving water supplies are Irrigation, Agriculture, Forestry, Public Health Engineering, Local Government and Rural Development, and NGOs. The Irrigation Department implements programmes to investigate and tap groundwater resources and install tubewells to increase water supplies for irrigation, construct checkdams, harvest flood water, improve recharge, and legislate undue installation of tubewells and over-exploitation of groundwater.

Watershed degradation has resulted in an increase in the incidences of flash floods, soil erosion, siltation of irrigation dams, decrease in the natural recharge rate of groundwater, and other problems. The importance of watershed management in increasing groundwater recharge has been realised in the province. The irrigation department has constructed delay action dams to increase recharge. There is a lack of collaboration between the irrigation department and other related departments. The Department of Agriculture has been undertaking On-Farm Water Management Programmes in the Province to increase supplies of water for irrigation and improve efficiency in its usage. The programme includes construction and improvement of water courses, construction of water storage tanks, and precision land levelling. Flood irrigation and harvesting are most commonly practised in Balochistan through development by the private sector with support from the government. The private sector has been instrumental in this respect as the farmers divert the flood flows by constructing low to medium height earthen bunds on perennial and ephemeral streams to serve as diversion structures. Construction of simple and small dykes across slopes in alluvial farms and valley areas is also carried out to store and conserve water whenever there is rain.

The Public Health Engineering and Local Government and Rural Development Department are involved in improving water and sanitation in rural Balochistan. Drinking water supplies are delivered by installing tubewells and providing water taps for the houses. The major project through which drinking water supply is being arranged is the SAP-II, and water and sanitation are among the components.

Because of the failure of government institutions to implement effective programmes in irrigation and drinking water supplies, the participation of communities in designing, implementing, operating, and maintaining irrigation and drinking water supply schemes / programmes has been made mandatory in order to explore new approaches to involving communities by introducing innovative ways to deliver social services to people's doorsteps. SAP was launched in 1992 – 93 with this in mind and has been extended for another five years. This programme was designed to provide five basic social services, of which one is rural water supply. The overall objective is to improve access to safe drinking water through participation of communities. The programme focuses on women and girls, facilitating behavioural change in order to realise the full benefits from such services, improved government / NGO capacities, and policy refinement. Following the policies and strategies of SAP-I (1992 - 1996) and SAP-II (1997 - 2002), a uniform policy is adopted in each province / area. The uniform policy establishes beneficiary community involvement at each stage of scheme construction or rehabilitation from planning to preparation and operation.

The Balochistan Rural Water Supply and Sanitation Project has also been working in Balochistan to provide safe drinking water to the rural population (GOP 1997).

## 10. CONCLUSIONS

The Noza micro- (sub) watershed has over time been run over by Afghan refugees for grazing their livestock. Overgrazing and use of bushes for fuel led to its denudation, leading to a reduction in infiltration of water for the replenishment of aquifers. Sources of water for irrigation and drinking have registered a continuous lowering in the water table. Extraction of water from depths ranging from 300 to 500 ft has not only increased operation costs but has also led to the drying up of aquifers.

Everyone depends on agriculture in one way or the other. The present socioeconomic welfare of the area is directly related to sustainability and replenishment of water resources. There has been a rise in standards of living as a result of increases in income generated by high-value orchards and crops. Traditional winter migration is decreasing and people have adopted a sedentary way of life, but housing and living conditions are still as they were a hundred years ago.

Consciousness about education and health has increased. The female population has not received much in terms of education or literacy programmes. Access to education in terms of educational institutions is provided. Attitudes towards education are feudal and religious norms do not allow the spread of education, especially among women. Health facilities are minimal in the area. For treatment, people travel to city centres. Children and women are the main sufferers as they require immediate attention and treatment.

Women contribute to agriculture and livestock by assisting men in the fields and in raising livestock (goats and sheep). Nevertheless remuneration and recognition are negligible. Women have become involved in income-generating schemes and women's organisations have been formed at village level. Even then their participation is limited. Women are not yet able to accept changes in their present way of life. Still a breakthrough has been achieved. With education, women can become empowered and assert their opinions on family and other matters.

Water is of tremendous importance in the life of village women. Being the sole water collectors and carriers in the family, a major portion of their time is spent on this. They have to travel long distances repeatedly to fetch water. The quality of water in the open and *katcha* (not-concrete) water tanks and water channels used for irrigating orchards and crops is poor for drinking purposes, as they are polluted with fungi and micro-organisms, and these are seldom cleaned. The government, through the Social Action Programme (SAP) has provided tap water connections to some villages. Most villages, however, still do not have them. A range of vessels is used to fetch drinking water and storage facilities are generally not clean. Pollution of water tanks and channels often results in water-borne diseases, a major cause of morbidity and mortality among children in the study area.

The harsh environmental conditions and meagre resources, oppressive economic conditions, and inept infrastructure are the main constraints to development in the study area. The traditional feudal system and illiteracy have further aggravated this situation.

The low social status of women and traditional norms have kept women from the mainstream of society. The role of services offered by women is not recognised. However,

there have been some changes and a transition in women's economic role has begun. Stress is being placed on equality of treatment and the role of women in social upliftment. Government policies and programmes are being oriented to include community along with women in the formulation, implementation, and operation of area and community-specific schemes / projects.

## 11. RECOMMENDATIONS

The issues raised and problems of an imminent nature, whether they are related to sustainability of resources or provision of gender-related socioeconomic facilities or institutional inadequacies, need to be addressed seriously. Moreover, the condition of the most deprived and oppressed members of society, the women, needs to be improved and their share in the socioeconomic field needs to be provided. Social improvement should be realistically pursued. The specific recommendations arising from the study are as follow.

1. In order to save the depleting water tables, a serious threat to the sources of water for irrigation and drinking, further digging of tubewells should be prohibited.
2. Introduction / extension of on- and off-farm water-saving techniques should take place.
3. Watershed management programmes should be strengthened and the necessary measures adopted to improve watershed areas.
4. Improvement of economic conditions should be facilitated by activating and involving women in income-generating programmes and activities.
5. Hygienic house construction by providing for properly ventilated rooms, water storage, sanitation, and animal shed placement should be introduced.
6. Domestic animal raising by providing appropriate training in livestock management and disease treatment skills should be improved.
7. Better access to potable and hygienically safe water in close proximity to the houses, economic water usage techniques, hygiene and sanitation, and education should be provided.
8. Local training of women on a modern and commercial basis to improve their capabilities in culturally permissible enterprises should be introduced.
9. Introduction and training on development and use of time-saving and viable practices and uses such as food processing and preservation, improved farming methods, rearing exotic livestock breeds, nutrition and disease control, and linking women to agricultural extension services should be facilitated.
10. Legislation on minimum wages for handicrafts and agriculture (hired labour) should be enacted.
11. Awareness of the potential rights as enunciated by Islam to remove social evils should be raised.
12. Access of villagers to education and health care should be increased and NGOs encouraged to extend their outreach to villages.

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