respectively. And ration of irrigated farmland and orchard in whole farmland are 20 % and 43 %. Here, farmland on right bank of Boshar River occupies around 90 % and there are two major irrigation schemes in this area. Complain of irrigation water is not found in the right bank area, but all villages on the left bank request to develop water source for irrigation and improve irrigation facilities. Then, MOA is now improving irrigation scheme with pipeline and pump station, which locates near Cheshmeh Chenar and its water source is Boshar River. And, it is informed this irrigation scheme will cover the left bank area.

d) Zeras

Farmland in this area is reported to be 2,465 ha and all of them are dry farmland or fallow land. And it is difficult to find irrigation facilities in Zeras and water source for irrigation. Of course, it is possible to utilize water in reservoir of Karoon No.3 Dam after its completion. However, it is not feasible to pump water up for irrigation in the consideration of high pump head more than 300 m.

8.5 Agriculture, Livestock and Inland Fishery

8.5.1 Agriculture

(1) Present Agricultural Conditions Cropped Area and Crop Production

a) Cropped Area and Crop Production

Generally, the major crops cultivated in the Study Area are wheat and barley, while the other minor crops in terms of planted area are legume, alfalfa, vegetables and fruit trees.

According to the harvested area, wheat and barley account for the largest area among major crops except orchard in the Study Area with the total cultivated area of 3,528 ha or 41.3% of total farmland, followed by alfalfa, sugar beat, potatoes legume and vegetables. The cultivation area of major crops in the Study Area are shown Table 8-5-1-1.

Table 8-5-1-1 Cultivation Area of Major Crops Unit: ha

Sub-basin	Barley Wheat	Alfalfa	Sugar beat	Legume	Vegetable	Potatoes	Others	Total	Orchard	Grand Total
K4-1-9 Vastegan	540	271	82	15	0	47	10	965	50	1,015
K5-19a Bazoft	1,275	132	0	2	7	0	1	1,417	94	1,511
K7-0-19-1 Sarbaz	120	221	0	2	0	0	0	343	3,548	3,891
K7-48 Tang Sorkh	215	107	0	0	0	0	41	363	268	631
K8-28 Zeras	1,378	0	0	0	0	0	108	1,485	3	1,488
Total	3,528	731	82	19	7	47	160	4,573	3,962	8,535

Source: Village Survey of the Study Team

Cultivation area under major crop has changed significantly in the past decades. According to the data in Statistic Section, Ministry of Jihad-Agriculture, the acreage under wheat (non-irrigation) has decreased significantly in the every Study Area. Generally, the cultivation area of wheat and barley has been fluctuating from year to year due to the weather conditions. Farming practice of major crops is as follows.

i) Wheat

Wheat is cultivated in dry land in alternate years under a "wheat - fallow - wheat" or " beans - wheat - barley " cropping system. As farming practices, farmland is plowed with manual power or a tractor after harvesting, and the seeding period of wheat is from the end of October to November. Seeding machines are used for sowing. Stable manure (made by mixing livestock dung, human feces and earth) is mixed with chemical fertilizer and plowed in before seeding. Seed is usually collected in farmer himself farmland. The varieties are traditional ones such as Omid, Alwend in Vastegan and Shia Khosh in Zeras. Harvesting is carried out from May to August. Harvesting period is slightly different from area to areas. In some areas, harvesting is mechanized and harvester combines are used. However, in general, harvesting depends mainly on human power. Weeding is also done by human power.

The yield per hectare is different among the Areas with 1,972.1 kg in Zeras to 2,715.6 kg in Vastegan on 5-year average from the year of 1995 to 1999 for irrigation area and 499.0 kg in Zeras to 1,073.9 kg in Sarbaz for dry area. Average yield for irrigation area is approximately three times than that for dry area.

Table 8-5-1-2 Wheat Production and Yield in the Study Area, (1995-1999 Average)

Item / Township	Wheat								
	Harvested Area (ha)			Production (ton)			Yield (kg/ha)		
	Irrigation	Dry	Total	Irrigation	Dry	Total	Irrigation	Dry	Ave.
Vastegan (Borujen)	4,991.6	3,993.0	8,984.6	13,723.9	3,320.6	17,044.6	2,715.6	809.4	1,897.1
Bazoft (Farsan)	5,505.6	3,562.6	9,068.2	12,653.6	3,167.2	15,820.8	2,379.1	905.4	1,744.7
Sarbaz (Boyrahamd)	11,916.6	13,117.8	25,034.4	28,397.1	14,769.8	43,166.9	2,507.7	1,073.9	1,724.3
Tang Sorkh (Semilon)	3,814.6	4,743.6	8,558.2	10,811.1	3,456.9	14,268.0	2,798.4	690.4	1,667.2
Zeras (Izeh)	1,111.6	33,571.2	34,682.8	2,059.2	16,255.5	18,314.7	1,972.1	499.0	528.1
Total	27,340.0	58,988.2	86,328.2	67,645.0	40,970.1	108,615.0	2,474.2	694.5	1,258.2

Source: Statistic Section, Ministry of Jihad-Agriculture

ii) Barley

Barley is also cultivated on dry land and planted in alternate years, similarly to wheat. In some places, there is a system of "barley - fallow - wheat - barley". The farming practices are almost same as that of wheat. The seeds are local varieties, which are collected in their farms. The period of harvesting is between May and July. Harvesting period is slightly different among the areas. As of fertilizer, stable manure is mainly used. Only plowing is mechanized; weeding and harvesting are done by human power.

The yield per hectare is varied from 1,645.7 kg in Sarbaz to 3082.0 kg in Vastegan in irrigation area except 452.8 kg in Zeras showing quite low for irrigation area, and 639.8 kg in Zeras to 1,276.0 kg in Bazoft in dry area on 5-year average. Although the cultivation area extends to the whole Study areas, cultivation is mainly carried out in places of relatively high altitude.

Table 8-5-1-3 Barley Production and Yield in the Study Area, (1995-1999,Average)

Item / Township	Barley								
	Harvested Area (ha)			Production (ton)			Yield (kg/ha)		
	Irrigation	Dry	Total	Irrigation	Dry	Total	Irrigation	Dry	Ave.
Vastegan (Borujen)	1,088.8	1,005.2	2,094.0	3,262.1	707.3	3,969.4	3,082.0	687.0	1,895.6
Bazoft (Farsan)	829.8	1,533.0	2,362.8	2,199.1	1,338.1	3,537.2	3,037.3	1,276.0	1,497.1
Sarbaz (Boyrahmad)	1,993.8	11,896.4	13,890.2	3,250.1	12,136.9	15,387.0	1,645.7	996.3	1,107.8
Tang Sorkh (Semilon)	732.6	757.6	1,490.2	2,098.5	734.2	2,832.7	2,739.1	894.3	1,900.9
Zeras (Izeh)	286.6	23,989.8	24,276.4	352.5	16,690.6	17,043.1	1,229.9	639.8	702.1
Total	4,931.6	39,182.0	44,113.6	11,162.3	31,607.2	42,769.5	2,263.4	806.7	969.5

Source: Statistic Section, Ministry of Jihad-Agriculture

iii) Alfalfa

Alfalfa, which is used as feed for livestock, is cultivated in irrigated areas and planted continuously or in alternate years. Harvesting is carried out three or four times a year. Plowing, fertilization and seeding are done after the last harvesting of the year. The yield per hectare is from 5,864.5 kg in Sarbaz to 9,456.4 kg in Vastegan in irrigation area. Almost all alfalfa is cultivated in irrigation area.

Table 8-5-1-4 Alfalfa Production and Yield in the Study Area, 1995-1999

Item / Township	Alfalfa								
	Harvested Area (ha)			Production (ton)			Yield (kg/ha)		
	Irrigation	Dry	Total	Irrigation	Dry	Total	Irrigation	Dry	Ave.
Vastegan (Borujen)	4,524.2	0.0	4,524.2	42,606.1	0.0	42,606.1	9,456.4	0.0	9,456.4
Bazoft (Farsan)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sarbaz (Boyrahmad)	791.2	14.0	794.0	4,640.0	14.0	4,642.8	5,864.5	1,000.0	5,847.4
Tang Sorkh (Semilon)	2,175.0	167.0	2,208.4	18,333.2	106.5	18,439.6	8,429.0	637.6	8,349.8
Zeras (Izeh)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	7,490.4	181.0	7,526.6	65,579.3	120.5	65,688.6	8,755.1	665.7	8,727.5

Source: Statistic Sectionm Ministry of Jihad-Agriculture

iv) Legume

Legume, including kidney beans, lentils and green peas, are cultivated mainly in irrigated areas. The period of cultivation is approximately four months in summer, and that of harvesting is September and October. As fertilizer, stable manure is plowed in, and chemical fertilizer is applied in the period of growth.

The yield per hectare is from 1,095.0 kg in Tang Sorkh to 1,836.6 kg in Vastegan on 5-year average from 1995 to 1999.

Table 8-5-1-5 Legume Production and Yield in the Study Area, 1995-1999

Item / Township	Harvested Area (ha)			Production (ton)			Yield (kg/ha)		
	Irrigation	Dry	Total	Irrigation	Dry	Total	Irrigation	Dry	Axe.
Vastegan (Borujen)	659.4	2.8	662.2	1,224.0	0.7	1,224.6	1,836.6	47.6	1,849.3
Bazoft (Farsan)	144.8	0.0	144.8	227.4	0.0	227.4	1,473.4	0.0	1,570.1
Sarbaz (Boyrahmad)	431.4	0.0	431.4	630.2	0.0	630.2	1,357.7	0.0	1,460.9
Tang Sorkh (Semilon)	130.6	0.0	130.6	163.1	0.0	163.1	1,095.0	0.0	1,248.8
Izeh (Zeras)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1,366.2	2.8	1,369.0	2,244.6	0.7	2,245.3	1,643.0	238.0	1,640.1

Source: Statistic Section, Ministry of Jihad-Agriculture

v) Apples

In Semirom District containing the sub-basin K4 in Esfahan Province, the cultivation of apples is the most flourishing of all sub-basins and special production localities are formed. In case of new planting or renewal, planting pits are made early in November before snowfall or in March and April, and seedlings are planted early in December or from late March to middle April. Land is plowed late in March. Chemical fertilizer is applied at the time of planting and several times a year. The period of irrigation is between middle June and early October. Prevention of breeding and extermination with agricultural chemicals is carried out four times, i.e. late in March, late in May, late in June and early in August. The period of harvesting is from mid-September and mid-October. According to the site survey, the yield per hectare is various from 15 ton to 80 ton, said 40 ton on average.

b) Land Holding

According to the village survey, average land size owned by the villagers is 3.4 ha per family with variation from 1.7 ha in Charman Goli-Bazoft to 5.7 ha in Zeras. On the other hand, average land size owned by the nomads is 1.0 ha per family varying from 0.4 ha in Vastegan to 1.1 in Sarbaz. In some villages, it was found there are some families who have no land. Therefore, actual land holding size per family would be a little larger than the average value.

Table 8-5-1-6 Land Holding by Villagers

Area	Irrigated Farmland	Dry Farmland	Irrigated Orchard	Rainfed Orchard	Fallow land	Total	Per Family
Vastegan	924.0	60.0	25.0	0.0	460.0	1,469.0	2.9
Charman Goli-Bazoft	672.0	410.0	76.5	0.0	50.0	1,208.5	1.7
Sarbaz	541.0	37.0	2,472.0	300.0	12.0	3,362.0	4.0
Tang Sorkh	116.0	201.0	242.5	7.0	0.0	566.5	3.6
Zeras	0.0	1,475.0	2.3	0.0	988.0	2,465.3	5.7
Total	2,253.0	2,183.0	2,818.3	307.0	1,510.0	9,071.3	3.4

Source: Village Survey by the Study Team

Table 8.5-1-7 Land Holding by Nomads

Area	Irrigated Farmland	Dry Farmland	Irrigated Orchard	Rainfed Orchard	Fallow land	Total	Per Family
Vastegan	8.0	3.0	25.0	0.0	0.0	36.0	0.4
Charman Goli-Bazoft	215.0	145.0	19.0	0.0	0.0	379.0	1.0
Sarbaz	112.0	3.0	325.5	500.0	5.0	945.5	1.1
Tang Sorkh	29.5	45.5	15.5	3.0	0.0	93.5	0.8
Zeras	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	364.5	196.5	385.0	503.0	5.0	1,454.0	1.0

Source: Village Survey by the Study Team

According to the Township based behavioral study and supplementary information, Rural Research Center, land ownerships are to almost all private owners. Farmland rented is a very few. These are indebted to the government land ownership policies and their implementation for long years. As grazing of sheep and goats owned by nomads and even the villages has heavily been affecting the environment for recent years, these policies for agriculture should be aggressively promoted.

c) Farming Practice and Farming

Generally, farming activities in the Study Area mainly take place in the rainy season and farming practice is the same as almost all areas. The majority type of agriculture is under mono-cropping system and farming practice is still traditional. However, it was found that the farming technologies on seeding, application of manure and chemicals to wheat and barley have been transferred to farmers by extension officers. However, technologies on horticulture such as arrangement of branches, pruning, variety of seedling, etc. have not yet transferred to

farmers.

Regarding, farming types in the Study Area are as follows: major activities are of wheat, alfalfa, sugar beat and potatoes cropping and cattle raising in Vastegan; wheat and alfalfa cropping and cattle raising in Chaman Goli-Bazoft; apple plantation, alfalfa cropping and cattle grazing in Sarbaz; wheat and alfalfa cropping, orchard and cattle grazing in Tang Sorkh; and wheat cropping and cattle grazing in Zeras.

Table 8-5-1-8 Farming Types of Study Area

Study Area	Farming Types
K4-1-9 Vastegan	Wheat, alfalfa, sugar beat, potatoes cropping; Cattle raising
K5-19a Chaman Goli-Bazoft	Wheat, alfalfa cropping; Cattle raising
K7-0-19-1 Sarbaz	Apple plantation + alfalfa cropping; Cattle raising
K7-48 Tang Sorkh	Wheat, alfalfa cropping + Orchard; Cattle raising
K8-28 Zeras	Wheat cropping; Cattle raising

d) Cropping Calendar of Major Crops.

The cropping calendar of annual crops is slightly different by locality according to the weather conditions, availability of water for agriculture and the readiness of farmers. In rain fed areas, when there is a drought or dry spell at the period of sowing or cultivation, the farmers have to wait for the rainfall, eventually the actual cropping calendar would be delayed. The calendars of major crops are illustrated as below:

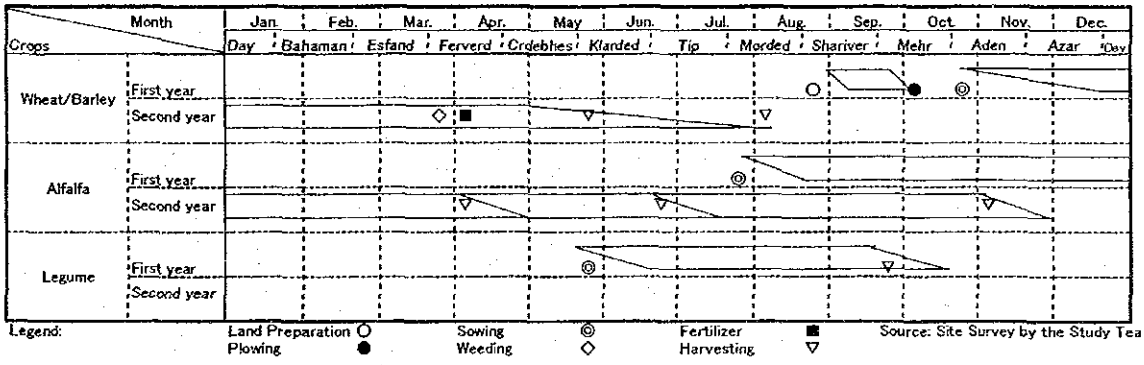

Figure 8-5-1-1 Typical Cropping Calendar

While Provincial Agricultural Office, Charharmahal-va-Bakhtiyari recommends proper cropping schedule for cereals, root crops, beans, vegetables and forage crops. According to this cropping schedule, chick bean and beans such as soybean, long bean and cowpea could be planted after wheat harvested in the same field. However, lentil and pea could not be planted

because their growing periods are same as that of wheat.

Table 8-5-1-9 Standard Cropping Schedule Recommended by Provincial Jihad-Agriculture

Crop / Item	Planting		Harvesting		Days up to harvesting**
	Beginning	Finishing	Beginning	Finishing	
Cereals					
Wheat	6 Sep.	21 Dec.	22 Jun.	21 Aug.	263
Barley	6 Sep.	21 Dec.	5 Jun.	6 Jul	232
Root Crops					
Potato	10 Jun.	1 Jul.	6 Sep.	17 Oct.	96
Sugar beat	25 Apr.	5 Jun.	2 Sep.	22 Oct.	132
Beans					
Pea	23 Sep	21 Nov.	10 Jun.	11 Jul.	243.5
Lentil	23 Sep.	21 Nov.	10 Jun.	11 Jul.	243.5
Chick bean	10 Jun.	1 Jul.	6 Sep.	7 Oct.	91
Bean *	10 Jun.	1 Jul.	11 Sep.	12 Oct.	96
Vegetables					
Tomato	31 May	6 Jul.	22 Jul.	22 Oct.	79
Spinach	10 Jun.	1 Jul.	6 Sep.	17 Oct.	96
Cucumber	22 May	6 Jul.	6 Aug.	7 Oct.	82.5
Forage crops***					
Alfalfa	6 Sep.	7-Oct.	10 Jun.	17 Oct.	322
Clover	6 Sep.	2 Oct.	15 May	20 Jun.	253.5

Note: Bean* = soybean, long bean, cowpea
Days up to harvesting = average days from beginning of planting and harvesting to finishing of those
Forage crops days = planting up to harvesting, however, 3-4 times harvesting per year is possible for several years.
Source: Budget and Planning Section Agricultural Office, Chaharmahal-va-Bakhtiyrari Province

According to the Provincial Agricultural Office, they promote and extend the agricultural technologies to the farmers; land reform and establishing cooperative, changing to irrigated land by pumping with subsidy, transferring technical knowledge and training, changing to garden on slope areas, promotion of productive cooperation among farmers, etc. by mean of extension with farmer training, staff training as well as providing credits with help of Agricultural Bank, National Bank, Export Bank and Mellat Bank for horticulture, infrastructure, irrigation facilities, etc. However, in the Study Area, it seems that extension services are not enough on the frequency for training or visit to the farmers as well as technologies to be transferred.

8.5.2 Livestock

Typical production of livestock in villages is carried out by traditional methods. Raising livestock is not of cooperatives operation but of individual activity. Raising livestock in the Areas has secondary importance and play a supplementary role in agricultural production. Animal husbandry in villages is

realized by pasturage with free grass and farmland grass and residue after harvesting. Production of milk in rural areas has been increasing year by year. Some villagers process milk to butter, oil, kashk, etc. and sell these products in the nearby market, although this is still rare. Poultry is also popular in villages for the production of eggs and meat. Families use livestock dung as fuel for cooking and stable manure.

On the other hand, nomads live on livestock farmers and scatter in the Study Area traveling from one rangeland to another. Major nomadic tribes in the Study Area are the Haft Lang Bakhtiyari, Gashghay and Boyerahmad-olia tribes. The period of nomadism of these tribes including nomadic migration is four to six months, staying in the Study Area in summer season from late April to mid-October. Shortage of feed for nomadic livestock frequently occurs for these years because of overgrazing and sometimes draught, therefore, nomads are obliged to purchase feed such as alfalfa and wheat straw from farmers, even for feed in winter on their way to home. Recently, nomads have obtained permits of settling from the Office of Forest and Rangeland, the Provincial Jihad Organizations.

Conditions of livestock are summarized in Table 8-5-2-1. In this table, animal unit has calculated based on assumption that cow, horse and donkey are equal to 5 heads of sheep respectively and sheep and goat have same value.

Table 8-5-2-1 Livestock in Selected Master Plan Areas

Item			Vastegan (K4-1-9)	Chaman Goli-Bazoft (K5-19a)	Sarbaz (K7-0-19-1)	Tang Sorkh (K7-48)	Zeras (K8-28)
Village	Household		440	634	753	141	418
	Rangeland (ha)		2,530	5,550	3,590	1,185	9,200
	Livestock	Sheep	5,350	3,230	3,285	1,180	7,110
		Goats	650	2,765	960	1,010	17,560
		Cows	750	1,380	1,219	94	638
		Horse	8	393	0	1	232
		Donkey	290	239	657	47	830
		Poultry	1,500	6,750	5,240	2,640	7,385
		Total	8,548	14,757	11,361	4,972	33,755
		Sheep+Goats	6,000	5,995	4,245	2,190	24,670
		Others*1	1,048	2,012	1,876	142	1,700
	Animal Unit*2	as Total	11,240	16,055	13,625	2,900	33,170
		per Household	26	25	18	21	79
		per Area	4	3	4	2	4
Nomad	Houschold		59	392	860	123	0
	Rangeland(ha)		670	6,050	3,600	2,350	0
	Livestock	Sheep	6,000	7,200	19,300	10,950	0
		Goats	1,250	4,850	18,750	8,400	0
		Cows	0	425	132	0	0
		Horse	60	762	80	57	0
		Donkey	260	702	755	212	0
		Poultry	250	1,560	3,300	2,510	0
		Total	7,820	15,499	42,317	22,129	0
		Sheep+Goats	7,250	12,050	38,050	19,350	0
		Others*1	320	1,889	967	269	0
	Animal Unit*2	as Total	8,850	21,495	42,885	20,695	0
		Total*3	2,950	7,165	14,295	6,898	0
		per Household	50	18	17	56	0
		per Area	4	1	4	3	0
Area Total	Household		499	1,026	1,613	264	418
	Rangeland(ha)		3,200	11,600	7,190	3,535	9,200
	Livestock	Sheep	11,350	10,430	22,585	12,130	7,110
		Goats	1,900	7,615	19,710	9,410	17,560
		Cows	750	1,805	1,351	94	638
		Horse	68	1,155	80	58	232
		Donkey	550	941	1,412	259	830
		Poultry	1,750	8,310	8,540	5,150	7,385
		Total	16,368	30,256	53,678	27,101	33,755
		Sheep+Goats	13,250	18,045	42,295	21,540	24,670
		Others*1	1,368	3,901	2,843	411	1,700
	Animal Unit*2	as Total	20,090	37,550	56,510	23,595	33,170
		Total*3	14,190	23,220	27,920	9,798	33,170
		per Household	28	23	17	37	79
		per Area	4	2	4	3	4

Source : Village Survey by the Study Team

Note : *1 Others excludes poultry, *2 animal unit is estimated as follows

*2 animal unit is estimated as follows; cow, horse and donkey are assumed to be equal to 5 sheep.

*3 estimated that nomads stay for four months in the Area.

As for average animal unit per hectare, value of village livestock varies from 2 to 4 and that in Chaman Goli-Bazoft is the lowest of all Study Areas. On the other hand, value of nomad livestock varies from 1 to 4 except in Zeras. While it is noticeable livestock of nomads is not found in Zeras. Comparing to village and nomad, it is said nomad is higher than village except in Chaman Goli-Bazoft.

It is obvious that animal unit of area total is high of 4AU in Vastegan, Sarbaz and Zeras. That in Tank Sorkh is 3AU on the same level. Chaman Goli-Bazoft is lowest of 2AU. Generally speaking, those values of nomad in the areas are badly influenced to the village except Charman Goli-Bazoft.

One the other hand, rangeland area by present land use is different from that of village survey like following table: It is said in all Study Areas that livestock cannot live only in the rangeland, it needs another feed such as alfalfa and wheat straw to live in good conditions. At present, it seems that the feed is not enough and it is heard that sheep would be sold grown up around one year old comparing to being sold up to half year old in good growing conditions.

Table 8-5-2-2 Animal Unit Based on the Present Land Use

		Vategan	Chaman Goli-Bazoft	Sarbaz	Tang Sorkh	Zeras
Household		499	1,026	1,613	264	418
Rangeland*1		3,200	11,600	7,190	3,535	9,200
Rangeland*2		1,142	1,875	5,392	3,118	3,361
Animal Unit*3	Total	15,665	26,803	35,068	13,248	33,170
	per Household	31	26	22	50	79
	Per Area*4	13.7	14.3	6.5	4.2	9.9

Note: *1 = village survey data *3= Animal unit based on the present land use by the Study Team
*2= Present land use by the Study Team *4=per area by Rangeland*2

According to the Livestock Office, Provincial Jihad, Charharlmahal-va-Bakhtiyari, shortage of feed is the main problem in whole areas, which is caused by shortage of water and lack of grazing land. Therefore, Provincial Five Year Plan includes diversification to industrial cow for meat and milk, improvement of insemination, decreasing local cow and increasing semi-local cow, changing from sheep and goats to cow, etc. Artificial insemination was started 30 years ago, but strongly promoted from 15 years ago. Training of AI is conducted every year and ID card is issued. Now, there are 45 ID holders in the Province.

As for Apiculture, beekeeping is carried out in Sarbaz and in some villagers. However, families participated are very few. Some nomads are also conducting by government's help. Two types of beehives are seen in areas; a local one and a modern one. Recently, modern beehive becomes popular by mean of promotion and extension by the government officers' help. According to the Rural Industry Office, Provincial Jihad, Charharmahal-va-Bakhtiuari, 46,413 beehives are supplied in the Province and honey production is 368,981kg in the year 2000. Production is increasing about 30%.

The Office provides a training course from education & extension department and supplies good bee queens from other provinces. In the Study Area, the production of honey from one beehive in a year would weigh 6 to 7 kg. It is quite low comparing to other countries because of limited nectar sources such as flowers, bush and trees in the Areas. However, it is heard that yield of one beehives was 30kg in good conditions in Sarbaz. Beekeeping in villages is conducted by individual manner where alfalfa and white Dutch clover, which are farm products as well as a lot of apple trees are growing. Some nomads are also conducting the beekeeping. In winter, as the snow covers in the Areas and temperature becomes cold, it is necessary sugar and/or honey are given as artificial feed to bees in order to being able to spend over winter.

8.5.3 Inland Fishery

Inland fishery is found at the place where can obtain fresh good quality water from springs and rivers in the Study Area. The species of fishes cultivated in cold water are rainbow trout and red trout. The fry production is carried out by the Freshwater Fish Multiplication Center and fry are distributed to fish farms on cost basis. There is one private feed company in Shahr-e-kord around the Study Area. The ownership of fish culture firms takes two forms: one is by village cooperative and other by entrepreneurs living in cities. In the Study Area, it is possible to find some fish culture. Among them, only in Charman Goli-Bazoft, ownership of fish culture firms belongs to villagers, those in other areas belongs to aggressive entrepreneurs. One of the two fish firms in Chaman Goli-Bazoft is now under construction with the help of Fishery Office. Application form has already been submitted to the Office and now waiting for loan.
Number of fish firm and production in the Study Area are as follows.

Table 8-5-3-1 Number of Registered Fish Farms and Their Production

Sub-basin No.	Sub-basin Name	Number	Annual Production (ton/year)	Note (village)
K4-1-9	Vastegan	1	5	Nasir Abad
K5-19a	Chaman Goli-Bazoft	2	200	Ghale Tabarak, Tabarak Olya
K7-0-19-1	Sarbaz	1	100	Noorabad
K7-48	Tang Sorkh	1	30	Sar Tang Sorkh
K8-28	Zeras	0	0	
Total	5	5	335	

Source: Village Survey by the Study team

According to the Fishery Office (Silat Company), the Provincial Jihad Organizations, Charharmal-va-Bakhtiyari, the Office gives permission for inland fishery for promotion of fish culture. The Office provides the inspection of water quality, evaluation of capacity, help to bank loan, training to applicant, etc before construction of fish culture firm. After construction, the Office conducts regular inspection of every three months by veterinary and fishery officers. At present, approximately 100 applicants are submitted application forms and 49 firms ID cards issued with bank loan in the

Province. In future, ID card issuance might be finished in 2-3 years because of shortage of expected places for obtaining suitable fresh water, the Office said. In the Study Area, it seems that there are no more expected places for fresh good quality water for fish culture.

8.6 Marketing System, Agro-processing and Rural Industry

8.6.1 Agricultural Product Marketing System

Products in the Study Area, are wheat, barley, rice (only in Zeras area), legumes, tomatoes, potatoes, alfalfa, apple, walnut, almond, grape, pomegranate for agricultural products, sheet, goat, cattle, house, donkey, chicken, egg, honey for products of animal husbandry and rainbow trout for product of fishery. Moreover, there are produces of the secondary industries such as carpet, gilim, jojin, hats, shoes for handicraft and yogurt, cheese, butter and cake of Kashk by processed milk.
Residents in the Study Area consume these products by themselves as well as sell to get earnings for their livelihoods. Main products for selling are wheat, barley, rice, alfalfa, apple, walnut, sheet and goat.

Agricultural Products

Some amounts of wheat and barley are consumed by farmer themselves, but almost all of them are sold, on the other hand, wheat flour to be consumed are bought from shops. Because wheat flour, which is a stable food in Iran, is distributed by the government subsidy and is sold in cheap price. Moreover, farmers prefer the distributed wheat four of high quality to the processed flour in the village, which includes wheat bran and is low quality. On the other hand, since rice is found in the limited area, it is consumed or sold as same as wheat and barley. Products are sold through agricultural cooperatives or traders. Selling price of them are guaranteed by the government(refer to ANNEX K-2 Guaranteed Price and ACCEX K-3 Market Price), but it is found that the actual farm gate prices have been less than the guaranteed depending on the market conditions. Farmers are not satisfied the selling price, however since the traders have a decision-power, farmer cannot help selling the products. Other agricultural products such as legumes, tomatoes, potatoes are sold in the near around cities and their traders. As for transportation, since the Study Areas are located insides and are mountainous, transportation is carried out by truck using the roads. Since roads are not paved, steep, is narrow and meandering, it is hard enough to transport. It is usually used synthetic fiber bags for packing.

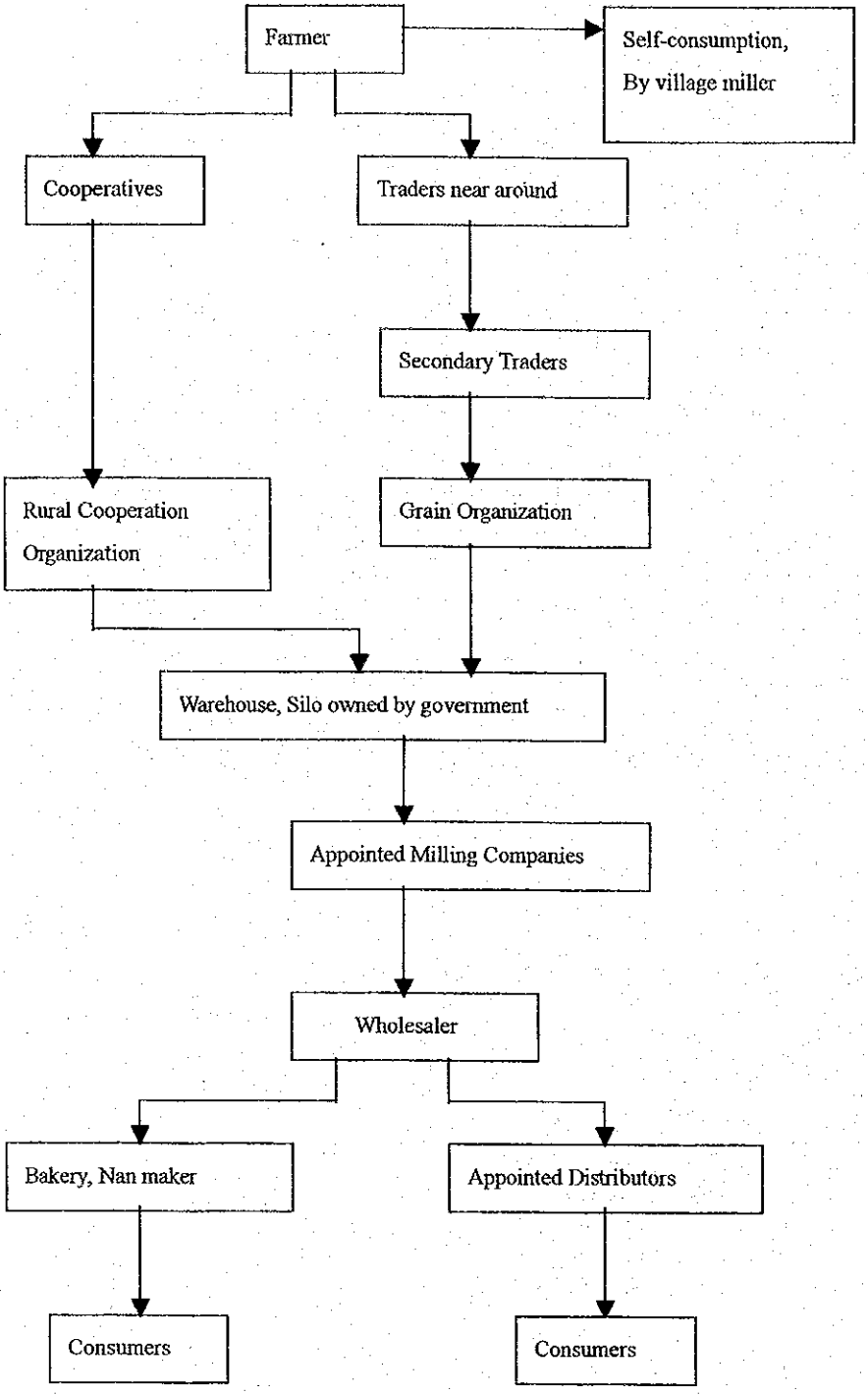

Figure 8-6-1-1 Marketing Channel for Wheat and Barley

Fruit

Apple as fruit is produced in some Study Area, especially Sar Baz a great deal, is sold to big cities through traders. Selling prices are set by the government regulation (270 – 1,032 Rials/kg in year 2000, refer to ANNEX K-2), however, since it is dependant the market situations, some are sold at higher price than the designated prices (1,500 – 1,800 Rials/kg, refer to the ANNEX K-1 Interview to Farmers). It may be that the tripartite meetings are held among farmers, traders and local governments and prices are determined at that meeting. Retail prices are ranging from 3,000 to 5,000 Rials/kg (refer to ANNEX K-4, Survey Market Price). Though roads in the Study Area are rough and selling prices are fluctuated, farmers intend to convert to crops farming to fruit farming by means of expanding and reclaiming the field, because that the fruit farming can give higher earnings than other crops farming. However, since the fruit farming needs irrigation in the Study Area, water resources and irrigation facilities are required. As farmer want to sell all products even in good quality or poor quality and maybe reduce their labor cost, they divide the field for each trader to sell the products ready to be harvested. Traders carry out the collection of the labor force to harvest, pack and transport. Harvested apple are packed in wooden case and transported by the trucks. Traders usually come from big cities and products are carried there such as Tehran, Esfahan or Shiraz.

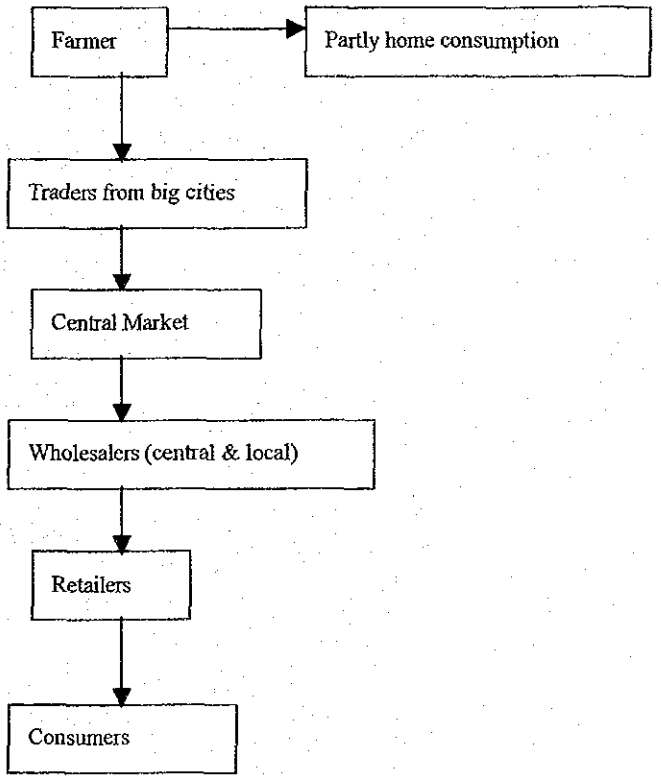

Figure 8-6-1-2 Marketing Channel for Apple

Livestock

Livestock products in the Study Areas are mainly sheep and goat. They are sold to traders near around or transported to sell to governmental trading places at Esfahan or Shahrekord by farmers' themselves. Minimum trading prices are determined by the government and they are stable. Products are usually transported by means of trucks. Price of sheep or goat is 10,000 Rials/kg at present (refer to ANNEX K-1). Chicken are usually consumed at home in the Study Area, and sold in very rare case. Selling price is less than a half price of sheep to within the village or near around. Other activities for livestock, bee-keeping are conducted in the Study Area. Modern beehives were introduced around 5 years ago and apiculture is hoped to develop. However, limited nectar sources in the Study Area and long winter season prevent from developing.

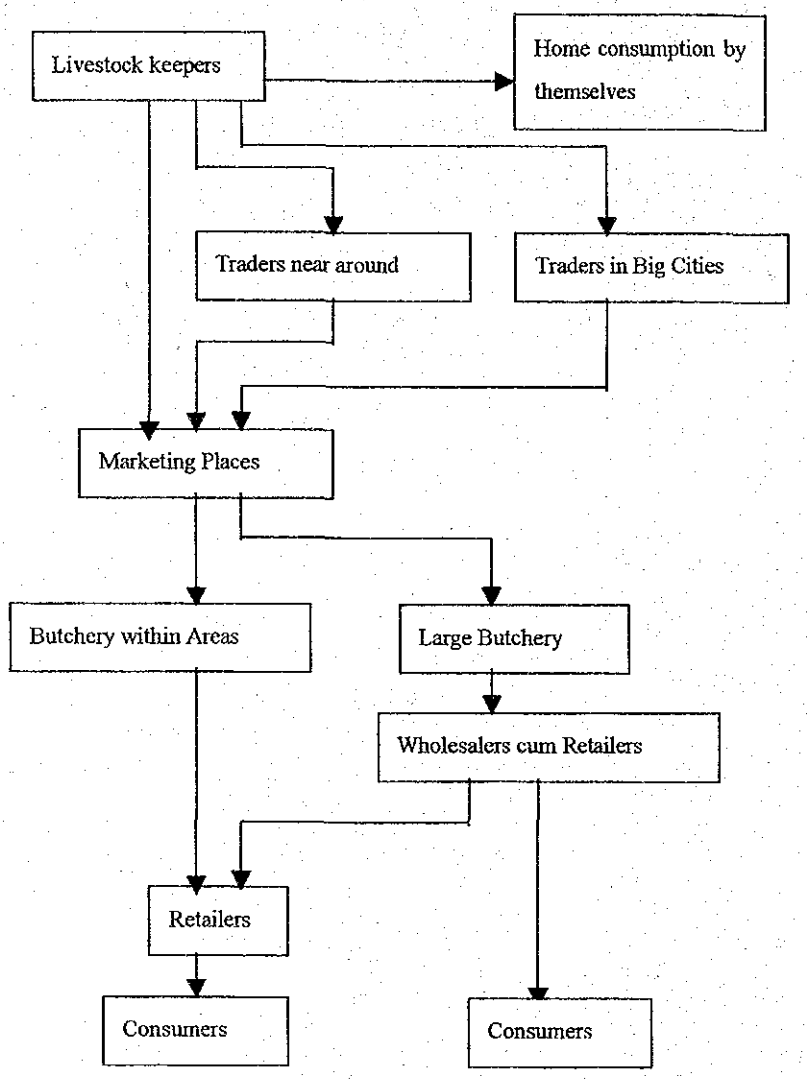

Figure 8-6-1-3 Marketing Channel for Sheep and Goat

Fishery Products

Fishery products in the Study Area is only rainbow trout which are grown at the fish culture farms using spring water from the foots of mountains. Fish-culture is usually conducted by individual private firms from big cities. It is rare case that the village people are conducting the fish-culture such as Sar Baz area. Construction and operation of fish-culture are regulated by the Provincial Fishery Organization and its permission and license are required. Fish firm person is required to training at the beginning and every year. Almost all fish-culture firm were received the loans. Fish products are sold by firm themselves and transported to the warehouse owned by the Fishery Organization in the central Tehran and Esfahan. They use trucks (pick-up truck rental cost: 200,000 – 250,000 Rials/day) for its transportation and sometimes refrigerator trucks are used. Hiring charge of refrigerator truck (1.5 ton capacity) are 800,000 Rials/time from Yasuj to Tehran. Almost of fish products are transported to central, then distributed to rural. Prices are determined by the government and stable. However, prices in summer and winter are different, 10 – 11,000 Rials/kg in summer, 16 – 17,000 Rials/kg in windter and 13,000 Rials/kg in average (refer to ANNEX K-5). Fishery organization determines the wholesale prices and retail prices, so marketing prices are not dependant on the market situation.

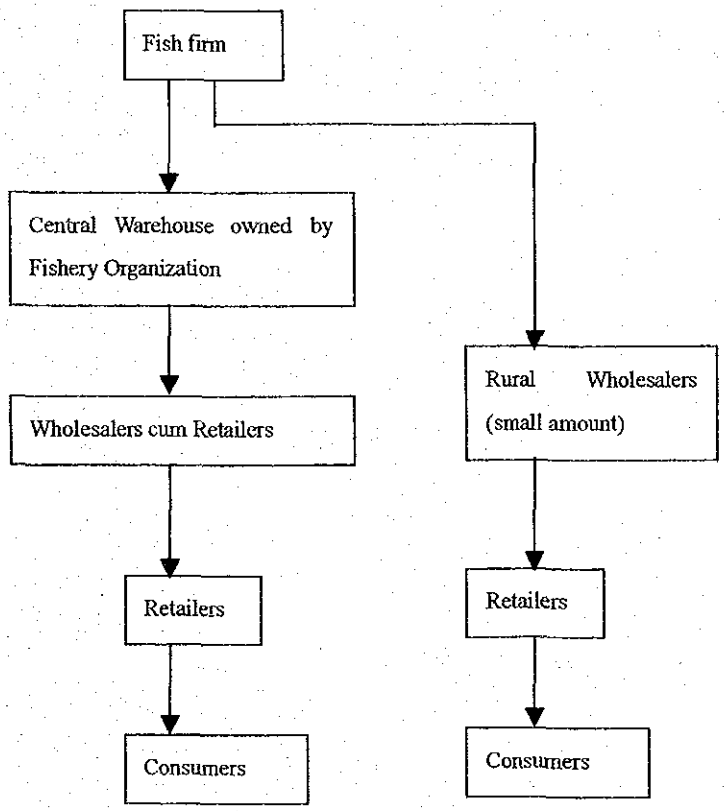

Figure 8-6-1-4 Marketing Channel of Rainbow Trout

8.6.2 Ago-processing

Agricultural processing activities belong to the next section, however, it is more closely mentioned in the section. Agricultural processing activities in the Study Area are mainly conducted for crop processing and livestock product processing. Main crops are wheat and rice, of which rice is only in Zeras area. In Zeras areas for crop processing, simple wheat four mill and rice mill are installed by means of investment of users themselves in almost all villages, for this area are closed the access road to the near town by the snowfall in winter. Operation and maintenance of these processing facilities are in good order and active. However, high quality factory wheat four have been distributed recent year, village mill flour is getting disliked to the villagers, because its flour contains wheat bran and its color is black. Other areas such as Vastegan has village mill. On the other hand, in Sar Baz area where apple are largely grown, villagers buy wheat flour for their consumption from the near town and village mill are not installed. Other processing activities conducted by the villagers are productions from milk of sheet, goat or cow.

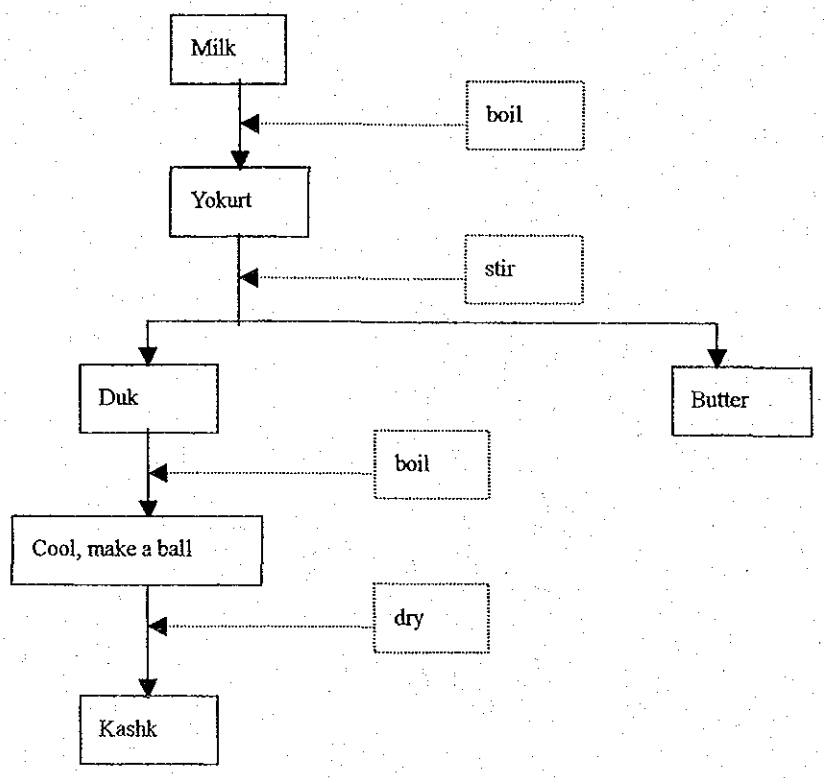

Figure 8-6-2-1 Process of making Yogurt, Butter and Kashk

They make milk, butter, cheese and Kashk as cake. Especially, in Vastegan and Sar Baz area, these

processing activities from cow's milk are popular. However, they are conducted within the family, not by the cooperatives or by the company. Villagers are willing to promote these processing activities. Although, at present, there are no first processing activities (collecting, grading, packing, distribution, etc) for agricultural products (example: apple or vegetable) grown in the area, there is a possibility to be developed by growers' themselves by means of establishing groups and/or cooperatives in the area.

8.6.3 Rural Industry

Handicraft

Handicraft in the Study Area is mainly manufacturing carpet and gilim. These productions are prevented from developing because of high price of raw materials, far distance of market places and lack of budget for buying raw materials and weaving machines. Other handicrafts manufacturing has same problems and is in same conditions as the carpet manufacturing. Though he government has conducted training, loan supply as well as marketing support to develop the rural handicraft, its limited budget prevent from properly supporting. Since the Study Area is far from large cities and government support cannot reach within the area, it is found that the handicraft activities are conducted by only one forth of village households and they are reducing. Handicraft promotion is conducted several governmental departments such as Deputy of Rural Industry and Development (Jihad), Ministry of Industry, Ministry of Cooperatives and Ministry of Health, their activities are independent not cooperate or not make up each other (refer to ANNEX K-5 to K-10 and K-11 to K-12). A part of activities is conducted together by Deputy of Rural Industry & Development (Jihad) and Ministry of Health for repairing workshops, procuring equipment and training and education by supplying loans (Tarheh Bagha and others). In Chaharmahal va Bakhtiyari Province, area of which accounts for 50.5% of total Study Area of Phase I, carpet production is reported increasing at 103.23% per year by rural weavers and at 114.26% per year by carpet cooperatives in Provincial Statistic Data Book (refer to ANNEX K-9).

The some villagers in convenient places around the Study Area can be obtained by the government supports. However, since the government support cannot reach five Study Area, villagers in these areas have not yet established the cooperatives or are not conducting group selling. Since selling volume is small, they usually use bus or sell to traders using trucks. Marketing places are big cities such as Esfahan, Shahrekord, Shiraz, etc. There are developing areas where villagers have established cooperatives and sold as group selling. For example, Semirom carpet cooperative supported by Deputy of Rural Industry and Development (Jihad) are conducting buying carpets from members of cooperative and selling them retail shops within the area or exhibition market at the near towns and cities. However, it is found that said cooperative have stopped the activities on that survey's day of July 2001 for recovering the good marketing conditions and stable trading prices. In Vastegan area, there is a carpet cooperative in Borojen near Vastegan, villagers sell carpet through said cooperative.

These carpet price is 200,000 – 300,000 Rials per square meter.

Rural Industry

Government considers that the rural industry is one of the essential sectors for rural development, increment of employee rate and stability and sustainability of socio-economic and have been promoting. Rural industry promoted by Deputy of Rural Industry and Development (Jihad) is categorized as 115 types for food industry, 59 types for mineral (non-metal) industry, 78 types for textile, 118 types for chemical and cellulose and 57 types for metal as well as employee of which are less than 50 persons and investment value of which is less than 3 billion Rials in 1999 (refer to ANNEX K-6 to K-8). It is reported that 14,350 permissions were applied, 6.82 trillion Rials were invested and 195,000 persons were employed during 12 years from 1987 to 1999. And of which, it is reached that 4,318 industry were operated with 53,000 employees. Moreover, industry areas were developed and 90 industry areas out of 170 were reached to operation with 3,490 employees. It is expected to create newly 76,000 employees. It is reported that 130 permissions were accepted from 1995 to 1999, 58 actual credits with 469 employees were accomplished from 1995 to 1998 and 202 industry plants with 298 employees were exploited by reports of Chaharmahal va Bakhtiyari Province (ANNEX K-9, Rural Industry in Chaharmahal va Bakhtiyari, Rural Industry Department Provincial Jihad). Moreover, 5 categories of industry and industrial area have been developed year by year are reported by Annual Report 2001. Also, training and education have been conducted, they were 220 man-day about marketing, 150 man-day about project control and 45 man-day about meeting of producers in the year of 2000. However, as five Study Areas are scattered located in the mountainous areas as well as socio-economic infrastructure such as transportation and communication in the Study Areas have not yet developed enough, rural industrial plants have not yet installed. On the other hand, rural industries near the Study Areas have been developing. 43 plants in Gandoman near Vastegan Area, 33 plants in Semirom near Sar Baz area, 121 plants in Boyerahmad (Yasuj) near Tange Sork and 25 plants in Izeh near Zeras area have been obtained the permissions (ANNEX K-10, Rural Industry around Study Area). In the Study Areas, it is expected that rural industries (collecting, grading, packing, distribution, etc) using agricultural products and the local materials can be established coordinated with the existing rural industries (for employment, incentives, human development, development of infrastructure, etc) near the Study Areas.

8.7 Natural Disaster

8.7.1 Flood and Debris Flow

The detailed survey on flood and debris flow is included in the Sub-contract Works; Natural Disaster Survey, and the details of the results of the survey are explained in the Report. Thus the outline of flood and debris flow is excerpted here as in the followings.

(1) Vastegan (K4-1-9)

The topography of the master plan area is generally divided in three parts, upland on the west with the elevation of more than 2,500m up to 3,600m, lowland on the east consisted of alluvial fan and plain with the elevation of around 2,300m down to 2,200m, and the steep cliff in between. The western upland is also divided into two parts; one is northern part which is sloping south formed with limestone and the other is southern part consisted of Marl and limestone.

There are two major rivers in the master plan area. Gela River collects the water from upland and flows into the lowland, while R.Aghabolugh, that flows through the marsh located north, borders eastern part of the master plan area. In addition, there are several valleys on the steep cliff that borders the upland and the lowland.

Upstream of R.Aghabolugh is the marshland and it functions as a retarding pond, therefore, there is no severe flood damage along this river.

a) Southern Part of Western Upland

The elevation of this part is from 2,500m to 3,500m and the mountain slopes consisted of Marl generally face toward north. Many tributaries are dissected here just as dendritic drainage pattern and the lower part of these tributaries are filled with debris because of sever erosion on Marly slopes. Therefore, 43 check dams have been constructed in order to store the debris and to stabilize the foot of the slopes as shown in Table 8-7-1-1 and Fig.8.7.1.1. It is obviously clear that the extent of erosion is very large and that debris flow causes a lot of problem in the downstream.

No inhabitants in this part except for Nomad and some villagers staying in the tents in summer time. In addition, the orchard garden in this area scatters rather in the hill side and free from flood and debris flow. Thus the flood and debris flow are originated in this part, but do not cause significant damage. The unpaved road for Nomad, which connects west of this part, and very limited Nomad-cultivation area alongside

b) Northern Part of Western Upland

The elevation of this part is from 2,500m to 3,600m and the mountain slopes consisted of limestone face toward south. Several shallow drains are dissected in limestone stretch right down to south and join the watercourse which boarders north and south of Western Upland.

This part is geologically stable and erosion is not existed, however the run-off coefficient is very high with the following reasons;

a. Vegetation is scarce because of high elevation and shrubs can be seen mainly in the lower part,

b. Several shallow drains engraved in limestone stretch right down to south.

Neither inhabitants nor cultivation areas exists this part and there is no flood and debris flow damage.

c) Steep Cliff Area

Several valleys are formed on the steep cliff between the western upland and the eastern lowland. Among these valleys, the two northern tip ones, near Nasir Abad, have larger catchment area and a small alluvial fan is extended downstream. Two small valleys are also located behind the village of Nasir Abad. According to the interview with the villagers, small-scale debris flows occur during the heavy rain, however, the damage is so far very scarce.

d) Eastern Lowland

On the eastern part of Vastegan, a large alluvial plain is extended with the elevation of 2,200m to 2,300m and utilized as farmland. Originally this area used to be a lake or marsh, however, debris from western upland, especially the debris from Gela River filled the area and finally alluvial plain is formed.

Gela River carries a lot of debris with floodwater and spread over the lowland adjacent to the village of Vastegan located at the outlet of narrow gorge and it's downstream. The materials consist of debris from the upland are mainly fine particles and fragment of shale and the farmland along the river course of Gela is covered with such sediments.

The eastern lowland area has been suffering form flood and debris flow damage for many years, however, the records of damage were very scarce and the details won't be able to clarified. Thus interviews have been made with the villagers and provincial officials in order to grasp actual damage caused by flood and debris flow. The results are outlined as follows;

a. Around 60 years ago, a big flood hit Konark Olya, located between R.Aghabolugh and the middle reaches of Gela River, and farmland was damaged and a fort located beside Gela River was completely washed away. The ruins is now cultivated and willows and poplars are planted around it (interviewed with 85-aged man).

b. Konark Olya also had a big flood in 17 or 18 years ago, and another flood in 6 or 7 years ago. The both floods caused damage, but the latter flood caused farmland damage around 20 ha. (another interview in Konark Olya).

c. In 1998, Konark Sofla, located between R.Aghabolugh and the lower reaches of Gela River, received flood and debris flow from Gela River, and the farmland was covered with debris. In addition wheat and barley that had grown around 30 cm were damaged. This flood caused more damage in Konark Sofla in the downstream, however, Vastegan village in the upstream received more damage on infrastructures such as roads, and agricultural machines (interview in Konark Sofla).

d. In 1998, the village and surrounding area of Nasir Abad had been inundated and some houses in the perimeter of the village had to make temporary earth-filled pass by tractors to evacuate.

The road, which connects Vastegan and Nasir Abad, functioned as a dike for protecting the farmland at the foot of the cliff from inundation (interview in Nasir Abad).

e) 1998 Flood

On March 30th, 1998, Gela River flooded with a few days continuous heavy rain, and the muddy water overflowed the bridge beside Vastegan village, which connects Vastegan and Nasir Abad, and covered mainly on the left bank of Gela River, where the elevation is slightly lower than that of the right bank. Around 100 ha. of farmland had been inundated, and 80 ha. of it is still covered with debris and left behind. The inundation reached as far as Nasir Abad and its depth was at around one meter near the bridge.

Flood and debris flow damage is summarized as shown in the following table;

Table 8-7-1-2 Summary of Flood and Debris Flow Damage

Time of occurrence	Location	Damage	Source of information
60 years ago	Vastegan, Konark Olya, etc.	Farmland, fort	Villagers in Konark Olya
17 or 18 years ago	Vastegan, Konark Olya, etc.	Farmland	Villagers in Konark Olya
6~7 years ago	Vastegan, Konark Olya, etc.	Farmland; 20 ha	Villagers in Konark Olya
March, 1998	All Vastegan area	Road,ccreals,farmland;100 ha	Villagers in Vastegan & Nasir abad, Provincial Office
			Time of investigation; September, 2001

f) Rainfall Record

On March 30th, 1998, the daily rainfall was recorded 51 mm while the monthly amounted to 111.5 mm, which marks the maximum record in this area. The elevation of unmelted snow on the day of heavy rainfall was at around 2,650 m and the cause of flood is clearly derived from heavy rain and snow melting. Another cause of flood inundation is the two irrigation canals, which are aligned on the low embankment and cross Gela River almost perpendicular. The crossing points become "bottle necks" and then floodwater is retarded and inundated in the

surrounded areas by these low embankment and Gela River.

On the other hand, the maximum daily rainfall, the maximum monthly rainfall and the date of occurrence at Boroujen meteorological station are as follows;

Table 8-7-1-3 *Maximum Daily / Monthly Rainfall at Boroujen*

Max. daily rainfall	Date of occurrence	Max. monthly rainfall	Date of occurrence
40 mm	March 1, 1971	116 mm	May 22 ~June 21, 1990 (Iranian month : Khordad)
45 mm	February 17, 1980		
80 mm	June 3, 1970		

g) Existing Disaster Prevention Facility

As is discussed in the previous section and as shown in Fig.8-7-1-1 and Table 8-7-1-1, various sizes of 43-check dams have been constructed in the southern part of the Western Upland. The two out of 43 are stone check dams and the rest are generally gabion type dams.

One of the stone check dams were constructed in 2000 and in August 2001, the crest was raised and its upstream and downstream faces were shaped with boulders and rubble concrete. In the upstream of the dam, poplars are experimentally planted. The other stone check dam was also quickly constructed in 2001 with very big stones. This type of construction method is called as the rapid construction method in Iran.

(2) Chaman Goli-Bazoft (K5-19a)

Chaman Goli-Bazoft area is generally bordered by the mountain ranges except for the eastern part, the border of which is the Bazoft River. The west and south mountain ranges are consisted of the peaks of 3,000 m to 3,400 m, while the northern mountain range becomes lower to 2,500 m to 2,000 m

There are three sub-basins in the master plan area. All the basins are drained into the Bazoft River. Fariak River, located in the northeastern basin has a small catchment area. Gusale Bar River collects the water from the north and northwest basin, while Tabarak River drains from the south and southwest basin. In addition, several small tributaries drain into Bazoft River.

Gusale Bar River and Tabarak River generally have fan shaped catchment areas, which cause the concentration of floodwater.

The damage from flood and debris flow in the master plan area is as follows;

a) Fariak River basin

In the upper and middle reaches of Fariak River, oak trees are rather well vegetated, and

farmland is extended along the lower reaches of the River. No village is located, however, there are a few houses of Fariak village.

b) Gusale Bar River basin

From the upstream of this river, the villages of Kachooz, Baghchenar, Dorak, Arteh, Khiyarkar, Chemghaleh and Fariak are located.

Kachooz; In 1996, a severe debris flow occurred from the upper reaches of Gusale Bar River, one of the Nomad tents was washed down, and three people were killed and two or three people were missing. In 1996 and 1998, some small-scale flood and debris flow and rock falls occurred on the slope of the trunk road beside the village and caused damage to some houses located below the road. Upper reaches of Gusale Bar River are liable to cause debris flow based on its surface soil and geological conditions. Flood occurs from the right tributary of Gusale Bar River and causes some damages to the irrigation intake facility and the sediment from upper reaches is filled behind the intake, however, the flood does not cause serious damages here.

Baghchenar; There are two small tributaries joins into Gusale Bar River from the left bank. The village is located along these two tributaries. The catchments are rather small, poorly vegetated on the steep slope, and very erosive. Eventually, the riverbeds become deeper and deeper and the riverbanks are extended into the farmland adjacent to the rivers. The villagers planted willow trees along the riverbanks for their protection, however, this kind of countermeasures is not so effective. According to the interview with the villagers, "Around 15 years ago, these tributaries used to be wide enough to jump across for a man", but now they were deepened down to 10~15 m. The villagers are also aware that as the sudden decrease of the forests in the upper reaches, the more severe floods have come.

Dorak; The village, located on the left bank of Gusale Bar River, has gully erosion and frequent flood damage. One water mill located on the riverbank of Gusale Bar River, 4 m higher than its riverbed, had been washed away. Behind the village, one small tributary flows through the village and joins the Gusale Bar River. In 2000, heavy rain triggered floods in this tributary and caused serious damage in the village. Now, the villagers constructed bypass channel to detour the village and connected to Gusale Bar River directly. In addition, farmland is also receiving damage from landslides and rock falls. In this village, people are also aware that as the sudden decrease of the forests in the upper reaches, the more severe floods have come.

Arteh; The village is located on the right bank of Gusale Bar River. This village has also too

much problem from flood and sometimes people are killed.

Khiyarkar; The village is also located on the right bank of Gusale Bar River. This village has also too much problem from flood.

Chemghaleh; The village, the center of the master plan area, faces to the Bazoft River on the right bank. Gusale Bar River bends sharply at the northern part of Chemghaleh and joins the Bazoft River. This sharp bent causes problems such as overflow in the farmland, riverbank erosion, etc.

Fariak; The village is located on the left bank of Gusale Bar River and also faces to the Bazoft River on the right bank. After the river course bends sharply at Chemghaleh, the river turns to the village of Fariak, and joins the Bazoft River. The flood in 1998 and the following flood seriously eroded the riverbanks, especially on the left bank where graveyard and farmland of Fariak village are located, as far as around 70 m. Similar floods will threaten the houses and the village road to Fariak.

c) Tabarak River basin

This basin has three villages, Tabarak Olya, Tabarak Sofla and Ghale Tabarak, from upstream to downstream, and all the villages have flood and debris flow damage.

Tabarak Olya; The village is located on the left bank of Tabarak River. This village had too much problem from flood in 1998, which caused a lot of damage in orchard gardens and farmland. This flood was so strong that the villagers living near the river had to evacuate to safer places and that 6 check dams have been constructed since then. According to the interview with the villagers, "The flooded water reached around 4 m depth in the river, rooted out large trees in and around the village, and washed away many sheep and domestic animals".

Tabarak Sofla; The village is located on the hillside or hilltop of the left bank of Tabarak River. Thus the village itself has little problem with flood and debris flow. However, the flood in 1998 caused a lot of damage on orchard gardens and farmland along Tabarak River, and to domestic animals, especially sheep. It is reported that this flood triggered many landslides, made two house half-wrecked, and washed 40 sheep and 5 goats away.

Ghale Tabarak; The village is located on the small hilltop of the right bank of Tabarak River. The village has little problem with flood and debris flow. However, the flood in 1998 caused severe erosion on the rivers, which flow front and behind the village. Four check dams have been constructed on the river in front of the village in order to prevent further damage for the

village road and farmland. In addition, the river behind the village deepened its riverbed and caused erosion on surrounding farmland.

d) *Existing Disaster Prevention Facility*

As shown in Table 8-7-1-4 and Fig. 8.7.1.2, twenty-one check dams have been constructed on the Tabarak River basin, especially in and around Tabarak Olya. Almost 70% of these check dams have the height of only up to one meter and their storage volume is very limited. Based on the data from Table 8-7-1-4, the total storage volume is $1,100m^3$, stored sediment volume is $300m^3$, and vacant capacity is $800m^3$.

(3) Sarbaz (K7-0-19-1)

Sarbaz area is generally bordered by the Dena mountain ranges except for the northeastern part, the border of which is the Marbor River. The southern mountain range is consisted of the peaks of 4,000 m to 4,100 m, while the east and west mountain ranges descend to around 2,100 m near the Marbor River.

There are two major sub-basins in the master plan area, one is located in northern part and anther is in the southern part. All the basins are drained into the Marbor River.

The damage from flood and debris flow in the master plan area is as follows;

a) North Sub-basin

This basin has two villages, Noorabad and Sarbaz, and both these villages are located either on the hill or hill slope, and free from flood and debris flow damage. However, the lower part of the basin, where villages, farmland, and even Nomad camps are located, is generally covered with Marl and eroded severely, especially the farmland along the tributaries of Marbor River.

Noorabad; The village is located on the hill and has no flood and debris flow damage, however, the two tributaries running down along the both side of the hill sometimes cause flood and debris flow damage on the farmland.

Sarbaz; The village is located on the slope of the hill and has seldom flood and debris flow damage. One tributary with small catchments flows down below the village through the farmland and sometimes small-scale floods occur with minor damages.

b) South Sub-basin

Lee Sorkh River, which flows from south to north in the South sub-basin, is one of the major

tributaries of the Marbor River. From the upstream of this river, the villages of Noghel, Dangazloo, Kahangan, Deh Bozorg, Telmohamad, Zabih Abad, Devergan Olya, Devergan Sofla and Dorahan are located. The most downstream village, Dorahan, is also faces to the Marbor River

On the upper reaches of Lee Sorkh River, one of the valleys is filled with debris consisted of big boulders, which were derived from the huge rockslide on the slope of the Dena Mountains around 30 years ago. On the most upper reaches of the debris-filled valley, a small pond was formed at the time of the slide and remains stable since then. Judging from the size of boulders in the debris-filled valley, rather smaller materials had been washed down and big ones had been left in the riverbed.

The flood that occurred during the last ten days of March 1998 damaged the villages and orchards along Lee Sorkh River . Some landslides also happened because of the flood . Most of the damage was incurred to the orchard gardens along the River from Kahangan down to Marbor River.

The flood and debris flow damage in this basin occurs in Kahangan, Deh Bozorg, Telmohamad, Zabih Abad, Devergan Sofla and Dorahan. Other areas are very scarce.

The damage from flood and debris flow in the concerned villages is as follows;

Nogel; The village is located on the hill and has little flood and debris flow damage, however, the old village located around 3 km upstream was hit by the debris flow, most of the houses were destroyed, and they resettled here.

Dangazloo; The village is located on the left bank of Lee Sorkh River and has little flood and debris flow damage.

Kahangan; The village is located on the right bank of Lee Sorkh River and flood and debris flow sometimes occur. One of the inhabitants of this village, who is about 65 years old, explained that about 30 years ago, a severe flood that took place in the area and caused a lot of damage to the area and the villages .

Deh Bozorg; The village is located on the left bank of Lee Sorkh River and flood and debris flow sometimes occur.

Telmohamad; One left tributary, which drains the center of the master plan area, runs near this village located on the left bank of Lee Sorkh River, caused a lot of damage for lower lying

orchard gardens, and uprooted and washed away during the flood in 1998.

Zahid Abad; The village is located on the left bank of Lee Sorkh River and flood and debris flow sometimes occur because the village is located near the River.

Devergan Olya; The village is located on the left bank of Lee Sorkh River and has little flood and debris flow damage because the village is located apart from the River.

Devergan Sofla; The village is located on the left bank of Lee Sorkh River and flood and debris flow sometimes occur because the village is located near the River.

Dorahan; The village is located on the right bank of Lee Sorkh River and the Marbor River, therefore, flood and debris flow frequently occur.

c) Flood Information

There are no climatologic nor river gauging stations in the master plan area. Some data are available from the Shahid station, a little upstream from the master plan area.

The flow data recorded in this station show the big flood occurred about 30 years ago (in 6th of March, 1972, the river discharge was recorded 400 cubic meters per second).

The rain fall data recorded in this station are available for 33 years from 1966-67 to 1997-98. The longest rainfall duration occurred on 8th June, 1992, which was lasted for 7 days. The total rainfall in this period was 224 mm.

The maximum monthly rainfall is also recorded 464 mm in Bahman, Iranian month (21 Jan - 19 Feb) in 1967, the major rainfalls of which are 209 mm , 30 mm , 20 mm and 170mm. The second highest rainfall was recorded both in Jan 75-76 and Feb 77-78, the total amount of which is 352 mm.

No rainfall is observed in the master plan area during June, July, August and September.

The maximum daily, monthly, annual rainfall and the minimum annual rainfall are summarized as follows;

Table 8-7-1-5 Maximum Daily / Monthly Rainfall(Sarbaz)

Max. daily rainfall	Date of occurrence	Max. monthly rainfall	Date of occurrence
209 mm	Jan. 28, 1968	464 mm	Bahman, Iranian month (21 Jan - 19 Feb) in 1967
208 mm	Feb. 4, 1968		
200 mm	March 21, 1969	352 mm	Jan. 1975-76, Feb. 1977-78
150 mm	May 10, 1978		

Table 8-7-1-6 Maximum / Minimun Annual Rainfall (Sarbaz)

Max. annual rainfall	Year of occurrence	Min. annual rainfall	Year of occurrence
998.5 mm	1975-76	262 mm	1988-89
941mm	1977-78	268 mm	1969-70
920 mm	1965-66	269 mm	1981-82

d) Existing Disaster Prevention Facility

Revetment and spur dikes are partially installed on the banks of Lee Sorkh River.

(4) Tang Sorkh (K7-48)

Tang Sorkh area divided into three sub-basins. In the east, the biggest one is Tang Sorkh River basin, and the other is the rest of the catchment consisted of several small right tributaries of Boshar River. In the west, there are also several left tributaries of Boshar River.

Tang Sorkh River carries a lot of debris from its catchment and forms a large alluvial fan at the confluence of the Boshar River. Thus, the river course of Boshar River pushed westward at the confluence.

The villages of Tang Sorkh and Sar Tang Sorkh are located in the Tang Sorkh River catchment, while the other villages are in the left bank of the Boshar River.

The damage from flood and debris flow in the master plan area is as follows;

a) Boshar River

About 25 years ago, Boshar River flooded and had completely covered all the surrounding lands. Tange Sorkh River had also been flooded and had destroyed many farmlands. According to the investigation on the flood data at Pataveh station located on Boshar River, downstream of the master plan area, in 1977-78, the peak flow was recorded as much as 1,363 m^3/s.

One of the inhabitants of Hassan abad said that Boshar River over flowed about 10 years ago and destroyed the farmlands around the River.

b) Tang Sorkh River Catchment

During the 1998 flood, many parts of the farmland beside the Tang Sorkh watercourse in the vicinity of the Bashar River were destroyed.

Tang Sorkh; Flood and debris flows from the upper reaches of Tang Sorkh River cause a lot of problems here. The main source of debris is in the right tributary, which has seasonal flow in

the river. The bridge crossing Tang Sorkh River has been washed away three times. The existing one was constructed three years ago (1998).

Sar Tang Sorkh; The village is located on the right bank of Tang Sorkh River. Judging from the riverbed condition, debris flow is limited, but flood occurs frequently.

c) Right Bank of Boshar River

There is no village in the area, however, farmland is extended in the basins formed by several tributaries. Flood and debris flow occur in the area and cause damage on farmland.

d) Left Bank of Boshar River

According to the interviews with the villagers, a severe flood occurred in the area, however, it didn't cause a lot of damage to the villages.

Allah Abad; Behind the village, there are several streams flowing down from the hills consisted of Marl. Flood occurs frequently here.

Cheshmeh Chenar; The village is located at the foot of steep mountains, and flood/debris flow occurs frequently. The flood damaged some houses last year.

Hasan Abad; The Boshar River has frequent floods and causes damages on their farmland. One of the inhabitants of this village remembers one flood that happened about 10 years ago and said, " The flood was so strong that the water flowing from the mountain passed the asphalt road and covered the front of the houses but the damage to the villagers were not very great.

Mehrab Abad; Flood sometimes occurs in spring when snow melts due to rain from the upper part of mountains and Boshar River.

Islam Abad; Flood sometimes occurs in spring when snow melts due to rain from the upper part of mountains and Boshar River.

e) Existing Disaster Prevention Facility

Zeras area is located on the right bank of the Karoon River, where very steep slope is formed in the northwest, while there are two mild plateaus in the southeast.

Generally, the land in the area slopes down to the Karoon River towards south. The lack of vegetation cover on the steep slope easily causes floods and the fertile soil is to be carried

down to the Karoon River, and causes surface and watercourse erosion.

The damage from flood and debris flow in the master plan area is as follows;

i) Northwest Area

This area has many small villages, such as Dawodiha, Ali Bandeh, Behoz, Bardkal, Zeras, Lir Siya Shapouri, Lir Siya Mozrom, Lir Siya Mozrom, Sartuf, Shahghaz and Sebalutak.

Dawodiha; The village is located on the top of the mountain range and free from flood and debris flow damage. However, according to the interviews with the villagers, about 24 years ago two villages named Ghaleandaroon and Darrehgazoon, each had about 50 families, were destroyed by flood and the villagers migrated to this place, that is now named Davoodiha. The old villages were deserted and fell into ruin.

Ali Bandeh; The village is located on the right bank of the Karoon River. Flood occurs frequently and causes many problems.

Behoz; The village is located just on the right bank of the Karoon River. Floods in the Karoon River directly affect the village. This village will be submerged after the completion of the Karoon No.3 Dam.

Bardkal; The village is located in the valley of the right tributary of the Karoon River. Flood/debris flow occurs frequently and causes many problems.

Zeras; The village is located on the steep slope of the Valley and gully erosion is well developed around the village. There is a danger of flush floods on these gullies.

Lir Siya Shapouri; The village is located at the most downstream of the deepest valley of the right tributary of the Karoon River. Flood and debris flow occurs frequently and causes many problems.

Lir Siya Mozrom; The village is located on the deepest valley of the right tributary of the Karoon River. Flood and debris flow occurs frequently and causes many problems, especially on road. Sometimes, the village transportation is completely stopped.

Sartuf; The village is located on the deepest valley of the right tributary of the Karoon River. The land around the village is easily eroded.

Shahghaz; The village is located on the right bank of the Karoon River, the location of which is the mild plateau, and no flood occurs.

Sebalutak; The village is located on the right bank of the Karoon River, the location of which is the mild plateau, and floods causes less problems.

ii) Southwest Area

This area has several villages, such as Gard Lidan, Dareh Zangi, Dareh Sohrab, Badelon and Cham.

Gard Lidan; The village is located on the right bank of the Karoon River, the location of which is the mild plateau, and floods causes less problems.

Dareh Zangi; The village is located on the western side of the mild plateau and there is a watercourse in the middle of the village, which is hazardous for some houses during flood.

Dareh Sohrab; One tributary passes through the village and during the intense rainfall, it is easily flooded and threatens the village.

Badelon; A few tributaries join above the village and the upstream has scarce vegetation. Thus erosion is severe here, and flood and debris flow occurs frequently and causes many problems.

Cham; The village is located just on the right bank of the Karoon River. Floods in the Karoon River directly affect the village. This village will be submerged after the completion of the Karoon No.3 Dam.

iii) Existing Disaster Prevention Facility

This area has no disaster prevention facility at all.

Table 8-7-1-1 Summary of Existing Check Dam Survey:Vastegan

No	Type of structure	Filled height (m)	Empty height (h) (m)	Depth (height) (m)	Width (B) (m)	Length (L) (m)	Area behind structure	Area of accumilated sediments	Bottom width of checkdam B -2 (d ' tana)	Sediments volume $K = \frac{1}{3} N \times I$	Slope $S = \frac{d}{I}$	Total length of sediment $L = \frac{D}{S}$	Total volume of reservoir $V = \frac{1}{3} M \times L$	Empty volume of reservoir $Q = V - K$
1	Stone	7.0	2.0	9.0	32.0	-	-	-	-	126,000.0	-	-	180,000	54,000
2	Mortar, stone	0.8	1.2	2.0	18.5	33.0	38.7	14.4	17.4	157.9	0.024	83.3	1,074	916
3	Mortar, stone	1.5	1.0	2.4	16.0	26.0	37.6	21.7	14.0	188.2	0.055	43.6	546	358
4	Mortar, stone	1.5	0.6	2.1	14.5	19.0	29.1	20.2	12.4	127.8	0.078	26.9	261	134
5	Mortar, stone	1.7	0.5	2.2	14.8	20.0	30.7	23.1	12.4	154.2	0.085	25.9	265	111
6	Mortar, stone	1.7	0.4	2.1	19.0	44.0	38.0	30.3	16.6	444.1	0.038	55.3	700	256
7	Mortar, stone	2.0	0.0	2.0	18.5	60.0	34.2	34.2	15.7	684.0	0.033	60.0	684	0
8	Gabion	2.6	-0.1	2.5	14.0	60.0	30.3	31.7	10.4	633.3	0.043	57.7	583	-51
9	Gabion	2.5	-0.1	2.4	14.0	45.0	29.2	30.6	10.5	459.4	0.056	43.2	421	-38
10	Gabion	2.6	-0.2	2.4	14.0	50.0	28.9	31.7	10.4	527.8	0.052	46.2	445	-83
11	Gabion	1.4	1.7	3.0	22.0	55.0	66.6	28.4	20.1	521.1	0.025	122.2	2,715	2,193
12	Gabion	1.5	1.3	2.8	22.0	75.0	61.2	31.4	19.9	785.6	0.020	140.0	2,856	2,071
13	Gabion	1.0	0.4	1.4	6.0	20.0	7.8	5.3	4.6	35.3	0.050	28.0	73	38
14	Gabion	1.2	0.9	2.1	18.5	47.0	38.4	21.2	16.8	332.0	0.026	82.4	1,054	722
15	Gabion	2.1	0.9	3.0	18.0	45.0	51.0	34.1	14.5	511.5	0.047	64.4	1,094	582
16	Gabion	2.0	0.0	2.0	9.0	20.0	14.6	14.6	5.6	97.6	0.100	20.0	98	0
17	Gabion	2.0	0.0	2.0	8.0	25.0	12.6	12.6	4.6	105.4	0.080	25.0	105	0
18	Gabion	1.1	2.0	3.0	11.0	62.0	35.3	10.6	9.3	658.7	0.017	177.5	2,087	1,428
19	Gabion	0.9	0.6	1.4	4.0	12.0	5.2	2.8	2.6	11.2	0.071	19.8	35	23
20	Gabion	2.0	0.5	2.5	26.0	120.0	62.0	49.0	23.0	1,960.0	0.017	149.0	3,080	1,120
21	Gabion	1.5	2.5	4.0	68.0	165.0	270.0	100.0	65.0	5,500.0	0.009	444.0	39,960	34,460
22	Gabion	2.5	0.2	2.7	22.0	130.0	54.0	49.0	17.0	2,120.0	0.019	142.0	2,556	436
23	Gabion	2.4	0.0	2.4	15.0	45.0	31.0	31.0	11.0	465.0	0.050	48.0	496	31
24	Gabion	1.9	0.3	2.2	15.0	36.0	30.0	25.5	12.0	306.0	0.052	42.0	420	114
25	Gabion	2.2	-0.2	2.0	19.0	45.0	55.0	60.0	26.0	900.0	0.048	45.0	900	0
26	Stone	1.0	3.5	4.5	12.0	9.0	62.0	11.3	10.6	34.0	0.110	41.0	847	813
27	Mortar, stone	18.0	1.3	2.1	30.0	45.0	64.0	24.0	29.0	360.0	0.018	118.0	2,517	21,570
28	Mortar, stone	1.0	1.2	2.2	26.0	50.0	58.0	25.0	25.0	416.0	0.020	110.0	2,126	1,710
29	Gabion	2.8	0.2	2.6	34.0	210.0	84.5	91.0	31.0	6,370.0	0.013	210.0	6,370	0
30	Gabion	1.3	1.2	2.5	28.0	100.0	70.0	35.5	26.5	1,183.0	0.013	192.0	4,480	3,297
31	Gabion	1.5	1.5	3.0	30.0	14.0	90.0	44.0	28.2	205.0	0.107	28.0	840	635
32	Gabion	1.4	1.4	2.8	16.0	36.0	45.0	21.0	14.4	252.0	0.039	72.0	1,080	828
33	Gabion	2.3	0.6	2.8	32.0	103.0	87.5	69.0	29.5	2,369.0	0.022	127.0	3,407	1,038
34	Gabion	2.2	0.1	2.3	22.0	36.0	49.0	46.0	20.0	552.0	0.061	38.0	620	68
35	Gabion	2.5	0.3	2.8	18.5	36.0	49.0	43.0	16.0	516.0	0.069	40.0	653	37
36	Gabion	2.1	0.2	2.3	17.0	40.0	37.0	33.5	15.0	446.0	0.052	44.2	545	99
37	Gabion	2.1	0.1	2.2	14.0	45.0	28.5	27.0	12.0	405.0	0.047	47.0	447	42
38	Gabion	1.8	1.0	2.8	22.0	120.0	61.0	38.0	20.0	1,520.0	0.015	187.0	3,802	2,282
39	Gabion	0.1	2.4	2.5	12.0	10.0	33.0	1.2	12.0	4.0	0.010	250.0	2,750	2,746
40	Gabion	0.7	1.5	2.2	18.5	10.0	43.0	12.6	17.5	42.0	0.080	31.4	450	408
41	Gabion	0.1	2.1	2.2	16.0	10.0	39.0	1.6	16.0	5.5	0.010	220.0	2,860	2,855
42	Gabion	0.8	1.2	2.0	24.0	30.0	49.0	18.8	23.0	188.0	0.027	75.0	1,225	1,037
43	Gabion	0.2	1.9	2.1	15.0	7.0	34.0	3.0	15.0	7.0	0.030	70.0	793	787

Table 8-7-1-4 Summary of Existing Check Dam Survey:Chaman Goli-Bazoft

No. of water course	No. of checkdam	Type of structure	Length (L) (m)	Width (B) (m)	Depth (D) (m)	Empty height (h) (m)	Filled height (m)	Area of accumilated sediments	Area behind structure	Bottom width of checkdam	Sediments volume $K=\frac{1}{3}N\times l$	Slope $S=\frac{d}{l}$	Total length of sediment $L=\frac{D}{S}$	Total volume of reservoir $V=\frac{1}{3}M\times L$	Empty volume of reservoir $Q=V-K$
T1-6	1	Mortar & stone	4.0	1.0	1.0	0.5	0.5	0.380	0.995	0.53	0.126	0.1250	8.0	2.650	2.524
	2	Mortar & stone	5.0	1.0	0.9	0.3	0.6	0.432	0.774	0.44	0.720	0.1200	7.5	1.935	1.215
	3	Mortar & stone	3.0	1.0	1.0	0.6	0.4	0.324	1.085	0.62	0.324	0.1300	7.7	2.780	2.456
	4	Mortar & stone	3.0	1.0	0.7	0.2	0.5	0.380	0.600	0.53	0.380	0.1600	4.4	0.880	0.500
	5	Mortar & stone	6.0	0.9	0.9	0.5	0.4	0.282	0.850	0.52	0.564	0.0600	15.0	4.250	3.686
	6	Mortar & stone	7.0	0.9	1.0	0.4	0.6	0.372	0.800	0.34	0.868	0.0800	12.5	3.330	2.462
T1-7	1	Mortar & stone	6.0	1.5	0.5	0.5	1.0	1.030	0.400	0.56	2.060	0.1600	3.1	1.650	0.410
	2	Mortar & stone	4.0	1.5	0.8	0.4	0.4	0.672	1.200	1.12	0.896	0.1000	8.0	3.200	2.300
	3	Mortar & stone	3.0	1.5	0.8	0.3	0.5	0.632	1.120	1.03	0.632	0.1600	5.0	1.860	1.230
	4	Mortar & stone	3.0	1.5	0.8	0.4	0.4	0.524	1.200	1.12	0.524	0.1300	6.1	2.440	1.916
	5	Mortar & stone	3.0	1.5	0.6	0.0	0.6	0.732	0.645	0.94	0.732	0.2000	3.0	0.732	0.000
	6	Mortar & stone	3.0	1.5	0.8	0.5	0.3	0.405	1.100	1.20	0.405	0.1000	8.0	2.900	2.500
	7	Mortar & stone	3.0	1.5	0.6	0.4	0.2	0.280	0.860	1.30	0.280	0.0600	10.0	2.860	2.580
Galleh Tabalak	1	Mortar & stone	10.9	4.0	3.7	3.4	0.3	1.140	1.850	3.58	51.300	0.0275	135.0	83.000	31.700
	2	Mortar & stone	9.0	3.4	2.1	0.1	2.0	4.000	4.350	0.60	12.800	0.2200	9.6	14.000	1.200
	3	Mortar & stone	6.0	2.0	1.2	0.2	1.0	1.300	1.730	0.60	3.120	0.1670	7.2	4.150	1.030
	4	Mortar & stone	5.0	2.1	1.0	0.8	0.2	0.370	2.300	1.60	3.000	0.4000	25.0	19.160	16.160
Galleh Tabalak	1	Mortar & stone	16.0	8.0	2.4	0.7	1.7	11.560	17.400	5.60	88.600	0.1060	23.0	133.400	44.800
	2	Mortar & stone	16.0	5.0	2.2	1.6	0.6	2.750	12.480	4.15	53.000	0.0375	58.0	241.000	18.800
	3	Mortar & stone	11.0	5.0	2.0	1.2	0.8	3.520	10.400	3.80	32.800	0.0730	28.0	97.000	64.200
	4	Mortar & stone	15.0	5.9	3.2	2.2	1.0	5.200	31.670	4.50	81.500	0.6700	47.0	496.000	414.500

*A diversion dam has been constructed on the river beside Tabarok sofla village that its details have been brought in the seetion relevant to flood.

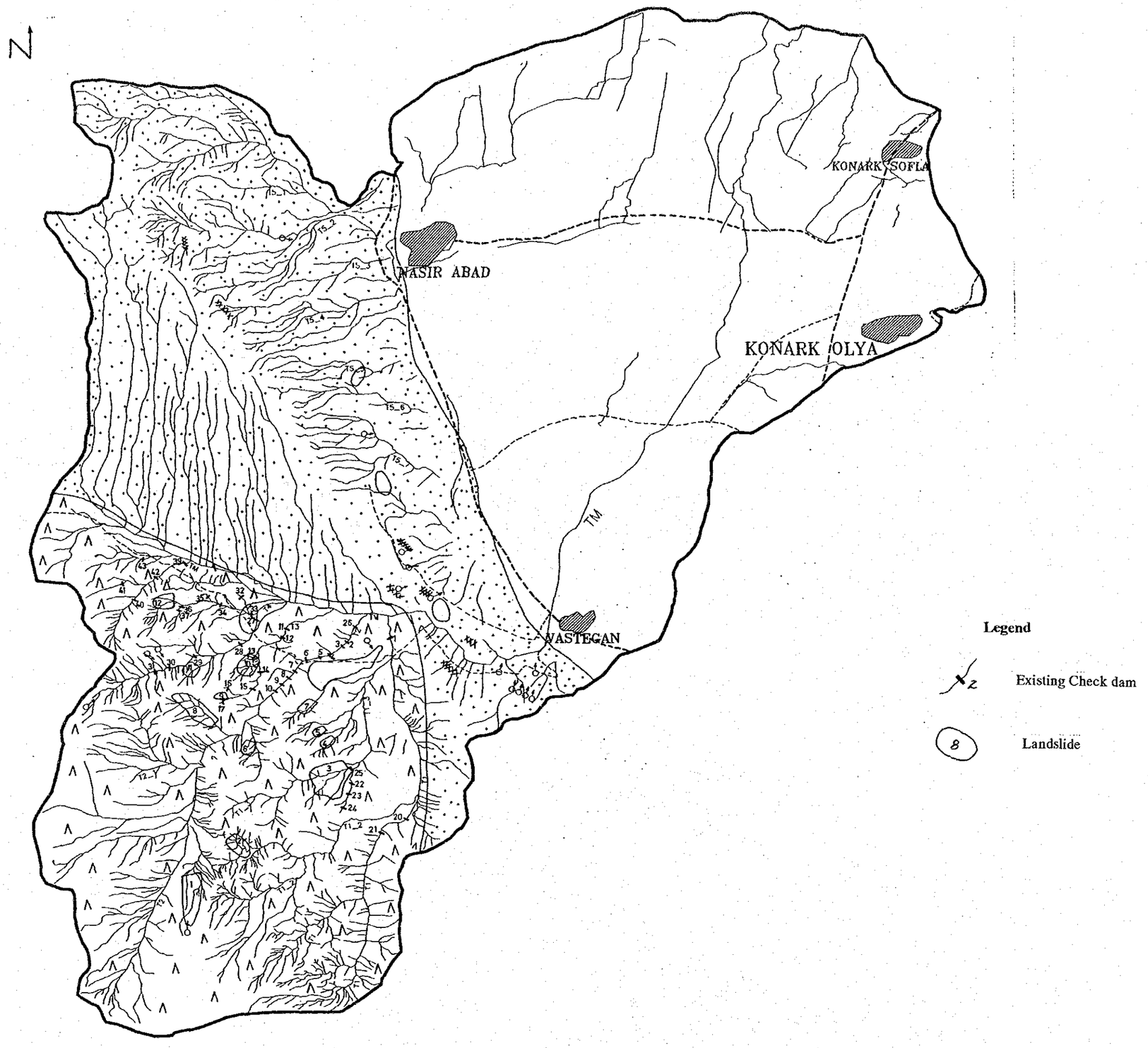

Figure 8-7-1-1 Location Map of Existing Check Dam and Landslide: Vastegan

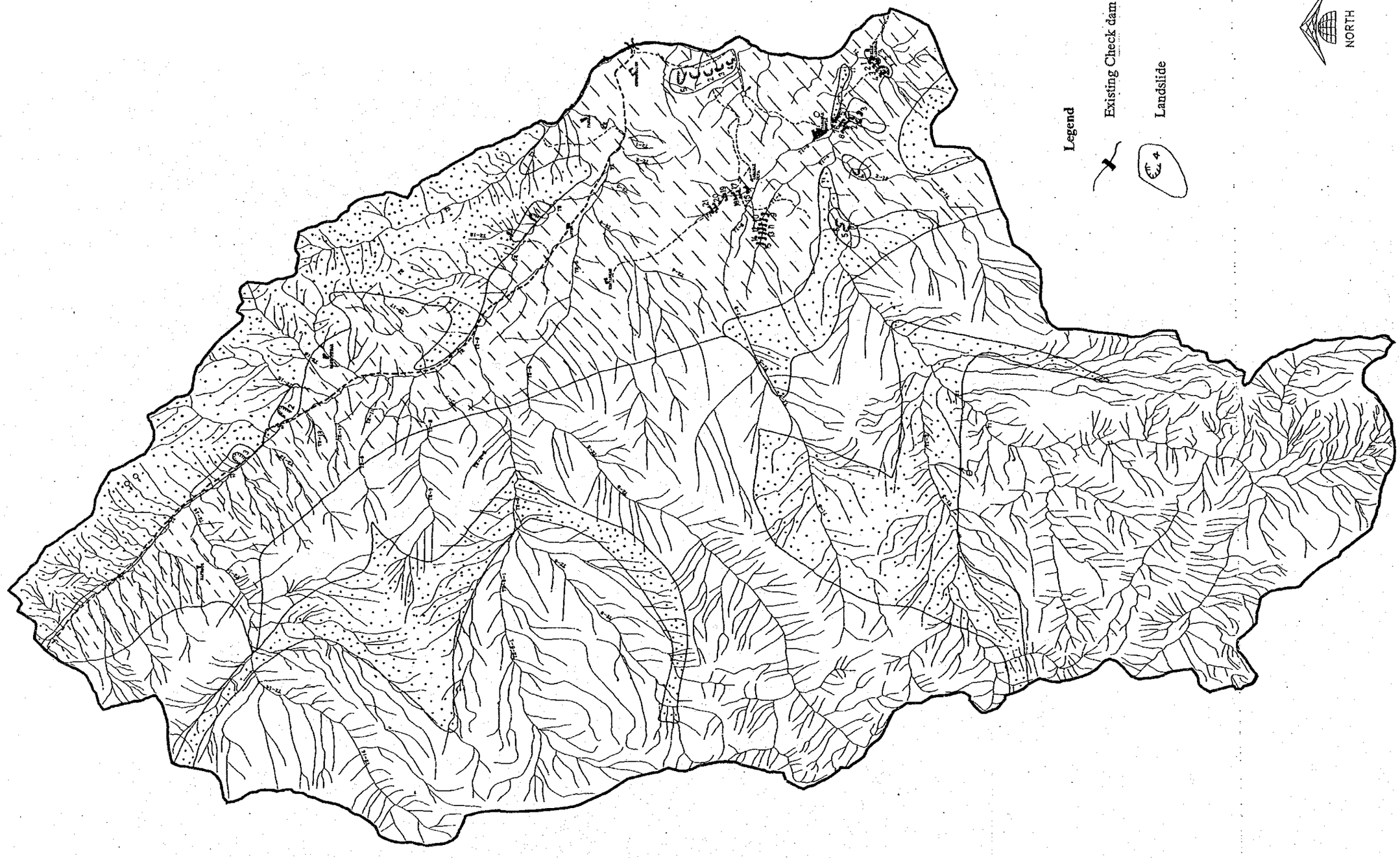

Figure 8-7-1-2 Location Map of Existing Check Dam and Landslide : Chaman Goli-Bazoft

8.7.2 Landslide

The detailed survey on landslide is included in the Sub-contract Works; Natural Disaster Survey, and the details of the results of the survey are explained in the Report. Thus the outline of landslide survey is excerpted here as in the followings.

(1) Vastegan (K4-1-9)

There are some landslides in southern part of western upland as shown in Table 8-7-2-1 and Fig.8.7.1.1, small-scale rock falls occur on the Steep Cliff Area.

(2) Bazoft (K5-19a)

Landslides in this area occur in and around Kachooz, Baghchenar, Dorak, Chemghaleh, Tabarak Sofla and Ghale Tabarak as shown in Table 8-7-2-2. and Fig 8.7.1.2.

Kachooz has rock falls from the slope along the main road and hit to the houses located below the road, especially in spring and after the heavy rain.

(3) Sarbaz (K7-0-19-1)

Many landslides occur in the North Sub-basin, especially in and around the Noorabad and Sarbaz. In the South Sub-basin, landslides occur in three locations such as south of Kahangan, a small hill facing to Lee Sorkh River between Kahangan and Dorahan, and west of Zabih Abad adjacent to the North Sub-basin. The detail of these landslides is shown in Table 8-7-2-3. and Fig 8.7.2.1.

Many villages also receive small-scale landslides damage on their farmland, irrigation canals and roads, especially in spring and after the heavy rain. Among these villages in the area, Dorahan has rather severe problems in their farmland and irrigation canals, while Sarbaz has slides in the middle of the village and some houses have been damaged.

(4) Tang Sorkh (K7-48)

Most of the landslides in this area occur rather apart from villages and farmland. The one behind the village of Cheshmeh Chenar is small-scale rock fall. The details of the landslide are shown in Table 8-7-2-4. and Fig 8-7-2-2.

In 1973, a large-scale landslide occurred on the right bank of Boshar River, the location of which is immediate downstream of the master plan area. The size of the slide was 160 m in width, 480 m in length, and the collapsed earth volume was 768,000 m^3. The collapsed earth blocked up the Boshar River and a temporal pond was created with the water depth of around 10 m. After a short time, the blocked earth was collapsed and washed down.

(5) Zeras (K8-28)

Landslides in this area are scattered along the right bank of Karoo River, in and around the main road from Dawodiha to Lir Siya Shapouri, and on the Southwest Area. The details of the landslide are shown in Table 8-7-2-5 and Fig 8-7-2-3.

Table 8-7-2-1 Summary of Landslide Survey in Vastegan

No	Surface drainage	Deep drainage	Formation material	Mass slope (Degrees)	Date of movement	Type of Movement	Coodinate		The dimensions of landslide				
							Longitude	Latitude	Vol.(m^3)	Area (m^2)	Depth (m)	Width(m)	Length (m)
1	Good	Very poor	Soil , detritus , stone	20.7	Old	Continous	51° 04′ 5″	31° 44′ 02″	-	130,000	-	225	650
2	Good	Very poor	Soil , detritus	5.0	Old	Continous	51° 04′ 28″	31° 44′ 21″	-	50,000	-	175	300
3	Good	Very poor	Soil , detritus	7.0	Old	Continous	51° 05′ 13″	31° 44′ 46″	-	180,000	-	420	480
4	Good	Very poor	Soil , detritus	6.0	Old	Continous	51° 05′ 09″	31° 45′ 03″	-	10,000	-	70	170
5	Good	Very poor	Soil , detritus	10.0	Old	Continous	51° 05′ 04″	31° 45′ 08″	-	11,000	-	80	160
6	Good	Very poor	Soil , detritus	11.0	Old	Continous	51° 04′ 34″	31° 45′ 00″	-	28,000	-	120	250
7	Good	Very poor	Soil , detritus	6.9	Old	Continous	51° 04′ 52″	31° 45′ 14″	-	35,000	-	150	250
8	Good	Very poor	Soil , detritus	7.3	Old	Continous	51° 04′ 16″	31° 45′ 20″	-	11,000	-	220	550
9	Good	Very poor	Soil , detritus	5.0	Old	Continous	51° 04′ 31″	31° 45′ 24″	-	13,000	-	100	150
10	Good	Very poor	Soil , detritus	7.3	Old	Continous	51° 04′ 32″	31° 45′ 32″	-	75,000	-	270	270
11	Good	Very poor	Soil , detritus	10.2	Old	Continous	51° 04′ 05″	31° 45′ 31″	-	26,000	-	160	180
12	Good	Very poor	Soil , detritus	6.9	Old	Continous	51° 03′ 52″	31° 45′ 00″	-	47,000	-	200	250

Table 8-7-2-2 Summary of Landslide Survey in Chaman Goli-Bazoft

No	Drainage	Type of formations	Date of movement	Type of Movement	Coodinate		Location	Slope angle	The dimensions of landslide			
					Longitude	Latitude		(degree)	Vol.(m^3)	Area (m^2)	Width(m)	Length (m)
1	very poor	Aghajary	1997	Simple Rotative	50°, 01, 20²	32°, 12, 48²	Cham ghaleh 1	30	625	750	80	10
2	very poor	Aghajary	1997	Simple Rotative	50°, 01, 22²	32°, 12, 58²	Cham ghaleh 2	22	52	95	20	5
3	very poor	Aghajary	1997	Simple Rotative	50°, 01, 24²	32°, 12, 49²	Cham ghaleh 3	23	222	380	85	5
4	very poor	Aghajary	1997	Repeated Rotative	50°, 01, 26²	32°, 12, 49²	Cham ghaleh 4	31	1,570	850	40	25
5	very poor	Aghajary	1997	flowing	50°, 01, 19²	32°, 12, 48²	Cham ghaleh 5	20	1,256	550	15	40
6	very poor	Aghajary	1991	Collapsive-rotative	50°, 00, 42²	32°, 13, 16²	Arteh 1	37	33,510	7,200	200	40
7	very poor	Aghajary	1991	Collapsive-rotative	50°, 00, 10²	32°, 13, 37²	Arteh 2	35	590	350	25	15
8	very poor	Aghajary	1991	Rotative-collapsive	50°, 58, 32²	32°, 15, 25²	Arteh 3	26	863	500	24	13
9	very weak to weak	Aghajary (Mp1)	1991	Collapsive-rotative	50°, 01, 20²	32°, 11, 10²	Tabarak 1	30	549	500	35	15
10	very weak to weak	Aghajary (Mp1)	1991	Collapsive-rotative	50°, 01, 20²	32°, 11, 10²	Tabarak 2	40	408	280	40	16
11	very weak to weak	Aghajary (Mp1)	1991	Rotative	50°, 01, 20²	32°, 11, 10²	Tabarak 3	35	320	250	30	10
12	very weak to weak	Aghajary (Mp1)	1991	Rotative	50°, 00, 40²	32°, 11, 18²	Tabarak 4	34	210	170	20	10
13	very weak to weak	Aghajary (Mp1)	1991	Rotative	50°, 00, 08²	32°, 11, 00²	Tabarak 5	42	1,507	650	40	18
14	very weak to weak	Aghajary (Mp1)	1991	Rotative	50°, 00, 07²	32°, 10, 06²	Tabarak 6	48	1,570	550	30	20
15	very weak to weak	Aghajary (Mp1)	1996	Whole slide	50°, 01, 54²	32°, 11, 00²	Ghaleh tabarak 1	24	950	550	150	35
16	very weak to weak	Aghajary (Mp1)	1996	Simple Rotative	50°, 01, 56²	32°, 11, 02²	Ghaleh tabarak 2	28	8,246	4,800	45	25
17	very weak to weak	Aghajary (Mp1)	1996	Repeated Rotative	50°, 01, 58²	32°, 11, 04²	Ghaleh tabarak 3	26	863	50	20	25

Table 8-7-2-3 Summary of Landslide Survey in Sarbaz

No	Drainage	Formation material	Type of formations	Date of movement	Type of Movement	Coodinate		Location	Type of Activity	The dimensions of landslide				
						Longitude	Latitude			Vol.(m^3)	Area (m^2)	Depth (m)	Width(m)	Length (m)
1	medium	Soil	Pabedeh marl	1992	Sliding Rotational	51°, 36′, 10″	30°, 57′, 50″	Sarbaz 1	simple	9,811	3,963	5	50	80
2	very poor	Soil	Alluvium	1992	vast expansive slide area	51°, 36′, 38″	30°, 56′, 40″	Sarbaz 2	complex	2,356,194	157,080	15	200	200
3	very poor-poor	Soil	Pabedeh marl	1993	flowing	51°, 36′, 35″	30°, 55′, 40″	Noorabad 1	complex	16,800	4,200	8	150	30
4	very poor-poor	Soil	Pabedeh marl	1993	Rotational	51°, 36′, 37″	30°, 55′, 43″	Noorabad 2	simple	6,000	2,200	5	120	20
5	very poor-poor	Soil	Pabedeh marl	1992	Sliding Rotational	51°, 36′, 53″	30°, 55′, 52″	Noorabad 3	simple	13,750	5,500	5	200	30
6	very poor-poor	Soil	Pabedeh marl	1992	Sliding Rotational	51°, 37′, 12″	30°, 55′, 40″	Noorabad 4	Repeated	307,445	25,498	25	170	150
7	very poor-poor	Soil	Alluvium	1992	Sliding Rotational	51°, 37′, 12″	30°, 55′, 42″	Noorabad 5	simple	190,000	18,000	20	200	100
8	very poor	Soil	Pabedeh marl	1992	Sliding Rotational	51°, 37′, 06″	30°, 55′, 12″	Noorabad 6	simple	157,080	31,416	5	200	300
9	very poor	Soil	Alluvium	1992	Sliding Rotational	51°, 36′, 27″	30°, 55′, 12″	Noorabad 7	complex	392,699	196,300	20	150	500
10	very poor	Soil	Pabedeh marl	1992	Sliding Rotational	51°, 35′, 41″	30°, 55′, 40″	Noorabad 8	simple	3,142	1,100	5	20	60
11	very poor	Soil and alluvium	Alluvium	1998	Sliding Rotational	51°, 38′, 38″	30°, 54′, 16″	Kahangan 1	simple	36,750	10,000	7	300	35
12	very poor	Soil	Pabedeh marl	1998	Sliding Rotational	51°, 38′, 56″	30°, 53′, 28″	Kahangan 2	simple	1,050	420	5	30	15
13	very poor	Soil	Alluvium	Old	Sliding Rotational	51°, 37′, 00″	30°, 53′, 55″	Nomad area	simple	7,000	2,800	5	50	60
14	very poor	Soil	Pabedeh marl	1992	Sliding Rotational	51°, 34′, 07″	30°, 54′, 05″	Bijan pass	simple	10,500	3,500	6	60	60

Table 8-7-2-4 Summary of Landslide Survey in Tang Sorkh

No	Erosion	Formation material	Type of formations	Date of movement	Type of Movement	Coodinate		Location	Type of Activity	The dimensions of landslide				
						Longitude	Latitude			Vol.(m^3)	Area (m^2)	Depth (m)	Width(m)	Length (m)
1	very intense	Soil	Pabedeh-Gurpi	1973	Rotational	51°, 46′, 00″	30°, 28′, 12″	Cheshmeh chenar 1	simple	84,000	14,000	12	200	80
2	intense	Soil	Pabedeh-Gurpi	1992	Rotational	51°, 44′, 32″	30°, 27′, 51″	Cheshmeh chenar 2	simple	675	900	2	10	10
3	intense	Soil	Pabedeh-Gurpi	1992	Rotational	51°, 44′, 30″	30°, 27′, 47″	Cheshmeh chenar 3	simple	25,000	5,000	10	60	100
4	intense	Soil	Pabedeh-Gurpi	1992	Rotational	51°, 44′, 42″	30°, 27′, 12″	Cheshmeh chenar 4	simple	68,250	10,500	13	120	100
5	low	Soil & stones	Razak	1973	Rotational	51°, 48′, 5″	30°, 28′, 10″	Yegaf Fild	simple	14,000	3,500	8	80	50
6	very intense	Soil	Pabedeh-Gurpi	1981	Ratational	51°, 46′, 40″	30°, 28′, 10″	Tange sorkh 1	simple	135,000	18,000	15	100	200
7	very intense	Soil & stones	Razak	1981	Rotational-collapsive	51°, 47′, 5″	30°, 28′, 18″	South of Tang sorkh village	simple	5,400	1,350	8	30	50
8	very intense	Soil	Razak	1981	Rotational	51°, 48′, 22″	30°, 27′, 18″	Tange sorkh 2	simple	4,950	1,100	9	25	50
9	very intense	Soil	Razak	1981	Rotational	51°, 48′, 28″	30°, 27′, 17″	North of Tang sorkh village	simple	6,075	1,350	9	30	50

Table 8-7-2-5 Summary of Landslide Survey in Zeras

No	Condition of weathering	Formation material	Type of formations	Date of movement		Coodinate		Location	County-village	The dimensions of landslide				
				First	last	Longitude	Latitude			Vol.(m^3)	Area (m^2)	Depth (m)	Width(m)	Length (m)
1	Surface	Marl	Aghajary	1997	Continued	50° - 19′ - 55″	31° - 35′ - 34″	Badeloon1-In 750 m distance to the village	Dehdez-Badeloon	12	22	1	8	3
2	Surface	Marl	Aghajary	1997	Continued	50° - 19′ - 50″	31° - 35′ - 34″	Badeloon2-In 850 m distance to the village	Dehdez-Badeloon	12	22	1	8	3
3	Surface	Marl	Aghajary	1997	Continued	50° - 19′ - 40″	31° - 35′ - 34″	Badeloon3-In 1000 m distance to the village	Dehdez-Badeloon	12	22	1	8	3
4	Surface	Marl	Aghajary	1997	Continued	50° - 18′ - 38″	31° - 35′ - 13″	Gerdledan 1- In 500 m distance with the village	Dehdez-	1,400	800	3	30	30
5	To the depth of 2 meters	Topsoil & Red marl	Topsoil & Aghajary	1996	Continued	50° - 18′ - 53″	31° - 35′ - 00″	Gerdledan 2- In 900 m distance below the road	Dehdez-Gerdledan	412,234	38,000	20	187	210
6	Surface	Marl	Aghajary	1997	Continued	50° - 17′ - 12″	31° - 36′ - 35″	Zeras 1- In 3000 m distance to the village	Dehdez-Zeras	104	90	2	10	10
7	2 meters depth	Marl	Aghajary	1996	Continued	50° - 16′ - 31″	31° - 35′ - 57″	Dehno 1- In 700 m distance to the village	Dehdez-Dehno	45,240	7,000	12	120	60
8	1 meters depth	Marl	Aghajary	1997	Continued	50° - 16′ - 41″	31° - 37′ - 06″	Zeras 2- In 500 m distance to the village	Dehdez-Zeras	3,140	1,100	5	40	30
9	Surface	Marl	Aghajary	1997	Continued	50° - 17′ - 59″	31° - 37′ - 06″	Zeras 3- In 4000 m distance to the village	Dehdez-Zeras	780	470	3	20	25
10	Surface	Marl	Aghajary	1997	Continued	50° - 17′ - 11″	31° - 37′ - 34″	Zeras 4- In 2000 m distance to the village	Dehdez-Zeras	3,270	1,700	4	30	60
11	Surface	Marl	Aghajary	1999	Continued	50° - 17′ - 27″	31° - 36′ - 44″	Zeras 5- In 2500 m distance to the village	Dehdez-Zeras	2,100	900	4	25	40
12	Surface	Marl	Aghajary	1997	2000	50° - 17′ - 23″	31° - 36′ - 48″	Zeras 6- In 2500 m distance to the village	Dehdez-Zeras	2,360	900	4	25	45
13	Surface	Marl	Aghajary	1997	Continued	50° - 18′ - 47″	31° - 37′ - 58″	Davoodiha - In 3500 m distance to the village	Dehdez-Davoodiha	9,160	2,300	5	50	70

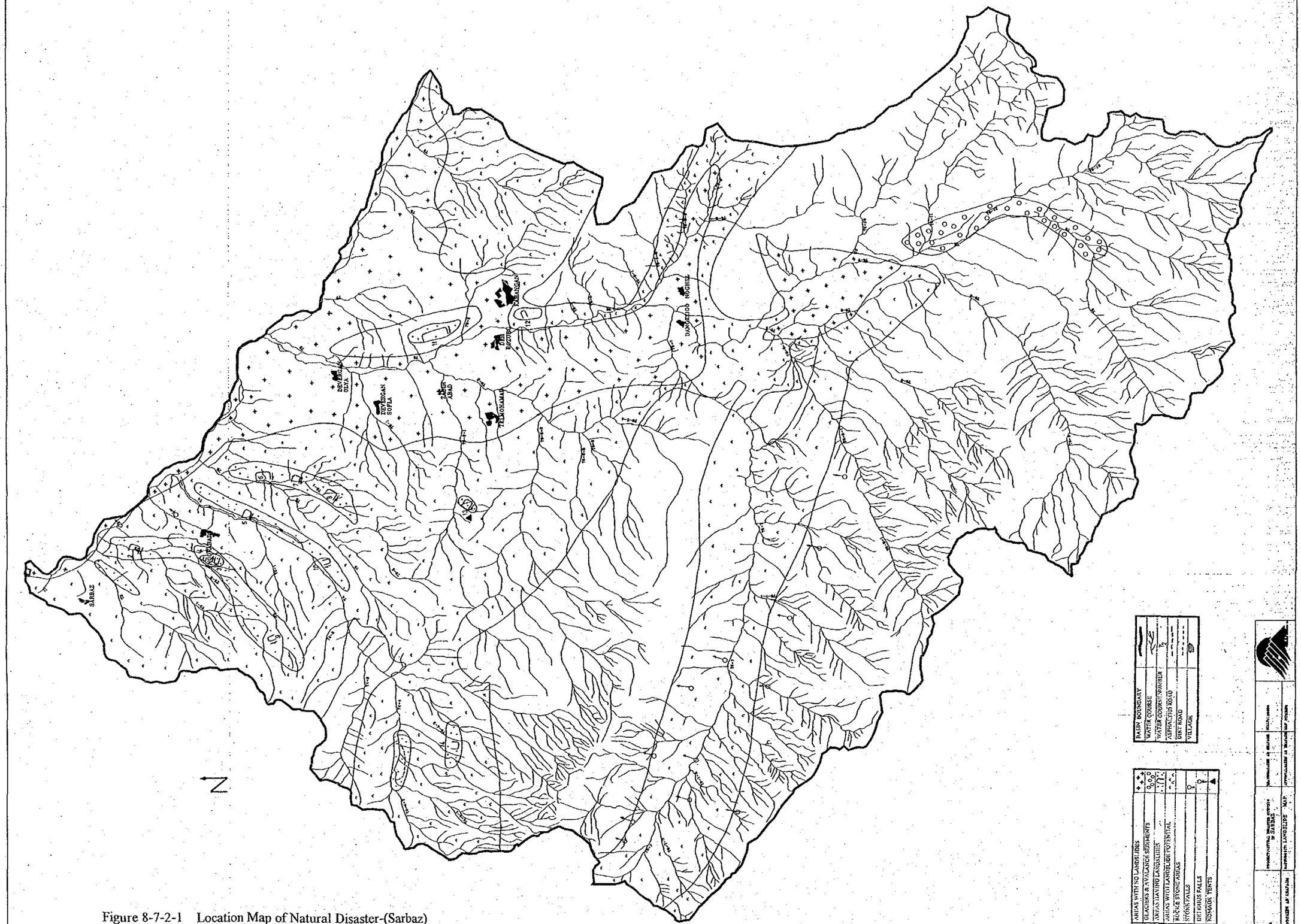

Figure 8-7-2-1 Location Map of Natural Disaster-(Sarbaz)

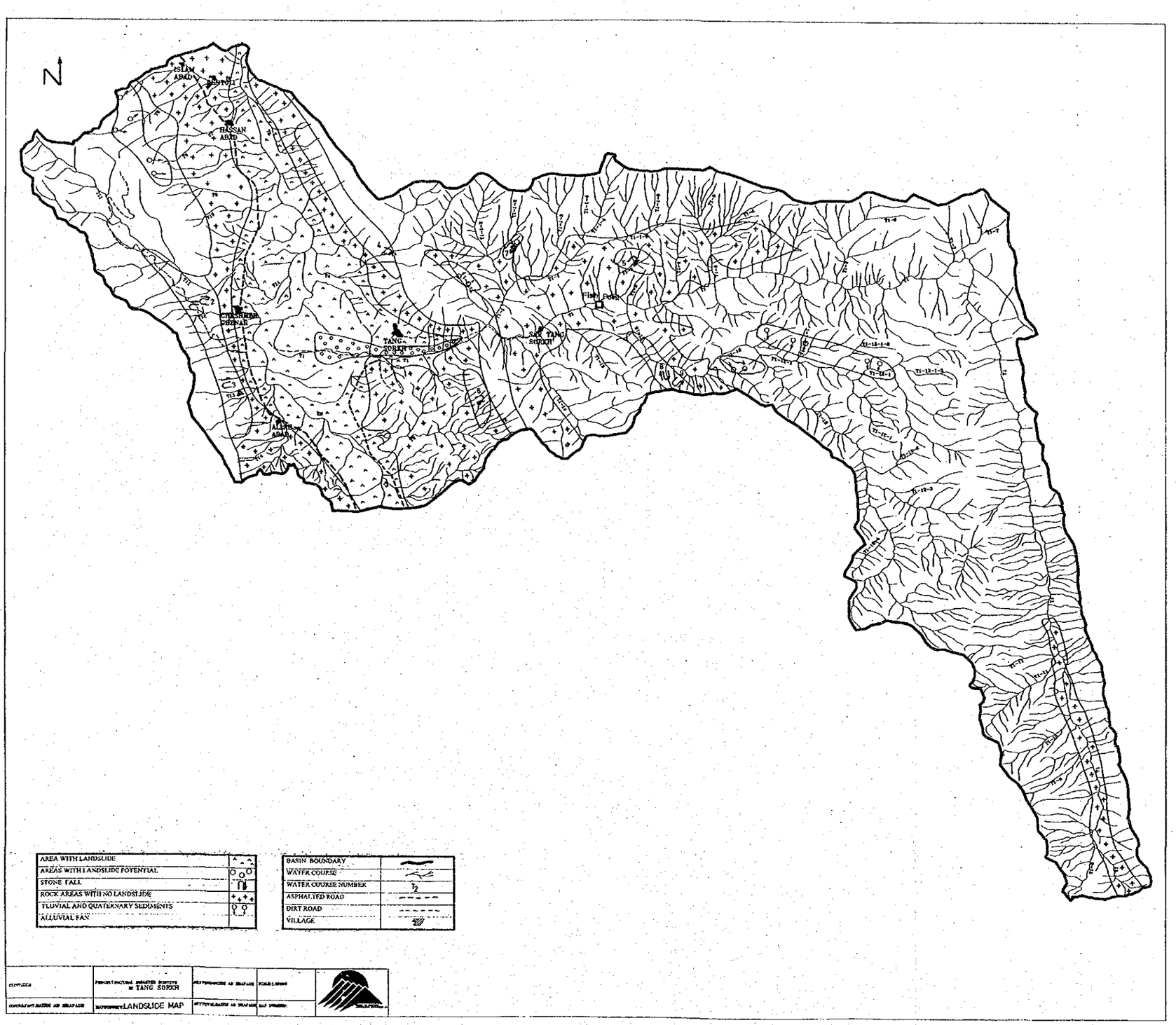

Figure 8-7-2-2 Location Map of Natural Disaster-(Tang Sorkh)

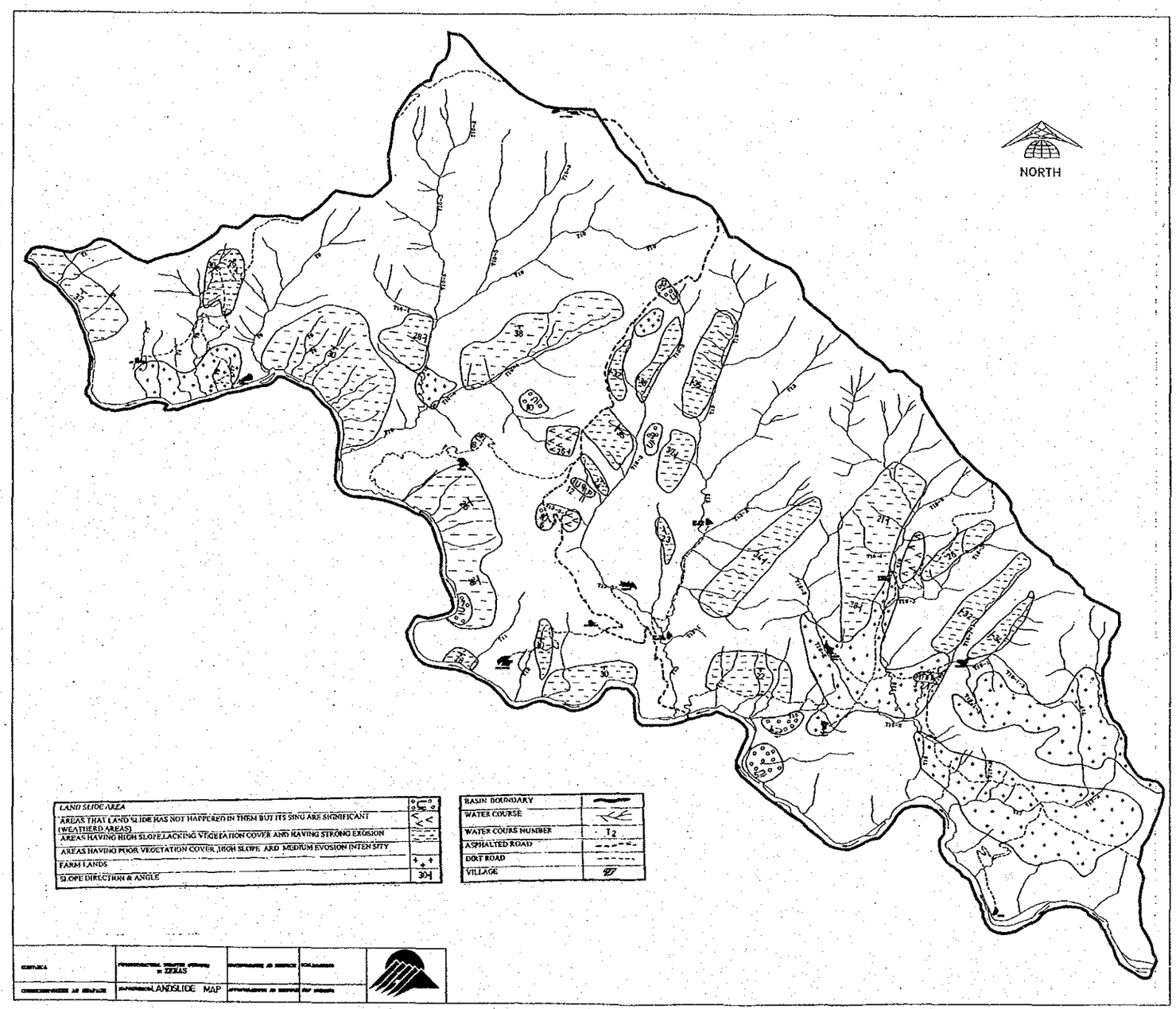

Figure 8-7-2-3 Location Map of Natural Disaster-(Zeras)