10.3.14 Increment of Household Income and Job Creation

Increasing household income and job opportunity is one of the most important matters in the villages in the Study Areas. Development plan will include the contents of increasing household income and job creation. These, in case of being fully developed, are shown as income generating activities below:

Table 10-3-14-1 Job Creation and Yearly Income Increment (with plan, fully developed)

Items	Job Creation (number)	Income Increment (Riel)	Increased income per household or person (Riel/H.H or person)
Fish culture (one place, 3 villages)	164 household	409,920,000	2,499,512 per h.h.
	5 operators	32,375,000	6,475,000 per p.
Diversification of Milk Cow			
Milk production (whole villages)	1,089 households	3,677,700,000	3,377,135 per h.h.
Milk processing center (5 villages)	627 households	561,350,000	895,295 per h.h.
	25 operators	161,875,000	6,475,000 per p.
Milk collection & distribution center (one village)	271 households	394,870,000	1,457,085 per h.h.
	7 operators	37,375,000	5,339,286 per p.
Handicraft facilities (4 places)	80 members	101,720,000	1,271,500 per p.
	80 weavers	96,000,000	1,200,000 per p.

Note: Details are referred to ANNEX L Economic and Financial Evaluation, Annual O/M Cost and Value of Output.

10.4 K7-0-19-1 Sarbaz

10.4.1 Construction of Check Dam

(1) Specific Sediment Discharge

In order to estimate sediment discharge of each check dams, the specific sediment discharge used for the planning of Beaedeh Dam at Sarbaz (400 $m^3/km^2/year$) is applied.

(2) North Basin

In North Basin, four medium and small tributaries flow into Marbor River. Among these tributaries, the one located in the utmost north near Sarbaz flows in the basin with gentle slope and a little erosion, whereas the basins of the other three are very devastated with severe erosion and landslides.

This area is categorized as surface erosion type and main check dams with Type C are allocated on these three tributaries in order to prevent vertical/horizontal erosion of the river course and the movement of unstable sediment left on the riverbed, stabilize the foot of slope, and protect farmland in the downstream.

a) *T1 Basin*

Seven main check dams on the main river course and three on the left tributaries are planned in the T1 Basin, which has the biggest catchment area in North Basin. Four check dams are located in the

landslide areas and serve to prevent further slide through prevention of movement of unstable sediment left on the riverbed, and stabilizing the riverbed and foot of slope.

b) T2 Basin

Four main check dams on the main river course and two on the tributaries are planned in the T2 basin, which is located southeast of T1 Basin. Two check dams are located in the landslide areas and serve to prevent further slide through prevention of movement of unstable sediment left on the riverbed, and stabilizing the riverbed and foot of slope.

c) T3 Basin

Three main check dams on the main river course and one on the tributary are planned in the T3 basin, which is located northwest of T1 Basin. Two check dams are located in the landslide areas and serve to prevent further slide through prevention of movement of unstable sediment left on the riverbed, and stabilizing the riverbed and foot of slope.

(3) South Basin

South Basin consists of Lee Sorkh River basin, which originates from Dena Mountains. The flood and debris flow damage in this basin occurs in the lower reaches of Lee Sorkh River, such as Kahangan, Deh Bozorg, Telmohamad, Zabih Abad, Devergan Sofla and Dorahan.

a) Left Bank-TM2

Four villages out of six are located on the left bank of Lee Sorkh River, the area of which borders North Basin and has landslide potential. Four main check dams with Type C and five check dams to be implemented by people's participation are planned in order to prevent the movement of unstable sediment left on the riverbed, and stabilize the riverbed and foot of slope.

b) Middle Reaches

The two basins of right and left tributaries (TM3 and TM4), which join Lee Sorkh River around Dangazloo, also have landslide potential on their upper reaches. Especially, erosion is more severe on the right tributary. Two main check dams with Type C are planned on each tributary in order to prevent the movement of unstable sediment left on the riverbed, and stabilize the riverbed and foot of slope.

In addition, six check dams to be implemented by people's participation are allocated on the right tributary.

c) Upper Reaches

Upper reaches of Lee Sorkh River, upstream of Dangazloo, there are no villages except Nomad camps. Because of high-rocky mountain area, devastation is very limited. However,

Four main check dams are planned mainly at just downstream of the confluences of tributaries in order to prevent the movement of unstable sediment left on the riverbed, stabilize the riverbed and foot of slope, and preserve downstream area. In addition, one check dam to be implemented by people's participation is allocated on one of the left tributaries.

d) Main River Course

On the upper reaches of Lee Sorkh River, the valley of the main river course 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 main river course, a small pond was formed at the time of the slide and remains stable since then. The size of this pond is 10 m in depth, 10 m width in average, and around 20 m in length. Stored water infiltrates through surrounding debris, and the pond has very limited catchment, therefore, there is no danger of collapse.

In the debris-filled valley, rather smaller materials had been washed down and only big ones had been left in the riverbed. Judging from the size of boulders, there is no possibility of sudden movement.

Two main check dams are planned in order to prevent the movement of unstable sediment left on the riverbed, stabilize the riverbed and foot of slope, and preserve downstream area. One is located just the downstream of the debris-filled valley, and another is on the upstream of Dangazloo. Type C and Type B is adopted respectively in consideration of the river condition.

(3) Outline of Check Dams

The total number of check dams by type is summarized as follows;

Main check dam (Type B)..... 1 No.
Main check dam (Type C)..... 33 Nos.
Check dam (Type D) ..... 12 Nos.

(4) Effect of Check Dams

The check dams planned here are mainly considering storing capacity for debris, securing farmland on the lower reaches, and preventing devastation in the northern basin, while preventing devastation and securing farmland are considered in the southern basin.

The total vacant volume (storing capacity for debris) of main check dams is around 136,500m^3, and that of 12-check dams by people's participation 36,000m^3 (3,000m^3 per each) and totally become 172,500

m^3. On the other hand, annual sediment discharge is estimated around 46,000 m^3. Thus, the total vacant volume is equivalent to about 4-years of sediment discharge (in northern basin: 7-years, and in southern basin 3-years).

10.4.2 River Treatment

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

Revetment and spur dikes are partially installed on some sections of the banks, downstream of Lee Sorkh River, however, these are not enough to cover most of the river banks. Thus, gabion type bank protection by people's participation is planned for 1.5 km upstream from Kahangan Bridge and 4 km downstream from the Bridge.

10.4.3 Landslide Protection

In North Basin, landslide occurs Sarbaz and the catchments of T1, T2 and T3 tributaries in and around Noorabad, while in South Basin it occurs on the small hills, each of which are located south and north of Kahangan, and on the catchment of one of left tributaries (TM2).

The countermeasures planned are the same as that of Bazoft. One landslide area is located on the small hill, north of Kahangan, and there is one dirt irrigation canal on the middle of the landslide slope. Lining of this canal is necessary in order to reduce the landslide movement.

The farmland and road sections to be protected with such countermeasures are estimated to be 58 ha and 1.1 km respectively.

10.4.4 Soil Erosion Protection

Present annual soil loss of Sarbaz is 14.6 t/ha (1.0 mm) in the sub-basin basis, that is the lowest among five Master Plan areas due to large extent of orchard as well as relatively low rainfall erodibility and gentle slope. The annual erosion rates of dry farmland and rangeland are 32.8 t/ha and 26.8 t/ha that are equivalent to 2.2 and 1.8 times of the basin-wise soil loss. From the viewpoint of occupation of area, erosion of rangeland is dominant in the area. The annual erosion rate will be improved to 6.8 t/ha (0.5 mm) in future by soil erosion protection.

(1) Plan of Surface Erosion Protection for Farmland

Due to large extent of orchard, soils are enough protected already so that no measures are necessary

for soil protection except dry farmland. Erosion of dry farmland is exceeding the allowable level due to high ratio of fallow land. The fallow land occupies 80% of farmland. Based on the Agricultural Plan Scenario-1, 20 m interval contour bund has been proposed in the dry farmland over 13% inclination. However, it is difficult to keep erosion within the allowable level due to high ratio of fallow land. Consequently, it is proposed to convert fallow land of 15 ha to dry type alfalfa in Scenario-2. Annual erosion rate of dry farmland of 162 ha is reduced from 41.1 t/ha (2.94 mm) to 14.8 t/ha (1.06 mm). The effects of contour bund provision are summarized as follow.

Table 10-4-4-1 Surface Erosion Protection for Dry Farmland in Sarbaz

Area (ha)	Type of Farmland	Slope	Facility	Alfalfa Introduction	Soil Loss	
					Present	Senario-2
162	Dry farmland	13%-30%	Contour Bund (20 m interval)	15ha	41.1 t/ha/yr 2.94 mm/yr	14.8 t/ha/yr 1.06 mm/yr

(2) Erosion Improvement in Rangeland

Rangeland improvement is carried out for 1,641 ha by protection and for 3,695 ha by seeding, totally for 5,336 ha. Annual erosion rate of rangeland will be improved from 26.8 t/ha (1.91 mm) to 5.6 t/ha (0.4 mm), that is enough lower than the allowable rate of 15 t/ha. There is no severe problem in the rangelands both for protection and seeding.

(3) Gully Protection

There are no severe gullies in this area, so that no plans are established.

10.4.5 Rangeland Vegetation Improvement

Improvement of rangeland vegetation is carried out in order to mitigate over grazing and to protect soil from erosion. Total rangeland area is 5,392 ha, of which 1,080 ha are under care of Department of Environment for improvement. 56.5 ha will be converted to orchard by a separate plan. The remaining 4,256 ha are improved by this plan. Of this 2,528 ha are used as seed production (4 ha) and vegetation improvement plots (2,524 ha). Each year 252 ha (2,524 ha/10 years) is protected and sown by grass seeds. Upon establishment of a new plot, the old plot is opened to herds. However seed-sowing area is 252 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the work is done in few scattered smaller pieces, sum being 252 ha. 4 watering points for livestock are established in the area. Other 1,728 ha with slope more than 40% is improved through protection and rotational use. Each year 173 ha (1,728 ha/10 years) is protected to enhance the natural recovery of vegetation. When protection of a new plot begins, the old plot is opened to herds. However protected area is 173 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the practice is performed in few scattered smaller pieces, sum being 173 ha.

10.4.6 Increased of Irrigated Agriculture

(1) Irrigation Scheme

It is possible to reduce conveyance loss up to 20 % and surplus water is estimated at 26.7 % of present discharge by canal lining. Dangazloo-Kahangan, Kahanghan-Devergan, Dangazloo and Noorabad-Sarbaz canal are proposed to be rehabilitated with concrete lining. After rehabilitation of these canals, surplus water is estimated as follows.

Table 10-4-6-1 Surplus Water and Irrigation Water Demand of Major Crops

Canal	Production of Surplus Water (liters/s)	Water Demand (liters/s/ha)		
		Alfalfa	Vegetable	Apple
Dangazloo-Kahangan canal	94	1.68	1.93	1.77
Kahanghan-Devergan canal	20			
Dangazloo canal	30			
Noorabad-Sarbaz canal	100			

Source) JICA Study Team and Revised Data of MOA

Improvements of irrigation scheme are summarized as follows. These facilities will be maintained by PIC. By these projects, expansion of irrigated farmland and/or increase of cropping intensity will be expected.

- Improvement of Dangazloo-Kahangan canal (B 0.85 m x H 0.50 m) 3.0 km
- Improvement of Kahangan-Devergan Olya canal (B 0.30 m x H 0.25 m) 1.9 km
- Improvement of Dangazloo canal (B 0.50 m x H 0.35 m) 2.3 km
- Improvement of Noorabad-Sarbaz canal (B 0.50 m x H 0.35 m) 11.0 km

(2) Agricultural Scheme

1) Potential of Development

In Sarbaz, almost all farmland are irrigable. Farmland is located in narrow fan and low hills. According to the land use at present, total farmland is 2,249 ha including orchard land, dry farmland and fallow land, and almost all farmland is irrigated, canals have been constructed. Apple is fully planted in irrigated farmland. It is said that irrigated agriculture has already been developed in the Area and some irrigation canals are constructed of earth. In such conditions, when the canals are rehabilitated, it is possible to obtain more water for irrigation and more agricultural production.

2) Development Plan

According to the above irrigation scheme plan, after rehabilitated the canals of Dangazloo-Kahanghan, and Dangazloo, production area increment will be reached 73.81 ha for alfalfa, (or 70.06 ha for apple or 64.25 ha for vegetable). These canal are supplying water to apple trees areas at present. Apple and alfalfa are planted in these irrigation areas, but as irrigation water is limited, alternate irrigation is applied or limitation of irrigation water occurs in summer season. Considering the marketing

conditions of apple products, village progress situations and feed shortage for livestock, it is recommendable to select alfalfa planting in apple trees areas.

And, Kahanghan-Devergan canal rehabilitaion could be supplied water for 11.30 ha for apple (or 11.90 ha for alfalfa or 10.36 ha for vegetable) in present dry farmland.

On the other hand, rehabilitation of Noorabad-Srabaz canal could be supplied water to newly developed area from village rangeland. Considering the intentions of farmers and marketing conditions of products, it is recommendable to select apple for 56.50 ha.

Moreover, by the conservation plan, when it is implemented, crops areas could be slightly expanded.

According to the cropping pattern, in irrigation farmland, some legume and vegetables could be planted after wheat harvested. It would be possible to expand more intensity in whole irrigated farmland considering the limitation of irrigation water and development of cropping pattern such as wheat in winter season + legume (+ vegetable) in summer season or apple + alfalfa (+ vegetable or + legume) planting. Alfalfa could be planted in same apple orchard, affected little the production yield of alfalfa.

Ministry of Jihad-Agriculture and related institutes should develop the cropping pattern for intensive agriculture, selection of seed variety, planting technology such as fertilizer application, improved pest management as well as conduct the application examination in the selected area before dissemination of the said cropping pattern and promote the mechanization of agriculture with the provision of low interest loan to the farmers.

10.4.7 Collecting and Grading Center of Apple

For apple collecting and grading center, it is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. The promotion of these development plans should be required the further feasibility study and detailed design study.

(1) Establishment of apple collecting & grading center (short-term)

1) Purpose:
   To emphasize villagers and promote apple sale by means of establishment of collection, grading, packing and distribution facilities.
2) Participants:
   - A group should be established, whose members grow apple and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

3) Establishment of apple collecting and grading facilities (short-term)

(a) Size of group: It will be set that one unit is 100 households in village. A group should be established one in each village. Members should have the intention to development. As the apple land area is approximately 3ha on the average, while yield will be 40t/ha, production will be 12,000t/year. Size of facilities should be designed 2,400 t/year, one-fifth of total production for the first stage.

(b) Proposed villages: Deh Bozorg, Kahangan and Telmohamd; 3 places

(c) Required equipment, materials and facilities: Building, water tank, drying table, conveyer, etc.

10.4.8 Diversification to Milk Cow

(1) Potential of Development

In Sarbaz, over grazing rate is of 10.5. Development potential is very low, even the feed would be obtained by purchasing.

(2) Development Plan of Diversification

However, it is possible to change to milk cow in future for one of the methods of reducing sheep and goats number. It will stabilize introduction of milk cow and milk processing industry, and make people to reduce number of sheep and goats for mitigating over grazing by means of adding values to products. According to the Livestock Office of Provincial Jihad, they promote to diversify into milk cow, varieties of which are Holstein and Semi-local.

In case of diversifying Local variety to Semi-local variety, milk production would be increased 8-11 litre/day and its duration is enlarged 40 days. Total milk production is increased 2,160-3,170 litre/year or average 2,665 litre/year or 266,500 litre/year per 100 heads. When all cows at present are diversified to milk cow, number of which will be reached 1,219 heads in the Sarbaz Study Area.

This diversification plan should be promoted step by step with the help of Livestock Office, taking into consideration progress of artificial insemination, disease control, registering method, inspection method for milk cow as well as pasteurization, sterilization, disease control, inspection method for raw milk.

(3) Marketing Plan of Milk

Marketing plan should be conducted during the half time of diversification progressed or after diversified. For marketing of milk, it is necessary to apply the participatory approach, establishment of groups & cooperatives and proper training & education by the government for promoting these development plans. The promotion of these development plans should be required the further

feasibility study and detailed design study. Plans are as follows:

1) Establishment of groups and cooperatives for milk processing center: medium-, long-term
2) Collection & distribution center for milk: long-term

1) Establishment of groups and cooperatives for milk processing center (medium-term)

a) Purpose:

To change to cow-grazing and to promote the sale of milk-processed products.

b) Participants:

A group should be established, whose members should grow cows and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as Iran's administration.

c) Structural Measures:

- Size of facilities: To establish the collection and distribution facilities for processed milk products. Approx. 1.0 t/day.
- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- Proposed villages: Deh Bozorg, Kahangan, Sarbaz and Telmohamad; 4 places
- Required equipment, materials and facilities: Building, vehicle, mixing machine, etc.

2) Collection & distribution center for milk (long-term)

a) Purpose:

To promote sale of milk products.

b) Participants:

Participants will be villagers who graze cow or have intentions to produce milk products.

c) Structural Measures:

- Size of facilities: To establish the collection and distribution facilities for condensed milk. Approx. 5t/day.
- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- Proposed villages: Sarbaz; 1 place
- Required equipment, materials and facilities: Building, vehicle, bulk cooler, etc.

10.4.9 Rural Water Supply Improvement

Domestic water demand per capita is applied to be 180 liter/day/person also according to the suggestion by SED. Expansion of rural water supply in each village is proposed on the basis of

estimated population in 2020. Surplus water demand by 2020 is 2,637 m^3/day. It is planned to expand distribution tanks and connection pipeline for surplus water supply. Here, capacity of distribution tank is designed to be the volume of supply for 12 hours and 30 % spare.

Dimensions of distribution tanks and pipeline are summarized as follows. RWWC will operate and maintain facilities and collect water charges in cooperation with PIC. In addition, PIC will enhance villagers to recognize water charge system and desirable water use for 5 years after completion of construction. By these projects, necessary and clean water will be provided to villagers.

Table 10-4-9-1 Proposed Plan for Water Supply

Village	Distribution Tank	Pipeline
Deh Bozorg	B 7.3 m x L 7.3 m x H 3.0 m	PVC pipe ϕ 75, L=1,300 m
Dangazloo	B 6.9 m x L 6.9 m x H 3.0 m	PVC pipe ϕ 75, L=1,200 m
Dorahan	B 6.4 m x L 6.4 m x H 3.0 m	PVC pipe ϕ 75, L=1,000 m
Devergan Olya	B 4.0 m x L 4.0 m x H 3.0 m	PVC pipe ϕ 50, L=300 m
Develgan Sofla	B 4.3 m x L 4.3 m x H 3.0 m	PVC pipe ϕ 50, L=400 m
Kahangan	B 14.5 m x L 14.5 m x H 3.0 m	PVC pipe ϕ 140, L=5,700 m
Noghel	B 6.4 m x L 6.4 m x H 3.0 m	PVC pipe ϕ 75, L=1,000 m
Noorabad	B 8.5 m x L 8.5 m x H 3.0 m	PVC pipe ϕ 90, L=1,800 m
Sarbaz	B 9.5 m x L 9.5 m x H 3.0 m	PVC pipe ϕ 90, L=2,300 m
Telmohamad	B 8.1 m x L 8.1 m x H 3.0 m	PVC pipe ϕ 75, L=1,700 m
Zabih Abad	B 1.7 m x L 1.7 m x H 3.0 m	PVC pipe ϕ 50, L=50 m

10.4.10 Rural Road Improvement

It is proposed to improve the road with asphalt pavement from Sarbaz to Dangazloo via Noolabad. Widths of road and pavement are designed to be 4 m and 3 m respectively. After improvement, asphalt and gravel paved road should be maintained by government. In addition, it is planned to transfer technology of road maintenance of road and side drain. Then, PIC should prepare training program. Project components are summarized as follows. By these projects, accessibility to the market will be improved.

- Improvement of road from Sarbaz to Dangazloo via Noolabad 20 km
- Transfer of technology for maintenance of road and side ditch 5 years
- Construction and maintenance of farm road by farmers 300 km

10.4.11 Establishment of Cooperative

For establishment of cooperatives, it is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. Development plans are as follows:

(1) Establishment of groups and cooperatives for handicraft:

short-term

(2) Establishment of multi-purpose training center:

short-term

(3) Training and education plan by government:

short-, medium-term

(4) Others (for formerly mentioned plans; establishment of apple collecting & grading center, establishment of groups and cooperatives for milk processing center and collection & distribution center for milk)

(1) Establishment of groups and cooperatives for handicraft (short-term)

1) Purpose:

To emphasize villagers and promote the sale of produces and processed products made of and from raw materials grown in this area.

2) Participants:

A group should be established, whose members should grow the raw materials and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

3) Structural measures:

(a) Size of group: It will be set that one unit is 100 households in village. Size of group is of 20 members within the said village.

(b) Proposed villages: Sarbaz; 1 place

(c) Required equipment, materials and facilities (In case of production of gilim and carpet): Building, weaving machine, etc.

However, in case of establishing multi-purpose training facilities, it should be used the said facilities for it.

(2) Establishment of multi-purpose training center (short-term)

1) Purpose:

To promote villagers, groups members for production and sales by area's processing and handicraft activities as well as to train and educate them for area's development.

2) Size of facilities:

Participants would be group members, cooperative members and villagers. If all villagers will happen to attend the meetings, a school or other larger place would be selected as venue. The standard size of multi-purpose training facilities should be for 50 persons. Facilities include building and play-yard.

3) Structural measures:

Size of facilities: Based on one village 100 households, required multi-purpose facilities to be constructed will be as large for 50 persons. Approx. 50m2.

(a) Form of building: It should be constructed using the suitable materials for this area and

environment and taking into consideration the participatory scheme. Basically, main building material is brick.

(b) Proposed villages: Deh Bozorg, Dangazloo, Dorahan, Kahangan, Noorabad, Sarbaz, and Temohamad; 7 places

(c) Required equipment, materials and facilities: Building, etc.

(3) *Training and education plan by government (short-, medium-term)*

1) Purpose:

To instruct, train, educate and transfer the technology to group and cooperative members and villagers for development of areas.

2) Extension service organization:

To improve the organization so as to be able to instruct, train, educate and transfer the technology to group and cooperative members and villagers.

3) Structural measures: None.

Each plan is basically independent. However, there would be rooms for reciprocal affection or common usage. Development plan should be implemented step by step. Suitable development could be led by conducting the monitoring, evaluation and feed back step by step taking into consideration the levels and situations of around development.

10.4.12 Community Enhancement

(1) Purpose

a) To promote villager's participation in the projects implementation,

b) To build up villager's mind for mutual aid, and capability against natural disasters,

c) To strengthen villager's living environment.

(2) Organizing Villagers

To realize above purposes, village organization is planned to establish. Relevant government organizations, both in central and local levels, have to facilitate the establishment of the village organization, in cooperation with Village Islamic Councils. All villagers are naturally member of the village organization. But, the member of the organization should be formed case by case, based on the purpose of the project. Such type of project as profitable and, therefore, villager have to bear a part of project cost, should be organized by those villagers who have a willingness to the development. Followings are procedure for establishment of village organization.

a) Relevant government organization, both in central and local government, establish committee for M/P project which promote implementation of proposed projects and facilitate the establishment of

village organization.

b) The government committee holds meeting with representatives of Village Islamic Councils to explain the project purpose, project components, implementation method, etc.

c) Representatives of Village Islamic Council hold small meeting at each villages to explain outline of the project.

d) The government committee facilitates to establish villager's organization based on the villager's willingness to participation in the project.

e) The village organization discusses and establishes organizational structure, rules and regulations of operation, detail plan for participation in the project, etc., under the support by the government committee and Village Islamic Councils.

Followings are remarks of establishment of village organization

- Project Coordination Committee should facilitate establishment of the village organization in cooperation with Village Islamic Council. The council is helpful to promote villager's participation, and to establish rules and regulations of the organization, and to arbitrate villager's conflict if it happens,
- Participatory approach should be taken into consideration at the beginning of the establishment. It is recommended to hold workshop to pull out villager's frank opinion when plan of operation and monitoring are formulated by villagers themselves,
- At the time of establishment of rules and regulation, including account system, general meeting should be held with all members' participation. It is quite important that all villagers participate in the decision making of important issue. Such issue as member's rights, duties, and penal regulation are also the matter of general meeting,
- All villagers in the organization, including member of Village Islamic Council, should have a vote as an individual right of members. It is important that all members have equal right to participate in their decision-making.

(3) Activities

Activities of village organization should be planned and implemented through discussion among members in the organization. Followings are basic activities to attain the purpose of community enhancement.

a) Participation in implementation, operation and maintenance of the projects in cooperation with local and/or central government.

b) Participation in monitoring and evaluation of the projects in corporation with relevant government officers,

c) Participation in enlightenment activities against disasters such as landslide, and soil erosion. Enlightenment activities will be carried out at least once after flood season.

d) Promotion of health services and nutritional education, environmental education such as fuel

consumption.

e) Meeting with other village organizations and relevant government organization to exchange information and experience which obtain through the projects.

Community enhancement will be promoted step by step in the process of project implementation. Relevant government organization, especially in the provincial levers, should assist and facilitate the enhancement of the village organization. There are tree steps in the process of the project implementation to enhance function of the village organization.

First step is at the beginning of the project implementation, and the village organization will be established based on the villager's willingness to participation in the projects. All members belong to the village organization will participate in the decision making process of their organization, and participate in the activities of the organization. Through these activities, a sense of participation will be formulated.

At the time of commencement of the project, plan of operations and detail activities of the villager are already designed by the government. The village organization, therefore, just receive the planned project. It should be noted that some of the members of village organization is dubious about for the result and effect of the project. The government officers have to make close communication with the village organization and build up intimate relations with them.

Second step is at the time of monitoring of the project. In the monitoring activities, villagers grasp the problem faced in the project implementation, and discuss how overcome the problems. The results of the monitoring are put into next activities. The village organization reviews their activities and improves their original plan by themselves. Through these activities, villagers can formulate and enhance a sense of ownership for the development projects.

Third step is at the time of completion of the project. At this time, government organization will hold the workshop for project evaluation under participation by village organization. The result of the project evaluation will be put into the next project activities. The village organization will choice next activity among the master plan projects, or will make new project plan based on their willingness to development. The government organization for project implementation have to support and facilitate villager' selection of next activities.

10.4.13 Increment of Household Income and Job Creation

Increasing household income and job opportunity is one of the most important matters in the villages in the Study Areas. Development plan will include the contents of increasing household income and

job creation. These, in case of being fully developed, are shown as income generating activities below:

Table 10-4-13-1 Job Creation and Yearly Income Increment (with plan, fully developed)

Items	Job Creation (number)	Income Increment (Riel)	Increased income per household or person (Riel/H.H or person)
Apple collecting & grading center (3 places)	300 households	2,626,590,000	87,553,000 per h.h.
	102 workers	255,000,000	2,500,000 per p.
Diversification of Milk Cow			
Milk production (whole villages)	1,705 households	3,248,635,000	1,905,358 per h.h.
Milk processing center (4 villages)	1,338 households	449,080,000	335,635 per h.h.
	20 operators	129,500,000	6,475,000 per p.
Milk collection & distribution center (one village)	300 households	394,870,000	1,316,233 per h.h.
	7 operators	37,375,000	5,339,286 per p.
Handicraft facilities (one place)	20 members	25,430,000	1,271,500 per p.
	20 weavers	24,000,000	1,200,000 per p.

Note: Details are referred to ANNEX L Economic and Financial Evaluation, Annual O/M Cost and Value of Output.

10.5 K7-48 Tang Sorkh

10.5.1 Construction of Check Dam

(1) Specific Sediment Discharge

Based on the topography, geological condition and riverbed condition, the specific sediment discharge for the right tributary of Tang Sorkh River and T3, T5 and T6 tributaries, where sediment production is larger than that of the other tributary, is applied 350 $m^3/km^2/year$, while the rest of the tributary is adopted 100 $m^3/km^2/year$.

(2) Tang Sorkh River Basin

a) Right Tributary

The right tributary of Tang Sorkh River is severely devastated and feed a lot of debris to the main river. Five main check dams with Type C and two check dams to be implemented by people's participation are planned in order to prevent the movement of unstable sediment, and stabilize the riverbed and foot of slope.

b) Main River Course

Sar Tang Sorkh located on the right bank of Tang Sorkh River has flood, but the damage is very limited. In addition, sediment in the riverbed is very little. Thus, two check dams to be implemented by people's participation are planned on the tributaries from the stone fall area.

On the left bank, three major tributaries join the main river course near Sar Tang Sorkh and fishpond. One main check dam is allocated on each tributary in order to prevent the movement of unstable sediment, and stabilize the riverbed and foot of slope.

A narrow gorge is formed at the confluence with the left tributary. Another main check dam with Type

B is located here in order to protect farmland in the lower reaches and stabilize the water for existing irrigation system on both banks through intake facility attached to the dam. This dam should be implemented after the completion of the check dams on the right tributary.

(3) Right Bank of Boshar River

a) North Basin

A few tributaries flow into Boshar River on its right bank, north of Tang Sorkh River. One main check dam with Type C and one check dams to be implemented by people's participation are planned in order to prevent the movement of unstable sediment, and stabilize the riverbed and foot of slope.

b) South Basin

South of Tang Sorkh River, a few tributaries also flow into Boshar River on its right bank. Erosion is very severe in the area and seven main check dam with Type C are planned on this basin in order to prevent movement of unstable sediment, and stabilize the riverbed and foot of slope, and protect further erosion and farmland in the lower reaches.

(4) Left Bank of Boshar River

Several tributaries join into Boshar River from the left bank. Two of them, which flow through Allah Abad and Cheshmeh Chenar, cause damage on these villages by flood and debris flow. One main check dam with Type C is planned on each tributary in order to prevent the movement of unstable sediment, and stabilize the riverbed and foot of slope.

One tributary located north of Cheshmeh Chenar has the largest catchment among the tributaries on the left bank and farmland in the lower reaches near Boshar River. The catchment area of this tributary is rocky and less devastated. Thus, one main check dam with Type C is allocated on this tributary in order to prevent the movement of unstable sediment and protect farmland in the lower reaches.

In addition, one check dam to be implemented by people's participation is planned in order to prevent further erosion.

(5) Outline of Check Dams

The total number of check dams by type is summarized as follows;

Main check dam (Type B)..... 1 No.
Main check dam (Type C).....19 Nos.
Check dam (Type D) .....6 Nos.

(6) Effect of Check Dams

The check dams planned here are mainly considering storing capacity for debris, securing farmland on

the lower reaches, and preventing devastation of the basin. The total vacant volume (storing capacity for debris) of main check dams is around 55,700m³, and that of 6-check dams by people's participation 18,000m³ (3,000m³ per each) and totally become 73,700m³. On the other hand, annual sediment discharge is estimated around 6,300 m³. Thus, the total vacant volume is equivalent to about 12-years of sediment discharge.

10.5.2 Soil Erosion Protection

Present annual erosion rate of this sub-basin is 29 t/ha (2.1 mm/yr), that is the highest following Zeras. The annual erosion rates of dry farmland and rangeland are 18.1 t/ha and 48 t/ha respectively. The rate of rangeland is 1.7 times of it of the basin-wise so that the erosion of rangeland is dominant in this sub-basin. The basin-wise erosion will be improved to 16 t/ha/yr (1.1 mm/yr) in future.

(1) Plan of Surface Erosion Protection for Farmland

Present annual erosion rate of the irrigated farmland is 1.6 t/ha (0.11 mm) ,that is enough lower than the allowable level of 15 t/ha. On the other hand, erosion rate of dry farmland of 20-30% inclination is extremely high at 41 t/ha (3.0 mm), that is largely exceeding the allowable level. Since this dry farmland locates at the foot of mountain slope in the right bank of Boshar river, where the high erosive soil (Soil series 2.3) is covering the land, as will as high rainfall erodibility, heavy erosion is caused.

In this dry farmland, annual erosion rate can be reduced from 41.4 t/ha (2.96 mm) to 15.5 t/ha (1.11 mm), almost close to the allowable level, by provision of 20 m interval contour bund as below:

Table 10-5-2-1 Surface Erosion Protection for Dry Farmland in Tang Sorkh

Area (ha)	Type of Farmland	Slope	Facility	Alfalfa Introduction	Soil Loss	
					Present	Scenario-2
44	Dry farmland	20%-30%	Contour Bund (20 m interval)	none	41.4 t/ha/yr	15.5 t/ha/yr
					2.96 mm/yr	1.11 mm/yr

(2) Erosion Improvement in Rangeland

Rangeland improvement is carried out for 2,262 ha by protection and for 856 ha by seeding, totally for 3,118 ha. The annual erosion rate of rangeland will be reduced from 48.4 t/ha (3.46 mm) to 24.7 t/ha (1.76 mm) by protection and seeding. In the rangelands with seeding, erosion rate decreases to 9.8 t/ha (0.70 mm) enough lower than the allowable level. On the other hand, erosion rate of rangelands by protection decreases only to 26.9 t/ha (1.92 mm), that is still higher than the allowable level. It is due to the high erosion rate of AG-1 vegetation zone even after protection because of severe deterioration of this rangeland. Other than AG-1, it is possible to reduce erosion rate lower than the allowable level.

(3) Improvement of Waste Land

The erosive marl hills defined as the wasteland (AR) are locating at both banks of the Boshar river.

Present annual erosion rate of the wasteland is estimated at 40 t/ha (2.86 mm). The marl hills can be developed by fruit tree plantation with drip irrigation, because the hills are relatively gentle in slope and close to the Boshar river that can be water source for the hills. There is a plan to develop those hills by MOJA in future. When it is developed by fruit tree plantation, annual erosion rate will be reduced to 7.7 t/ha (0.55 mm).

(4) Gully Protection

In this area, there is no severe gully erosion, so that no plans are made for gully protection.

10.5.3 Rangeland Vegetation Improvement

Improvement of rangeland vegetation is carried out in order to mitigate over grazing and to protect soil from erosion. The rangeland with a total area of 3,118 ha, possesses many oak trees. 600 ha of this, and 160 ha of a degraded rangeland (600 +160), having slope less than 40% are improved through seed sowing works. Of this 4 ha for seed production, and 756 ha for vegetation improvement plots of 76 ha each (756 ha/10 years). However seed-sowing area is 76 ha, whenever rangeland utilization norm (communal/villages uses) does not permits, the work is done in few scattered smaller pieces, sum being 76 ha. 2 water points for livestock are established in the area. The remaining part with slope more than 40% is improved by protection and rotational use. Size of each plot is 252 ha (2,518 ha/10 years) and protected for one year. When protection of a new plot begins, the old plot is opened to herds. However protected area is 252 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the practice is performed in few scattered smaller pieces, sum being 252 ha.

10.5.4 Forestland Vegetation Recovery

There is a piece of land of 25 ha having oak and wild almond trees, with good potential for improvement. In a year, 2.5 ha each (25 ha/10 years) of this area is sown by almond seeds, to establish about 400 plant/ha. The established plots are protected and regularly cared for economical and environmental conservation benefits.

10.5.5 Increased of Irrigated Agriculture

(1) Irrigation Scheme

It is possible to reduce conveyance loss up to 20 % and surplus water is estimated at 26.7 % of present discharge by canal lining. In the area, check dam is planned at conjunction of Tangsork River and its tributary near Tang Sorkh village. Then it is expected that steady intake of water will be actualized. And also lower streams of canals at this check dam are lined with concrete. Then, surplus water by

this integration of intakes is estimated as follows and rehabilitation of canal is not planned.

Table 10-5-5-1 Surplus Water and Irrigation Water Demand of Major Crops

Canal	Production of Surplus Water (liters/s)	Water Demand (liters/s/ha)		
		Alfalfa	Vegetable	Apple
Tang Sorkh left bank canal	32	1.56	1.88	1.64
Tang Sorkh right bank canal	87			

Source) JICA Study Team and Revised Data of MOA

(2) Agricultural Scheme

1) Potential of Development

In Tang Sorkh, approximately half of farmland is irrigable. Farmland is located in narrow fan and low hills. According to the present land use, total farmland is 724 ha including orchard land and almost irrigable area is irrigated, canals have been constructed. In irrigated crop farmland, wheat, barley, alfalfa, legume are planted. It is said that irrigated agriculture has already been developed and some irrigation canals are constructed of earth. In such condition, when the canals are rehabilitated, it is possible to obtain more water for irrigation and more agricultural production. Moreover, diversification to vegetable to be supplied to cities will be possible.

2) Development Plan

According to the above irrigation scheme plan, after rehabilitated the canal of Tang Sorkh, production area increment will be reached 76.28 ha for alfalfa, (or 63.30 ha for vegetable or 72.56 ha for apple). At present, wheat is planted in these irrigation areas, but as irrigation water is limited, dry farmland is there. Considering the feed shortage of livestock in these areas, it is recommendable to increase livestock feed such as alfalfa.

Moreover, by the conservation plan, when it is implemented, crops areas could be slightly expanded.

According to the cropping pattern, in irrigation farmland, some legume and vegetables could be planted after wheat harvested. After created the farm practice and cropping pattern, it would be possible to expand more than intensity in whole irrigated farmland considering the limitation of irrigation water; development of cropping pattern such as wheat in winter season + legume (+ vegetable) in summer season or apple + alfalfa (+ vegetable or + legume) planting. Moreover, Alfalfa could be planted in same apple orchard, affected little the production yield of alfalfa.

Ministry of Jihad-Agriculture and related institutes should develop the cropping pattern for intensive agriculture, selection of seed variety, planting technology such as fertilizer application, improved pest management as well as conduct the application examination in the selected area before dissemination of the said cropping pattern and promote the mechanization of agriculture with the provision of low interest loan to the farmers.

10.5.6 Collecting and Grading Center of Vegetable and Apple

For collecting and grading center of vegetable and apple, it is necessary to apply the participatory approach, establishment of groups & cooperatives and proper training & education by the government for promoting these development plans. The promotion of these development plans should be required the further feasibility study and detailed design study.

(1) Establishment of horticultural crops collecting and grading center: short-, medium-term
(2) Establishment of apple collecting and grading center: medium-, long-term

(1) Establishment of horticultural crops collecting and grading center (short-term)

1) Purpose:

To emphasize villagers and promote the cooperate sale of horticultural crops by means of conducting the collection, grading, packing and distribution.

2) Participants:

A group should be established, whose members should grow horticultural crops and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

3) Structural Measures:

(a) Size of group: It will be set that one unit is 100 households in village. A group should be established one in each village. Members should have the intention to development. When group's member would be 20, using approx. 0.25ha of each land, while yield is 20t/ha, total production would be 100t/season or approx 3 t/day. Crops with higher demands should be selected. 3-5 kinds of crops should be chosen for first stage.

(b) Proposed villages: Tang Sorkh; 1 place

(c) Required equipment, materials and facilities: Building, water tank, vehicle, etc.

(2) Establishment of apple collecting & grading center (medium-, long-term)

1) Purpose:

To emphasize villagers and promote apple sale by means of establishment of collection, grading, packing and distribution facilities.

2) Participants:

A group should be established, whose members grow apple and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

3) Structural Measures:

a) Size of group: It will be set that one unit is 100 households in village. A group should be established one in each village. Members should have the intention to development. As the

apple land area is approximately 1ha in average of 20 families, while yield will be 40t/ha, production will be 800t/year.

b) Proposed villages: Tang Sorkh; 1 place

c) Required equipment, materials and facilities: Building, water tank, drying table, conveyor, vehicle, etc.

10.5.7 Rural Water Supply Improvement

Domestic water demand per capita is applied to be 180 liter/day/person also according to the suggestion by SED. Expansion of rural water supply in each village is proposed on the basis of estimated population in 2020. Surplus water demand by 2020 is estimated at 274 m^3/day. Then it is proposed to improve distribution tank and pipeline. Here, capacity of distribution tank is designed to be the volume of supply for 12 hours and 30 % spare.

Dimensions of distribution tank and pipeline are summarized as follows. RWWC will operate and maintain facilities and collect water charge in cooperation with PIC. In addition, PIC will enhance villagers to recognize water charge system and desirable water use. By these projects, necessary and clean water will be provided to the villagers.

Table 10-5-7-1 Proposed Water Delmand and Distribution

Village	Distribution Tank	Pipeline
Allah Abad	B 2.5 m x L 2.5 m x H 3.0 m	PVC pipe ϕ 50, L=100 m
Cheshmeh Chenar	B 1.9 m x L 1.9 m x H 3.0 m	PVC pipe ϕ 50, L=50 m
Hassan Abad	B 2.8 m x L 2.8 m x H 3.0 m	PVC pipe ϕ 50, L=100 m
Islam Abad	B 2.2 m x L 2.2 m x H 3.0 m	PVC pipe ϕ 50, L=100 m
Mehrab Abad	B 2.1 m x L 2.1 m x H 3.0 m	PVC pipe ϕ 50, L=100 m
Sar Tang Sorkh	B 2.7 m x L 2.7 m x H 3.0 m	PVC pipe ϕ 50, L=100 m
Tang Sorkh	B 7.2 m x L 7.2 m x H 3.0 m	PVC pipe ϕ 75, L=1,000 m

10.5.8 Rural Road Improvement

It is planned to improve the rural road from Tang Sorkh to the bridge over Boshar River as asphalt pavement road. Widths of road and pavement are designed to be 4 m and 3 m respectively. After improvement, asphalt and gravel paved road should be maintained by government. In addition, it is planned to transfer technology of road maintenance of road and side drain. PIC should prepare training program. Project components are summarized as follows. By these projects, accessibility to the market will be improved.

- Improvement of road from Tangsork to the bridge constructed over Boshar River 5 km
- Transfer of technology for maintenance of road and side ditch 5 years
- Construction and maintenance of farm road by farmers 97 km

10.5.9 Establishment of Cooperatives

For establishment of cooperatives, it is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. Development plans are as follows:

(1) Establishment of various groups and cooperatives: short-term
(2) Establishment of multi-purpose training center: short-term
(3) Training and education plan by government: short-, medium-term
(4) Others (for formerly mentioned plans; establishment of horticultural crops collecting and grading center and establishment of apple collecting and grading center)

(1) Establishment of groups and cooperatives (short-term)

1) Purpose:

To emphasize villagers and promote the sale of produces and processed products made of and from raw materials grown in this area.

2) Participants:

A group should be established, whose members should grow the raw materials and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

(2) Establishment of multi-purpose training center (short-term)

1) Purpose:

To promote villagers, groups members for production and sales by area's processing and handicraft activities as well as to train and educate them for area's development.

2) Size of facilities:

Participants would be group members, cooperative members and villagers. If all villagers will happen to attend the meetings, a school or other larger place would be selected as venue. The standard size of multi-purpose training facilities should be for 50 persons. Facilities include building and play-yard.

3) Structural measures:

(a) Size of facilities: Based on one village 100 households, required multi-purpose facilities to be constructed will be as large for 50 persons. Approx. 100m2.
(b) Form of building: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
(c) Proposed villages: Tang Sorkh; 1 place
(d) Required equipment, materials and facilities: Building, etc.

(3) Training and education plan by government (short-, medium-term)

1) Purpose:

To instruct, train, educate and transfer the technology to group and cooperative members and villagers for development of areas.

2) Extension service organization:

To improve the organization so as to be able to instruct, train, educate and transfer the technology to group and cooperative members and villagers.

3) Structural measures: None.

Each plan is basically independent. However, there would be rooms for reciprocal affection or common usage. Development plan should be implemented step by step. Suitable development could be led by conducting the monitoring, evaluation and feed back step by step taking into consideration the levels and situations of around development.

10.5.10 Community Enhancement

(1) Purpose

a) To promote villager's participation in the projects implementation,

b) To build up villager's mind for mutual aid, and capability against natural disasters,

c) To strengthen villager's living environment.

(2) Organizing Villagers

To realize above purposes, village organization is planned to establish. Relevant government organizations, both in central and local levels, have to facilitate the establishment of the village organization, in cooperation with Village Islamic Councils. All villagers are naturally member of the village organization. But, the member of the organization should be formed case by case, based on the purpose of the project. Such type of project as profitable and, therefore, villager have to bear a part of project cost, should be organized by those villagers who have a willingness to the development. Followings are procedure for establishment of village organization.

a) Relevant government organization, both in central and local government, establish committee for M/P project which promote implementation of proposed projects and facilitate the establishment of village organization.

b) The government committee holds meeting with representatives of Village Islamic Councils to explain the project purpose, project components, implementation method, etc.

c) Representatives of Village Islamic Council hold small meeting at each villages to explain outline of the project.

d) The government committee facilitates to establish villager's organization based on the villager's

willingness to participation in the project.

e) The village organization discusses and establishes organizational structure, rules and regulations of operation, detail plan for participation in the project, etc., under the support by the government committee and Village Islamic Councils.

Followings are remarks of establishment of village organization

- Project Coordination Committee should facilitate establishment of the village organization in cooperation with Village Islamic Council. The council is helpful to promote villager's participation, and to establish rules and regulations of the organization, and to arbitrate villager's conflict if it happens,
- Participatory approach should be taken into consideration at the beginning of the establishment. It is recommended to hold workshop to pull out villager's frank opinion when plan of operation and monitoring are formulated by villagers themselves,
- At the time of establishment of rules and regulation, including account system, general meeting should be held with all members' participation. It is quite important that all villagers participate in the decision making of important issue. Such issue as member's rights, duties, and penal regulation are also the matter of general meeting,
- All villagers in the organization, including member of Village Islamic Council, should have a vote as an individual right of members. It is important that all members have equal right to participate in their decision-making.

(3) Activities

Activities of village organization should be planned and implemented through discussion among members in the organization. Followings are basic activities to attain the purpose of community enhancement.

a) Participation in implementation, operation and maintenance of the projects in cooperation with local and/or central government.
b) Participation in monitoring and evaluation of the projects in corporation with relevant government officers,
c) Participation in enlightenment activities against disasters such as flood, debris flow, and soil erosion. Enlightenment activities will be carried out at least once after flood season.
d) Promotion of health services and nutritional education, environmental education such as fuel consumption.
e) Meeting with other village organizations and relevant government organization to exchange information and experience which obtain through the projects.

Community enhancement will be promoted step by step in the process of project implementation. Relevant government organization, especially in the provincial levers, should assist and facilitate the

enhancement of the village organization. There are tree steps in the process of the project implementation to enhance function of the village organization.

First step is at the beginning of the project implementation, and the village organization will be established based on the villager's willingness to participation in the projects. All members belong to the village organization will participate in the decision making process of their organization, and participate in the activities of the organization. Through these activities, a sense of participation will be formulated.

At the time of commencement of the project, plan of operations and detail activities of the villager are already designed by the government. The village organization, therefore, just receive the planned project. It should be noted that some of the members of village organization is dubious about for the result and effect of the project. The government officers have to make close communication with the village organization and build up intimate relations with them.

Second step is at the time of monitoring of the project. In the monitoring activities, villagers grasp the problem faced in the project implementation, and discuss how overcome the problems. The results of the monitoring are put into next activities. The village organization reviews their activities and improves their original plan by themselves. Through these activities, villagers can formulate and enhance a sense of ownership for the development projects.

Third step is at the time of completion of the project. At this time, government organization will hold the workshop for project evaluation under participation by village organization. The result of the project evaluation will be put into the next project activities. The village organization will choice next activity among the master plan projects, or will make new project plan based on their willingness to development. The government organization for project implementation have to support and facilitate villager' selection of next activities.

10.5.11 Increment of Household Income and Job Creation

Increasing household income and job opportunity is one of the most important matters in the villages in the Study Areas. Development plan will include the contents of increasing household income and job creation. These, in case of being fully developed, are shown as income generating activities below:

Table 10-5-11-1 Job Creation and Yearly Income Increment (with plan, fully developed)

Items	Job Creation (number)	Income Increment (Riel)	Increased income per household or person (Riel/H.H or person)
Horticultural crops collecting and grading center (one place)	100 households	3,750,000	37,570 per h.h.
	22 workers	55,000,000	2,500,000 per p.
Apple collecting and grading center (one place)	100 households	204,130,000	2,041,300 per p.
	32 workers	80,000,000	2,500,000 per p.

Note: Details are referred to ANNEX L Economic and Financial Evaluation, Annual O/M Cost and Value of Output.

10.6 K8-28 Zeras

10.6.1 Construction of Check Dam

(1) Specific Sediment Discharge

Based on the topography, geological condition and riverbed condition, the specific sediment discharge is applied 250 $m^3/km^2/year$.

(2) T1 Basin

The basin is located in the deepest valley of the right tributary of the Karoon River. Although the terrain is very steep and hazardous, four villages of Bardkal, Lir Siya Shapouri, Lir Siya Mozrom and Sartuf are located in the basin and receive frequent flood and debris flow damage.

Eight main check dams and one check dam to be implemented by people's participation are planned in order to prevent the movement of unstable sediment, and stabilize the riverbed and foot of slope. The villages of Bardkal and Lir Siya Shapouri, located in the most downstream, the place of which is the most hazardous area, are to be relocated to the safe area.

(3) T2 Basin

This basin has several villages, such as Gard Lidan, Dareh Zangi, Dareh Sohrab and Badelon, on the mild plateaus located in the middle reaches. Erosion is very severe in the upper reaches and flood and debris flow causes problems on houses and farmland, especially Dareh Sohrab and Dareh Zangi. Erosion is also severe in the upper reaches of Badelon village.

Four main check dams and five check dams to be implemented by people's participation are planned in order to prevent the movement of unstable sediment, stabilize the riverbed and foot of slope, and protect farmland. Two check dams out of five are allocated on the small tributaries, which flow into the eastern plateau.

(4) T5 Basin

T5 basin, which borders T1 Basin, had two villages in the lower reaches, however, they were destroyed by flood and debris flow, deserted and fell into ruin. The two villages had relocated to the top of hill and only a few houses and limited farmland left in the basin. Erosion is also very severe here and gully is well developed on the steep slope.

Thus, only two main check dams are planned in order to prevent the movement of unstable sediment, and stabilize the riverbed and foot of slope.

(5) Other Basin

Several tributaries flow into the Karoon River at the western tip of the master plan area. Two villages, Ali Bandeh and Behoz, are located in this area. Ali Bandeh has one or two families, while Behoz has more than eighty. Behoz, located on the right bank of the Karoon River, will be submerged after the completion of the Karoon No.3 Dam and they will probably move to the higher riverbank adjacent to the existing village.

Two main check dams and three check dams to be implemented by people's participation are planned in order to prevent the movement of unstable sediment, stabilize the riverbed and foot of slope, and protect farmland.

(6) Outline of Check Dams

The total number of check dams by type is summarized as follows;

Main check dam (Type C).....10 No.
Main check dam (Type D) .....6 Nos.
Check dam (Type D) .....9 Nos.

(7) Effect of Check Dams

The check dams planned here are mainly considering securing farmland and villages on the lower reaches, and preventing devastation of the basin. Because of the steep gradient of the tributaries, storing capacity for debris is very limited. The total vacant volume (storing capacity for debris) of main check dams is around 15,800m^3, and that of 9-check dams by people's participation 9,000m^3 (1,000m^3 per each) and totally become 24,800m^3. On the other hand, annual sediment discharge is estimated around 7,600 m^3. Thus, the total vacant volume is equivalent to about 3-years of sediment discharge.

10.6.2 Relocation of Houses

(1) Critical Situation

Lir Siya Shapouri, located in the lower reaches of the deepest valley, T1 basin in Zeras, is surrounded with severely eroded steep slope and in hazard of debris flow from the tributary behind the village. On the narrow riverbank, the village is crowded with houses and many people, and consequently becomes in very poor living condition. In addition, there is high possibility of being hit by debris flow like the adjacent basin, T5, which occurred around 24 years ago. The village has 56 households with the population of around 280, which is the third from the top among Zeras Area.

While, Zeras village is located on the steep slope of the Karoon Valley and gully erosion is well developed around the village. There is a danger of flush floods on these gullies, which sometimes block up these gullies with big boulders and cause more damage to the village. The countermeasures are rather difficult and/or costly in view of its steep solpe. The village is rather small and has 15 households with the population of around 80.

(2) Study on Non-stucture Measures

A warning system with rainfall gauge is considered here, however, the problems arise on the evacuation routes.

a) Lir Siya Sapouri

- On the left bank of T1, where the village is located, it is difficult to locate evacuation route and a shelter because the slope behind the village is very steep.
- On the right bank, there are some flat areas on the gentle slope, however, it is necessary to cross the river. The village road branching from the main road is in poor condition and has to cross the riverbed because of no bridge. A footpath bridge, located in the lower part of the village, has no road access on the right bank, and flood sometimes overflows the bridge. A new bridge is required, there are no suitable sites on the same level of the village.

b) Zeras

The existing dirt road will be used as an evacuation route, however, the slope is rather steep and a few gullies cross the road. During evacuation, this route also becomes hazardous.

The warning system won't function safely, so that the system is abandoned, and instead relocation within the same area is planned.

(3) Relocation Plan

In both villages, majority people are mainly engaged in gazing and the farmland is limited, therefore, relocation is planned so as to shift safe areas within the same basin. The place to be relocated is selected on the ridge where the main road from Dawodiha is aligned. Reclamation of land on this ridge is planned in order to reserve the same space of the both village. The relocation areas are shown in Figure 10-6-2-1.

Altogether, 71 households, 360 people and the livestock such as 3,700 sheep and goat, and 160 cows, will be released from flood and debris flow hazards.

10.6.3 Landslide Protection

Landslide occurs around the ridge, where the main road is aligned from Dawodiha to the other side of the Karoon River, the right riverbank of the Karoon River, and the plateaus in the southeast. There are

no landslides near the villages. Therefore, the countermeasures are taken only along the main road and the plan of which are the same as that of Bazoft. The road distance to be protected is around 1.3 km.

10.6.4 Soil Erosion Protection

Present annual erosion rate is 48 t/ha (3.4 mm) in the sub-basin basis, that is the highest among five Master Plan areas. The annual erosion rates of dry farmland and rangeland are 41 t/ha and 63 t/ha respectively. Although both rates are high, the erosion of rangeland is dominant in this sub-basin. The erosin rate will be improved to 30 t/ha (2.2 mm) in the sub-basin basis in future. Improved erosion rate is still high due to high erosion rate of rangeland even after improvement.

(1) Plan of Surface Soil Erosion Protection for Farmland

In Zeras, dry farming is carried out extensively even in the very steep land over 50% inclination. Erosion rate exceeds the allowable level in the farmlands with a slope over 20% inclination. According to the agricultural plan of Senario-1, contour bunds of 30 and 20 m interval have been proposed for 20-30% and 30-40% inclination respectively, and vetiver grass contour bund of 12.5 m interval has been proposed for over 40% inclination. However, erosion rate can not be reduced to the allowable level in the lands over 30% inclination. Therefore, reduction of fallow land and introduction of dry type alfalfa have been proposed in Scenario-2. As the results of Scenario-2, 287 ha of dry type alfalfa is introduced and the fallow land is reduced from 664 ha to 434 ha. Annual erosion rate of the farmland of 1,724ha is reduced from 44.7 t/ha (3.19 mm) to 15.1 t/ha (1.08 mm) as shown in Table 10-6-4-1.

Table 10-6-4-1 Surface Erosion Protection for Farmland in Zeras

Area (ha)	Type of Farmland	Slope	Facility	Alfalfa Introduction	Soil Loss	
					Present	Senario-2
1,724	Dry farmland	20%-50%	Contour Bund (20 m interval in average)	287ha	44.7 t/ha/yr	15.1 t/ha/yr
					3.19 mm/yr	1.08 mm/yr

(2) Erosion improvement in Rangeland

In Zeras, vegetation improvement is proposed by means of protection in the whole rangeland of 3,361/ha due to steepness over 40%. Improvement of annual erosion rate is very limited only from 63.0 t/ha (4.5 mm) to 46.3 t/ha (3.31 mm) due to high bare soil ration even after protection. Due to severe deterioration of rangeland, bare land ratio is too high for protection, that is about 40% in average, and it remains at 24% even after protection. It is strongly recommended to study and experiment on possibility of seeding in the steep rangeland from the technical and economic viewpoints.

(3) Gully Protection

Lengths of waterways in the farmland are measured at 10.65 km. Loose-rock check dams are provided

at 30 m interval in 5 – 13% and at 20 m interval in 13 – 20% inclination. It is proposed to provide 486 loose-rock check dams for protection of gullies in the farmland. By the provision of those check dams, the farmland of 293 ha with a slope less than 20 % will be protected from gully erosion.

On the other hand, some large gullies are developed in the main outlet streams to the Karoon river and some of downstream villages are threatened. Such large gullies are to be protected by gabion type check dam by public works because the scale of gullies is too large for villagers to protect those.

10.6.5 Rangeland Vegetation Improvement

Improvement of rangeland vegetation is carried out in order to mitigate over grazing and to protect soil from erosion. Due to steep slope and low rainfall no seed sowing work is done in this area. Total area of rangeland is 3,361 ha, which is improved through protection and rotational use. Each year 336 ha (3,361 ha/ 10 years) of the area is protected to enhance the natural recovery of vegetation. When protection of a new plot begins, the old plot is opened to herds and utilized in a sustainable manner. However protected area is 336 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the practice is performed in few scattered smaller pieces, sum being 336 ha. Three (3) water points for livestock are established in the area.

Major benefits of these plans are:

- Increase in rangeland production and provision of more feed to livestock: In case of seed sowing an increment of 175 kg/ha, and in case of protection 75 kg/ha are expected.
- Increase in % of land cover: In cases of seed sowing the established grasses would bring-about an additional 30 %, and in case of protection 15% in land cover, contributing to prevention of soil erosion and conservation of the environment
- As a result of establishment of watering points for livestock, an additional 4.3 tons in meat production of grazing animals is obtained.
- With almond tree plantation, annually up to 8 tons of almond is produced. Moreover the established trees would cover an additional 20% of land surface, contributing to prevention of soil erosion and conservation of the environment.

10.6.6 Milk Processing and Marketing

Zeras is severely limited in water and land resources due to steep slopes and no adequate springs. The land is exposed to severe over grazing because of less vegetation due to bareness of rangeland and farmland. Increase of fodder crop production is the most urgent subject for mitigation of over grazing in this sub-basin as well as conversion of livestock to milk cow and introduction of milk processing in

order to decrease dependence on sheep and goats. For feeding livestock and mitigating over grazing, it is necessary to promote restoration of rangeland vegetation as well as introduction of dry type alfalfa in the fallow farmland. For milk processing and marketing, it is necessary to apply the participatory approach, establishment of groups & cooperatives and proper training & education by the government for promoting these development plans.

(1) Establishment of groups and cooperatives for milk processing center (medium-term)

1) Purpose:

To change to cow-grazing and to promote the sale of milk-processed products.

2) Participants:

A group should be established, whose members should grow cows and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as Iran's administration.

3) Structural Measures:

(a) Size of facilities: To establish the collection and distribution facilities for processed milk products. Approx. 1.0 t/day.

(b) Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.

(c) Proposed villages: Behoz and Lir Siya Shapouri; 2 places

(d) Required equipment, materials and facilities: Building, vehicle, mixing machine, etc.

10.6.7 Rural Water Supply Improvement

Domestic water demand per capita is applied to be 180 liter/day/person also according to the suggestion by SED. Surplus water demand is 313 m^3/day and it is proposed to supply potable water to villages. In addition, t is proposed to construct new rural water supply system which depends on Karoon River. Water demands and capacities of distribution tanks are summarized as follows. Here, capacity of distribution tank is designed to be the volume of supply for 12 hours and 30 % spare.

Intake of this water supply system is proposed to be constructed near Behoz and vertical shaft type is applied. Water is pumped up by submersible pump which total head is 1,000 m and yield is 45 m^3/hr. This pump is operated in 12 hours per day. And also conveyance pipeline from Behoz to Dawdiha is planned. At Dawdiha, reservoir tank is constructed and water is delivered to distribution tank in each village by pipeline network in gravity.

Projects are summarized as follows. RWWC will operate and maintain facilities and collect water charge in cooperation with PIC. In addition, PIC will enhance villagers to recognize water charge

system and desirable water use. By these projects, necessary potable water will be provided to the villagers.

- Construction of pumping station and conveyance pipeline
  here, pump type and capacity : submersible pump, total head 1,000 m, yield 45 m^3/hr
  intake : vertical shaft ϕ 300, depth 50 m
  conveyance pipeline : ϕ 125, length 8 km
- Construction of pipeline network : ϕ 50- ϕ 125, length 17 km
- Construction of reservoir tank (Capacity : 204 m3) 1 no.
- Expansion of distribution tanks and distribution pipes 15 nos.

Table 10-6-7-1 Proposed Plan for Water Supply

Village	Distribution Tank	Pipeline
Ali Bandeh	B 1.3 m x L 1.3 m x 3.0 m	PVC pipe ϕ 50, L=50 m
Badelon	B 2.4 m x L 2.4 m x 3.0 m	PVC pipe ϕ 50, L=50 m
Bardkal	B 1.5 m x L 1.5 m x 3.0 m	PVC pipe ϕ 50, L=50 m
Behoz	B 4.6 m x L 4.6 m x 3.0 m	PVC pipe ϕ 50, L=500 m
Cham	B 1.9 m x L 1.9 m x 3.0 m	PVC pipe ϕ 50, L=100 m
Dareh Sohrab	B 2.0 m x L 2.0 m x 3.0 m	PVC pipe ϕ 50, L=160 m
Dareh Zangi	B 3.7 m x L 3.7 m x 3.0 m	PVC pipe ϕ 50, L=800 m
Dawodiha	B 3.9 m x L 3.9 m x 3.0 m	PVC pipe ϕ 50, L=50 m
Gard Lidan	B 2.0 m x L 2.0 m x 3.0 m	PVC pipe ϕ 50, L=200 m
Lir Siya Mozrom	B 1.2 m x L 1.2 m x 3.0 m	PVC pipe ϕ 50, L=50 m
Lir Siya Shapour	B 3.9 m x L 3.9 m x 3.0 m	PVC pipe ϕ 50, L=400 m
Sartuf	B 2.2 m x L 2.2 m x 3.0 m	PVC pipe ϕ 50, L=80 m
Sebalutak	B 2.3 m x L 2.3 m x 3.0 m	PVC pipe ϕ 50, L=90 m
Shahghaz	B 1.9 m x L 1.9 m x 3.0 m	PVC pipe ϕ 50, L=50 m
Zeras	B 2.4 m x L 2.4 m x 3.0 m	PVC pipe ϕ 50, L=110 m

10.6.8 Rural Road Improvement

It is planned to improve roads with gravel pavement in the consideration of frequent damage by landslide in the future. Widths of road and pavement are designed to be 4 m and 3 m respectively. In addition, it is proposed to improve side drain and crossing facilities should be strengthened with concrete. After improvement, asphalt and gravel paved road should be maintained by government. In addition, it is planned to transfer technology for maintenance of road and side ditch. Then, PIC should prepare training program. Project components are summarized as follows. By these projects, accessibility to the market will be improved.

- Improvement of road with gravel pavement
  here, route from Dawdiha to Behoz and Ali Bandeh 10 km
  route from Conjunction of Dawodiha Highway to Cham, Badelon and Gard Lidan 13 km
  access route to Zeras 2 km
  access route to Sebalutak 2 km

- Transfer of technology for maintenance of road and side drain 5 years
- Construction and maintenance of farm road by farmers 285 km

10.6.9 Establishment of Cooperatives

For establishment of cooperatives, it is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. Development plans are as follows:

(1) Establishment of groups and cooperatives for handicraft: short-term

(2) Establishment of multi-purpose training center: short-term

(3) Training and education plan by government: short-, medium-term

(4) Others (for formerly mentioned plan: establishment of groups and cooperatives for milk processing center)

(1) Establishment of groups and cooperatives for handicraft (short-term)

1) Purpose:

To emphasize villagers and promote the sale of produces and processed products made of and from raw materials grown in this area.

2) Participants:

A group should be established, whose members should grow the raw materials and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

3) Structural measures:

(a) Size of group: It will be set that one unit is 100 households in village. Size of group is of 20 members within the said village.

(b) Proposed villages: Badelon, Behoz, Dareh Sohrab and Dawodiha; 4 places

(c) Required equipment, materials and facilities (In case of production of gilim and carpet): Building, weaving machine, etc.

However, in case of establishing multi-purpose training facilities, it should be used the said facilities for it.

(2) Establishment of multi-purpose training center (short-term)

1) Purpose:

To promote villagers, groups members for production and sales by area's processing and handicraft activities as well as to train and educate them for area's development.

2) Size of facilities:

Participants would be group members, cooperative members and villagers. If all villagers will happen to attend the meetings, a school or other larger place would be selected as venue. The standard size of multi-purpose training facilities should be for 50 persons. Facilities include building and play-yard.

3) Structural measures:
   (a) Size of facilities: Based on one village 100 households, required multi-purpose facilities to be constructed will be as large for 50 persons. Approx. 50m2.
   (b) Form of building: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
   (c) Proposed villages: Behoz, Dareh Zangi and Lir Siya Shapouri; 3 places
   (d) Required equipment, materials and facilities: Building, etc.

(3) Training and education plan by government (short-, medium-term)

1) Purpose:
   To instruct, train, educate and transfer the technology to group and cooperative members and villagers for development of areas.
2) Extension service organization:
   To improve the organization so as to be able to instruct, train, educate and transfer the technology to group and cooperative members and villagers.
3) Structural measures: None.

Each plan is basically independent. However, there would be rooms for reciprocal affection or common usage. Development plan should be implemented step by step. Suitable development could be led by conducting the monitoring, evaluation and feed back step by step taking into consideration the levels and situations of around development.

10.6.10 Community Enhancement

(1) Purpose

a) To promote villager's participation in the projects implementation,
b) To build up villager's mind for mutual aid, and capability against natural disasters,
c) To strengthen villager's living environment.

(2) Organizing Villagers

To realize above purposes, village organization is planned to establish. Relevant government organizations, both in central and local levels, have to facilitate the establishment of the village

organization, in cooperation with Village Islamic Councils. All villagers are naturally member of the village organization. But, the member of the organization should be formed case by case, based on the purpose of the project. Such type of project as profitable and, therefore, villager have to bear a part of project cost, should be organized by those villagers who have a willingness to the development. *Followings are procedure for establishment of village organization.*

a) Relevant government organization, both in central and local government, establish committee for M/P project which promote implementation of proposed projects and facilitate the establishment of village organization.
b) The government committee holds meeting with representatives of Village Islamic Councils to explain the project purpose, project components, implementation method, etc.
c) Representatives of Village Islamic Council hold small meeting at each villages to explain outline of the project.
d) The government committee facilitates to establish villager's organization based on the villager's willingness to participation in the project.
e) The village organization discusses and establishes organizational structure, rules and regulations of operation, detail plan for participation in the project, etc., under the support by the government committee and Village Islamic Councils.

Followings are remarks of establishment of village organization

- Project Coordination Committee should facilitate establishment of the village organization in cooperation with Village Islamic Council. The council is helpful to promote villager's participation, and to establish rules and regulations of the organization, and to arbitrate villager's conflict if it happens,
- Participatory approach should be taken into consideration at the beginning of the establishment. It is recommended to hold workshop to pull out villager's frank opinion when plan of operation and monitoring are formulated by villagers themselves,
- At the time of establishment of rules and regulation, including account system, general meeting should be held with all members' participation. It is quite important that all villagers participate in the decision making of important issue. Such issue as member's rights, duties, and penal regulation are also the matter of general meeting,
- All villagers in the organization, including member of Village Islamic Council, should have a vote as an individual right of members. It is important that all members have equal right to participate in their decision-making.

(3) Activities

Activities of village organization should be planned and implemented through discussion among members in the organization. Followings are basic activities to attain the purpose of community

enhancement.

a) Participation in implementation, operation and maintenance of the projects in cooperation with local and/or central government.
b) Participation in monitoring and evaluation of the projects in corporation with relevant government officers,
c) Participation in enlightenment activities against disasters such as landslide, and soil erosion. Enlightenment activities will be carried out at least once after flood season. Relocation of village is proposed to Lir shia shapouri village, and this kind of matter should be discussed among the village organizations to build up mutual aid system in the project area.
d) Promotion of health services and nutritional education, environmental education such as fuel consumption.
e) Meeting with other village organizations and relevant government organization to exchange information and experience which obtain through the projects.

Community enhancement will be promoted step by step in the process of project implementation. Relevant government organization, especially in the provincial levers, should assist and facilitate the enhancement of the village organization. There are tree steps in the process of the project implementation to enhance function of the village organization.

First step is at the beginning of the project implementation, and the village organization will be established based on the villager's willingness to participation in the projects. All members belong to the village organization will participate in the decision making process of their organization, and participate in the activities of the organization. Through these activities, a sense of participation will be formulated.

At the time of commencement of the project, plan of operations and detail activities of the villager are already designed by the government. The village organization, therefore, just receive the planned project. It should be noted that some of the members of village organization is dubious about for the result and effect of the project. The government officers have to make close communication with the village organization and build up intimate relations with them.

Second step is at the time of monitoring of the project. In the monitoring activities, villagers grasp the problem faced in the project implementation, and discuss how overcome the problems. The results of the monitoring are put into next activities. The village organization reviews their activities and improves their original plan by themselves. Through these activities, villagers can formulate and enhance a sense of ownership for the development projects.

Third step is at the time of completion of the project. At this time, government organization will hold the workshop for project evaluation under participation by village organization. The result of the project evaluation will be put into the next project activities. The village organization will choice next activity among the master plan projects, or will make new project plan based on their willingness to development. The government organization for project implementation have to support and facilitate villager' selection of next activities.

10.6.11 Increment of Household Income and Job Creation

Increasing household income and job opportunity is one of the most important matters in the villages in the Study Areas. Development plan will include the contents of increasing household income and job creation. These, in case of being fully developed, are shown as income generating activities below:

Table 10-6-11-1 Job Creation and Yearly Income Increment (with plan, fully developed)

Items	Job Creation (number)	Income Increment (Riel)	Increased income per household or person (Riel/H.H or person)
Milk processing center (2 villages)	141 households	224,540,000	1,592,482 per h.h.
	10 operators	64,750,000	6,475,000 per p.
Handicraft facilities (4 places)	80 members	101,720,000	1,271,500 per p.
	80 weavers	96,000,000	1,200,000 per p.

Note: Details are referred to ANNEX L Economic and Financial Evaluation, Annual O/M Cost and Value of Output.