

### 3. DISASTER PREVENTION PLAN FORMULATION

#### 3.1 Disaster Prevention Plans for the Priority Areas

##### 3.1.1 Phedigaon / Phatbazar CDPP

###### Background

The Phedigaon/Phatbazar community is located in the uppermost area of the Phedigaon river basin, which consists of sloped land and alluvium fan area. The population is about 2,600 with about 300 households. The community is mainly divided into three parts, from downstream Palung bazar, Phatbazar, and Phedigaon. The community is vital in cash crop production such as cauliflower, potato, cabbage, radish, and so on so thanks to the fact that they have direct access to the market in Kathmandu through Tribhuvan highway, and the topographical advantage of high elevation of about 1,700 m above mean sea level. On the other hand, the forest resources have been severely degraded since a long time due to high pressure of fuelwood requirement as well as land reclamation needs on the slopes. Particularly, the forest area upstream of the Dhungakate and Ghatte Khola, is in critical condition. Most of that area was lost, the slope was severely devastated by gully erosion and failures, and from which debris flow occurred in 1993 and damaged the downstream alluvium fan area.

###### Objectives of the Disaster Prevention Plan

The main objective of the disaster prevention plan is to recover the devastated alluvium fan area in which 58 people died due to the 1993 debris flow. The area is still left as it is and reclamation work is the first priority of the local people. The alluvium fan area is however defined as the highly hazardous zone due to the severely devastated condition of the upstream sloped area. It is therefore required to provide upstream disaster prevention measures such as gully control and hillside works together with channel works and land reclamation in the alluvium fan area.

Afforestation in the upstream area is earnestly desired by the local people, however, it was no more physically possible to start forest plantation immediately due to severe devastation of the slopes. Prior to afforestation it is necessary to provide slope stabilisation works such as gully control or hillside works. Conservation of the existing limited forest resources should be carried out in parallel with the disaster prevention works

###### Components of CDPP for Phedigaon / Phatbazar

The selected priority CDPP for Phedigaon / Phatbazar is shown in Figure 3.1.1, and its components are summarised below:

No	Subproject	Sector	Location	Cost standard	Project Cost (NRs.)
1	Phedigaon basic sabo project				53,018,600
	a) 2 Check dams, training dike and revetment works on the Dhungakate Khola	Sabo	Dh-1D,2D, Ph-3D, 7D	ICB	40,909,400
	b) 3 Groundsills and coffering dikes on Ghatte Khola tributaries	Sabo	Gh-4D~6D, Ph-2D	ICB	12,109,200
2	Phedigaon participatory disaster prevention project				44,969,500
	a) Channel works on alluvium fan area	Sabo	Ph-4D,5D	LCB	9,226,600
	b) Series of gabion groundsills on Dhungakate and Ghatte Khola	Sabo	Dh-3D~7D, Gh-1D~3D	LCB	29,489,600
	c) Hillside works on Dhungakate and Ghatte Khola basins	Sabo (bio-engineering)	Dh-8D~10D, Gh-4D~5D	LCB	6,253,300
3	Community disaster evacuation system with multipurpose shelters	Disaster management / Agriculture	Ph-8D	LCB*	3,000,000
4	Formation of users' committee	Institution	Ph-1C	PPP*	500,000
5	Land reclamation on alluvium fan area	Disaster recovery	Ph-6C	PPP*	5,000,000
6	Community forestry in 5 areas	Forest	Ph-7C~11C	PPP*	1,500,000
7	Agro forestry on sloped farmland	Agriculture / Forest	Ph-14C	PPP*	3,500,000
8	Management of stone quarry site	Environment	Ph-13C	PPP*	200,000
	<b>TOTAL PROJECT COST</b>				<b>111,688,100</b>

(\*) Assumed cost.

ICB : International Competitive Bidding, LCB:Local Competitive Bidding, PPP:People's Participation

As described above, the major components of the Phedigaon / Phatbazar CDPP are disaster prevention, disaster management and recovery activities. There are less community development programmes, because the community was most severely damaged by the 1993 disaster and the restoration activities are still limited. Local people are still suffering from the after-effects of the disaster. According to the results of discussions with local people, the priority sectors according to people's needs were forest conservation, stone quarry management, and disaster prevention. Therefore, the CDPP was formulated mainly for disaster prevention activities.

### 3.1.2 Namtar / Tilar CDPP

#### Background

Namtar is located in the centre of Makwanpur District, along the middle reaches of the Manhari Khola at an elevation of around 800 m. The population of the community is 816 with 136 families, living in the centre of Namtar VDC of which total population is 6,000. The community produces a variety of crops such as cereals, potato, cabbage, garlic, tomato, pear, orange, lemon, and so on. Since there is no access to the market, agricultural production is mainly for self-consumption. On the other hand, people in Namtar are quite active in the community development activities. In the course of the Study, the local people in Namtar immediately formed the people's group to participate in the CDPP plan formulation, and they tried to include their needs in the CDPP formulation. Because of their character, the people in Namtar have received various financial supports from INGOs after the disaster, such as high school rehabilitation, suspension bridge construction, and so on though there is no permanent access road and it is difficult for them to visit such INGOs and for government officials to approach the community.

Due to the 1993 disaster, the central bazar located on the right bank of the Manhari Khola was washed away by a tremendous amount of sediment and flood from the Manhari Khola and debris flow from the Syarse Khola. Seventy-one houses in the bazar were completely washed out together with the fertile farmland along the river.

#### Objectives of the Namtar / Tilar CDPP

The community development potential at Namtar is relatively high considering the people's capability. Road improvement would be a key issue for further development, which will change the cropping pattern in Namtar from cereal crops to cash crops and the income level of the farmers would be dramatically improved. However, the hazard potential in Namtar community is still high and disaster prevention activities would be essential for the sustainable development of the community. Sediment control works on the Manhari Khola, debris flow control on the Syarse Khola, and channel works on the Manhari Khola are required prior to the community development activities.

#### Components of the Namtar / Tilar CDPP

The selected priority CDPP for Namtar/Tilar is shown in Figure 3.1.2, and its components are summarised below:

No	Subproject	Sector	Location	Cost standard	Project Cost (NRs.)
1	Namtar multipurpose basic sabo project				271,845,500
	a) Multipurpose check dam Na-1	Sabo / Microhydro / Irrigation	Na-1D	ICB	47,141,000
	b) Multipurpose check dam Na-2	Sabo / Road	Na-2D	ICB	55,079,800
	c) Check dam Na-3 on Syarse Khola	Sabo	Na-3D	ICB	77,613,800
	d) Groundsill on Manhari Khola	Sabo	Na-4D	ICB	39,708,400
	e) Channel Work on Manhari Khola	Sabo / Land reclamation	Na-5D	ICB	52,302,500
2	Formation of Users' Committee	Institution	Na-1C	PPP*	500,000
3	Rural Road Improvement Programme	Road / Bio-engineering	Na-2C	LCB	4,739,000
4	Rehabilitation of Rural Irrigation System	Agriculture / Disaster recovery	Na-3C	LCB	5,026,000
5	Crop Diversification Programme	Agriculture	Na-7C	PPP*	2,500,000
6	VHF Wireless Telephone Installation	Communication network	Na-11C	PPP*	50,000
7	WID through Eri-silk Industry Research Programme	WID / Industry / Environment	Na-12C	PPP*	1,000,000
8	Microhydropower Plant	Rural electrification	Na-8C	LCB	7,836,000
	<b>TOTAL PROJECT COST</b>				<b>293,496,500</b>

(\*) Assumed cost.

ICB : International Competitive Bidding, LCB:Local Competitive Bidding, PPP:People's participation

Various community development subprograms were included in the CDPP for Namtar/Tilar, because the Study Team considered high capabilities of the local people to form the users' committee and to implement the subprograms on their initiative. WID through the eri-silk industry research programme is particularly expected in Namtar as a new approach to reduce the social and economic vulnerabilities of the community. The target group of the research programme is the schoolgirls in classes 9 and 10. Education and technical assistance will be given to them for their income generation. After graduating from the school, they will return to their villages and disseminate the learned technologies to the women in their villages. For the rural electrification programme through microhydropower plants, it is also expected that the operation and maintenance of the plants will be managed by the users' group under proper guidance by GO or NGO.

Prior to the above various community development activities, however, it is recommended to provide basic sabo works on the initiative of the central government.

Otherwise, it is feared that occasional natural hazard will attack the communities and hamper their sustainable development activities.

### 3.1.3 Chisapani CDPP

#### Background

Chisapani is located in the uppermost catchment area of the Agra river basin. The community spreads on a sloped land with an elevation of around 2000 m. The population in the community is about 500, and mostly belongs to the mountainous castes such as Tamangs and Gurungs.

Agriculture in Chisapani has advantages such as high altitude, fertile soil on the slope, and so on. Particularly, production of cauliflower has a great advantage that the harvesting is rather later than in other areas due to high altitude and thus it can be sold at higher prices.

On the other hand, the sloped agricultural land in Chisapani is severely reduced by slope failure and soil erosion, and many villagers are quite pessimistic to have to stay in the community. However, the Study Team found that the unstable slope could be stabilised to some extent by provision of gully control works and hillside works so that the sliding surface on the slope is not so deep, more or less 4m. Accordingly, to prevent the existing farmland from further gully erosion would be a key issue for Chisapani together with provision of the disaster evacuation system.

#### Objectives of the Chisapani CDPP

The main objective of the Chisapani CDPP is to sustain the existing farmland on the slope so that the local people can change their pessimistic attitude and are encouraged to stay there. The disaster prevention measures for the existing farmland stabilisation are therefore important for the Chisapani community. Together with the stabilisation measures, introduction of a community disaster evacuation system is essential, because the whole community area is defined as a rather highly hazardous zone against gully erosion, collapse, and landslide. Many residents are within the hazardous zone, and they should have their own destinations to evacuate at the time of emergency. For people empowerment for the sustainable community development, it is necessary to implement some development measures for effective utilisation of the local natural resources for the development activities. Water resources development would be a key issue for Chisapani. Effective usage of the existing water resources would trigger the community development on the people's initiative.

#### Components of the Chisapani CDPP

The selected priority CDPP for Chisapani is shown in Figure 3.1.3, and its components are summarised below:

No	Subproject	Sector	Location	Cost standard	Project Cost (NRs.)
1	Chisapani basic sabo project				42,985,500
	a) Check dam Ch-1D on Chisapani Khola	Sabo	Ch-1D	ICB	15,522,200
	b) 2 groundsills on Dharapani Khola and its Tributary	Sabo / Farmland conservation	Dr-1D,2D	ICB	27,463,300
2	Chisapani Participatory Farmland Conservation Program	Sabo / Farmland conservation			19,175,800
	a) A series of groundsills on Dharapani mainstream	Sabo / Farmland conservation	Ch-6D	LCB	7,988,100
	b) A series of groundsills on Dharapani tributary	Sabo / Farmland conservation	Ch-7D,8D	LCB	5,491,800
	c) Hillside works on the farmland slope	Sabo (bio-engineering works) / Farmland conservation	Ch-10D	LCB	5,695,900
3	Formation of Users' Committee	Institution	Ch-1C	PPP*	500,000
4	Disaster Evacuation System and 2 Multipurpose Shelters	Disaster management / Agriculture	Ch-12D	LCB*	4,500,000
5	Water Supply Network Development	Water supply / Agriculture	Ch-2C	LCB	3,070,000
6	Community Forestry at Chuliban	Forestry	Ch-4C	PPP*	1,000,000
7	Improvement of Contour Farming	Agriculture / Soil conservation	Ch-13C	PPP*	2,500,000
8	Agro-forestry on Sloped Farmland	Agriculture / Soil conservation	Ch-14C	PPP*	3,500,000
	<b>TOTAL PROJECT COST</b>				<b>77,231,300</b>

(\*) Assumed cost.

ICB : International Competitive Bidding, LCB:Local Competitive Bidding, PPP:People's participation

CDPP for Chisapani aims to sustain agriculture activities and many countermeasures for gully erosion and soil erosion on the slope are proposed. It is expected that the local people will be strongly encouraged to stay in the village through such disaster prevention measures, and they will think about the further development of the village. However, it is important that the local people should know the high disaster potential in the village and they should understand that disaster management is their responsibility. In this regard, installation of an evacuation system is a key subprogram in the CDPP, which is effective

only if the people understand the hazard potential, and destinations for evacuation in the emergency case. Evacuation shelters are proposed in 4 locations, and two of them are proposed to be used for potato seed storage in summer, thus saving the expenditure by farmers to buy potato seeds. The water supply network subprogram is also attractive to the people. It will satisfy the water supply needs mainly for the women, and improve cauliflower productivity.

### 3.1.4 Mahadevbesi Bridge IDPP

#### Background

Prithivi Highway, which connects Kathmandu with the Terai plain is defined as the lifeline of the Kathmandu city, ensuring the transport of food, energy and other things from Terai and India to the city. With a traffic volume of about 3,000 vehicles per day, it is considered as the most important road in Nepal. There are several bridges across the rivers such as the Mahadevbesi, Belkhu and Malekhu, and all the bridges were washed out by debris flow during the 1993 disaster. Due to damage of the bridges, the traffic on Prithivi Highway was completely interrupted for 3 weeks, causing serious problems to Kathmandu people. Disaster prevention measures for such bridges against debris flow are therefore required, and the technologies employed in these measures would be readily applicable to other bridges in Nepal as well.

#### Objectives of the Mahadevbesi IDPP

The river channel situated in the lowermost reaches of the Agra Khola between the sharp bent of the river course about 500 m upstream of the Mahadevbesi Bridge and the confluence with the Mahesh Khola, is still unstable longitudinally as well as laterally. It is feared that the existing situation of the river regime would have injurious effects on the safe maintenance of the Mahadevbesi Bridge. To cope with these unstable conditions, it is necessary to take countermeasures so as to stabilise the channel to a considerable extent. The objectives of the Mahadevbesi IDPP are therefore to stabilise the river condition near the bridge site, and the approach adopted for this purpose would be useful for other bridge protection measures in Nepal.

#### Components of the Mahadevbesi IDPP

The proposed structures for channel stabilisation are as shown in Figure 3.1.4 and summarised below:

- a) Groundsill No.1 with a view to controlling the excessive amount of sediment from upstream as well as conserving the existing riverbed around the sharp bent of the river course. The river gradient on the upstream side was designed to be 1.3 %.
- b) Groundsill No.2 with a view to consolidating the upstream riverbed and lowering the downstream riverbed so as reconcile with the downstream riverbed gradient of 1.3% as well as to direct a proper course of the river channel,
- c) Several spur dikes on the right bank downstream with a view to checking and adjusting the direction of the floodwater so as to secure its smooth passage at the bridge site.

The costs for the respective structures for the Mahadevbesi Bridge IDPP were estimated as follows:

a) Groundsill No.1	ICB	NRs. 47,755,700
b) Groundsill No.2	ICB	NRs. 42,082,100
<u>Sub-total for ICB works</u>		<u>NRs. 89,837,800</u>
c) Spur dikes and riverside park	LCB	NRs. 2,409,400
<u>Sub-total for LCB works</u>		<u>NRs. 2,409,400</u>
<b>TOTAL PROJECT COST</b>		<b>NRs. 92,247,200</b>

### 3.1.5 Kulekhani Reservoir IDPP

#### Background

The volumes of sediment deposited in the Kulekhani Reservoir from 1981 to November 1995 were estimated by the Study Team as follows:

#### Trend of Sedimentation in the Kulekhani Reservoir

Month and Year	Gross Storage Capacity	Effective Storage Capacity	Dead Storage Capacity	Accumulated Sediment Deposition
	(mil.m <sup>3</sup> )	(mil.m <sup>3</sup> )	(mil.m <sup>3</sup> )	(mil.m <sup>3</sup> )
1981	85.0	73.0	12.0	0.0
Mar. 1993	74.7	64.0	10.7	10.3
Dec. 1993	67.9	62.5	5.4	17.1
Oct. 1994	68.0	62.6	5.4	17.0
Nov. 1995	67.3	62.7	4.6	17.7

Source : Estimated by the Team based on the data from DOSC and NEA.

Based on the above estimated figures, the accumulated sediment deposit for 15 years from 1981 to 1995 was calculated at 17.7 million m<sup>3</sup>, which is about 20% of the original gross storage.

The annual average sediment deposit in the reservoir for 15 years, taking into account the severe rainstorm of July 1993, was estimated at 1.18 million m<sup>3</sup>. This figure represents the average volume of sediment deposit per year in 15 monsoon seasons from 1981 to 1995. The watershed denunciation rate was calculated to be 9.37 mm/km<sup>2</sup>/year.

#### Objectives of the Kulekhani Reservoir IDPP

With reference to the sediment issues in Kulekhani reservoir, the following three major issues are identified:

- 1) Sustainable operation of Kulekhani hydropower plants is not guaranteed due to the marginal storage volume below the intake structures of the power facilities in the Kulekhani reservoir.
- 2) Regulating capacity of the Kulekhani reservoir is rapidly decreasing and the generation capacity to meet the peak load in the dry season cannot be expected after 2010, taking into account the observed sediment deposition in the reservoir.



- 3) The basinwide watershed management activities are not supported by the people in the watershed due to less impact of the activities on the rural development.

The countermeasures are therefore required to meet the issues cited above.

### Components of the Kulekhani Reservoir IDPP

The countermeasures proposed for the Kulekhani Reservoir IDPP are essentially the sand resources development approach, which is to create an effective reservoir storage by excavation and to transport the excavated material to Kathmandu Valley for selling as a construction material. The generally layout of the plan is shown in Figure 3.1.5. The proposed works include procurement of excavation equipment, construction and improvement of the Kulekhani-Daksinkali road as the sand transportation route. The project cost was tentatively estimated as follows:

a)	Procurement of excavation equipment	ICB	NRs. 139,298,000
	<u>Sub-total for ICB works</u>		<u>NRs.139,298,000</u>
b)	Improvement of Kulekhani - Daksinkali Road	ICB	NRs.152,017,000
	<u>Sub-total for LCB works</u>		<u>NRs.152,017,000</u>
c)	Construction of Kulekhani - Daksinkali Road	PPP	NRs. 60,946,700
	<u>Sub-total of PPP works</u>		<u>NRs. 60,946,700</u>
	<b><u>TOTAL PROJECT COST</u></b>		<b><u>NRs. 352,261,700</u></b>

The envisaged sand resources development approach will have multiple effects: Maintaining the effective storage capacity of the Kulekhani reservoir, stimulating rural-economic activities by improvement of the Kulekhani - Daksinkali Road, solving the sand deficit in the Kathmandu Market, and stopping excess sand excavation from the rivers in Kathmandu Valley.

## 3.2 Disaster Prevention Plans in and around the Study Area

This section presents the results of additional studies, which were strongly requested by HNG/N or found to be urgently required to provide countermeasures in the course of the field investigation. They are not included in the scope of the Study, but the Study Team introduces an outline of the solutions for further studies.

### 3.2.1 CDPP for Sahan

Sahan village is located in the middle reaches of the Maru river in Sindhuli district. The village was selected as one of the nine investigation areas for CDPP at the beginning stage of the Study, however, it was not among the designated priority areas because its damage due to the 1993 disaster is relatively small.

On the other hand, the Department of Soil Conservation was very interested in promoting disaster prevention activities in Sindhuli district, and strongly requested to extend the Study to this area. The Sahan CDPP was therefore studied at a preliminary level. It is expected that detailed studies will be conducted HMG/N.

## Background

Sahan village has a population of 631 consisting of 96 families. A travel by car from Sindhulimadi town, capital of Sindhuli district along the river, to Sahan takes about 3 hours, but the road is not practicable in the rainy season.

Agriculture and livestock are the dominant sectors in economic activities in Sahan. Main agricultural products are cereals like paddy, wheat and corn, and also vegetables such as potato, mustard, garlic, onion, and cabbage. Livestock production is vital and practiced by 96 families which raise 424 cows and 140 goats among others. As the market is far from the village and difficult to access, local people mainly use their farm products for self consumption.

The Marin river basin including Sahan village belongs to the Siwalik Hills, which are known to be geologically fragile, and a remarkable amount of sediment is observed in the basin.

## Objectives of the Sahan CDDP

The major issue in Sahan is erosion of farmland located along the river due to severe bank erosion by floods of the Marin and Phurubari Khola. This is not a specific problem of Sahan only but also of all other villages along the Marin Khola. The root cause of severe bank erosion is geological fragility of the basin and excess sediment yield in the basin.

It is important to carry out sediment control activities particularly gully control, and soil conservation activities in the basin from the long-term viewpoints. Immediate measures were strongly requested by the local people because serious erosion of farmland is aggravated year by year as a result of periodical floods in the basin.

The objectives of the Sahan CDDP are therefore to prevent bank erosion as the urgent measure and to mitigate sediment yield in the basin as the long-term measure.

## Components of the Sahan CDDP

The proposed Sahan CDDP is summarised as follows:

### (1) Bank erosion prevention measures

It is proposed to implement the following measures to protect the farmland along the river against river bank erosion:

- a) Provision of gabion-made training dikes at the confluence of the Marin and Phurubari Khola,
- b) Construction of vegetated gabion spur-dikes along the left bank of the Marin Khola.

Construction materials are limited in Sahan due to the lack of transportation road. Only wood, bamboo, stone, and sand are available. Stones however can be found only at a site about 5 km upstream of Sahan. Gabion wire is generally provided by the Government according to the request of the village, however the quantity provided is usually not enough due to high demands of many other villages too. Considering these constraints for construction activities, it is proposed to consider transportation of stones by cows, utilization of wooden

boxes instead of gabion boxes, application of sand bags instead of stones, plantation of bamboo along the river, and so on.

(2) Community development measures

The following community development facilities are recommended as components of the Sahar CDPP:

- a) Rural irrigation system,
- b) Water supply network,
- c) Bio-gas plants.

Rural irrigation and water supply network development are highly required and the local people are applying to the local government for their materialization. Installation of bio-gas plants is suggested by the Study Team, taking into consideration the vital livestock activities in the village. According to the specialists, the waste of cows and goats in the village is enough for operation of bio-gas plants for all families. Each plant has a capacity of 6 m<sup>3</sup> and produces 36 kg of methane gas per year. The installation of household bio-gas plants, will enable rural electrification and cooking by methane gas, sparing the use of kerosene and firewood.

(3) Long-term measures

It is required to take a basin-wide integrated approach to meet the issue of excess sediment yield in the basin. A basin-wide master plan study including silt, river control, forest conservation, agriculture development, and transportation is recommended to be conducted to assess the long-term issues.

### 3.2.2 Vocational Training at Tsuchi Disaster Refuge Camp

#### Background

The Tsuchi disaster refuge camp was established near Hetauda city, Makwanpur district, by HMG/N with financial support of a Taiwanese NGO after the 1993 disaster. There are about 300 families in the camp who migrated mainly from the severely damaged areas in Makwanpur district. Some people migrated from Phedigaon, Nantar, and Chisapani. The disaster refugees are provided with brick houses but most of them have no farmland and job opportunities.

The people in the camp are those most severely affected by the 1993 disaster and the measures to restore their living conditions are quite important in the disaster prevention activities. Taken into consideration their severity, the Study Team carried out an additional study to support the people in the camp.

#### Major Issues

The most serious problem in the camp is that the refugees have no farmland and job opportunities. If the disaster refuge camp is left as it is, the Government will have to support the camp continuously with remarkable expenditures.

The Study Team assessed that creation of job opportunities in the camp and provision of income generation means as well as vocational training to the refugees will be essentially

required to solve the issue in the disaster refuge camp. The vocational training approach will encourage the people in the camp to return to their village and restart their life.

### Proposed Vocational Training at Tsuchi Disaster Refuge Camp

Under such situation, the Study Team recommends to establish an Eri-silk Industrial Centre in the Tsuchi community for vocational training and income generation for the refugees. The idea came from the research paper "Reduction of food deficit and dissolving poverty through rice and silk cultures" written by Professor A. Yoshida in the publication "Human and Development No. 56", July 1996, APDA, Japan.

According to the paper, a key issue to eliminate poverty is to create labour-intensive industry in the region to guarantee job opportunities to landless and jobless people. Another issue is to assess the marketability of the products of the selected labour-incentive industry. It is also important to assess the acceptability of the industry based on the people's cultural and educational background.

The sericulture industry is actively promoted by the Government and there are 8 sericulture centres in Nepal. One of them is located in Bandara about 70 km west of Hetauda. The Study Team and Japanese volunteers visited the Bandara sericulture centre and their findings are as follows:

- (1) The sericulture products of Nepal are not competitive in the international market due to technical limit of spinning. The international market is almost dominated by China and India.
- (2) On the other hand, eri-silk (wildsilk) worm rearing, which is of rather lower quality than silk, has a potential to be marketable as it does not require advanced spinning technologies.
- (3) In the Bandara sericulture centre, the spinning work is carried out by local workers operating manual spinning instruments. The spinning technologies being applied at the centre are sufficient for production of eri-silk as raw material.
- (4) It would be possible to sell eri-silk products as raw material in the international market, if the production capacity of eri-silk increases and is stable.
- (5) To produce eri-silk, it is necessary to plant castor-oil plants. The wild castor-oil plants exist in Terai and it would be possible to plant more castor-oil plants by farmers in Terai.
- (6) It is proposed to procure manual spinning instruments for the Tsuchi refuge camp, and provide vocational training on eri-silk spinning to the people in the refuge camp. For this purpose, technical support by the Bandara sericulture centre would be quite effective.
- (7) After receiving vocational training for a certain period and saving some amount of money, the refugees would be able to leave the camp and sustain their daily life through eri-silk spinning work.

Based on the above findings and ideas, the Study Team proposes to establish a vocational training centre for eri-silk spinning in the Tsuchi disaster refuge camp. The detailed procedures for project implementation would be as follows:

- Action 1: To establish a vocational training centre in the Tsuchi community, and to provide manual spinning instruments;
- Action 2: To procure excess cocoons from the Bandara and other sericulture centres and start spinning work in the Tsuchi vocational training centre;
- Action 3: To promote castor-oil plants plantation by farmers in Terai;
- Action 4: To establish a private eri-silk spinning company by the people who have got the spinning technology in the vocational centre; and
- Action 5: To study possible development of fish-raising industry and poultry activities using the used eri-silk worms as feed.

#### 4. ENVIRONMENTAL IMPACT ASSESSMENT

An Environmental Impact Assessment (EIA) was carried out for the five disaster prevention plans. The results of EIA are summarised below:

No	Parameters	Phedigaon CDPP	Namtar CDPP	Chisapani CDPP	Mahadevbesi bridge IDPP	Kulekhani reservoir IDPP
1	Physico-chemical Environment					
	Topography					
	River morphology	-L	-L	-L	-L	-M
	Geology					
	Water quality	-L	-L	-L	-L	-L
	Climate					
2	Biological Environment					
	Wildlife	+L	+L	+L		
	Bird species	+L	+L	+L		
	Fish species		-M		-L	±M
	Forest area	+M		+M		+L
	Grazing area	+L				
3	Socio-economic Environment					
	Population distribution			+L	+L	
	Occupation	+L	+L	+M	+M	+M
	Literacy					
	Living standard / level of income	+M	+M	+M	+M	+L
	Safety of the living area	+M	+M	+M	+L	
	Agriculture land use	+M	+M	+M		
	Economic activity	+M	+M	+M	+M	±L
	Religious / cultural activity					
Area of aesthetic / scientific value						

L : low impact, M : medium impact, + : positive impact, - : negative impact, ± : positive and negative impact.

##### (1) Phedigaon / Phatbazar CDPP

Tree plantation on the slopes in the upstream area could not be done effectively since the slopes are severely devastated and unstable. Physical foundation works for slope stabilisation would be required prior to tree plantation. Except for this matter, all the

proposed activities would have rather positive effects in the environmental aspects and no negative environmental effects are found.

(2) Namtar / Tilar CDPP

The Construction of check dams on the Manhari Khola would to some extent affect fisheries in the upper reaches. As a countermeasure, it is recommended to release fry in the reaches and monitor their activities. Except, for this issue, there would be no negative environmental effects due to the implementation of the CDPP.

(3) Chisapani CDPP

There are no negative impacts of implementation of the CDPP from the environmental viewpoints.

(4) Mahadevbesi Bridge IDPP

No remarkable negative impacts due to the implementation of the IDPP are expected.

(5) Kulekhani Reservoir IDPP

It is worried that the excavation in the reservoir may affect the existing aquaculture activities in the reservoir. It is recommended to carry out a detailed monitoring survey to check the effect of the reservoir excavation activities on aquaculture.

## 5. PROJECT EVALUATION

### 5.1 Economic Evaluation

The Economic Internal Rate of Return (EIRR), Net Present Value (NPV) and Benefit/Cost Ratio (B/C) of the proposed CDPPs as well as the IDPPs are shown below. For calculating the NPV and the B/C, a discount rate of 10 % was adopted.

S.N.	Area	EIRR (%)	NPV (NRs.)	B/C
1	Phedigaon/Phatbazar	4.35	-31,273,944	0.71
2	Namtar/Tilar	5.21	-76,331,197	0.76
3	Chisapani	-2.25	-41,379,935	0.37
4	Mahadevbesi Bridge	14.90	27,992,616	1.49
5	Kulekhani Reservoir	24.67	628,296,112	3.61

Except for the Chisapani CDPP, at least positive benefits will be obtained. The Namtar/Tilar CDPP gives the best result among the CDPPs while that of Chisapani shows a negative value. The EIRR of the Mahadevbesi Bridge IDPP and Kulekhani Reservoir IDPP indicate their high economic viability.

#### (1) Phedigaon/Phatbazar

The major benefits will be from cauliflower cultivation on the new farmland reclaimed after the completion of sabo works. The EIRR is 4.35 % which is at least positive, though it is very small. With the subprojects, the local economy will start developing, the sociological situation will be very much improved, and the district will become far less likely to suffer from another disaster, but these intangible benefits were not considered in the Cost-Benefit Analysis (CBA).

#### (2) Namtar/Tilar

The major benefits will be from the production shift to high-valued cash crops such as cauliflower, ginger, and garlic. This shift will be made possible by the road improvement. The EIRR is 5.21%. Considering the huge costs for construction of several large concrete structures, it is satisfactory to have a positive EIRR. It can be said that the road itself is a highly profitable project of all. With the road, many economic and social activities will be upgraded and flourished, but they were not counted in the evaluation.

#### (3) Chisapani

The major direct benefit producer will be the drinking water supply subproject. Without the sabo works, however, everything will be in vain, though. The EIRR is -2.25%. This negative value would automatically lead to the conclusion that the package of subprojects under the Chisapani CDPP are not viable and therefore should not be implemented. However, under the "without-the-project" condition, the Chisapani people will leave their villages sooner or later, or end up being affected by other disasters and the community of Chisapani will disappear. Thus it is too early to make such a



conclusion now. The final decision should be made by evaluating the intangible benefits.

(4) Mahadevbesi Bridge

The benefits were calculated based on the costs for the best alternative, a one-span truss bridge. The EIRR is 14.90%, which is good enough to conclude that the package of subprojects for the Mahadevbesi Bridge IDPP should be implemented. But it should be noticed again that the proposed sabo works are not perfectly comparable to the one-span truss bridge with respect to the capability of protecting the bridge from floods.

(5) Kulekhani Reservoir

The major benefits will be from the shift of cropping pattern from cereals to cash crops in the five VDCs along the Kulekhani-Daksinkali road. It means that the proposed countermeasures against the reservoir sedimentation will be highly beneficial to the local people rather than the electricity users. This tendency would be better to solve the current issue that the local people have no benefit from the hydropower project. The EIRR is 24.67%, which obviously demonstrates that the package of subprojects for the Kulekhani Reservoir IDPP should be implemented.

## 5.2 Impact Analysis

For the community disaster prevention projects, the tangible benefits are rather small and the calculated EIRR are marginal values. However, the justification of the project feasibility should not be based only by the economic viability particularly for the CDPPs.

There are various intangible benefits yielded by the project implementation and which would be highly effective for the local people to be empowered for further development in the various aspects. An impact analysis to estimate the intangible benefits was therefore carried out by the Study Team. The items and scoring of the impact analysis are as follows:

No.	Category	Phedigaon/Phatbazar	Namtar/Tilar	Chisapani
1.	Community			
	a) Stimulation	3	5	3
	b) Efficiency	2	4	2
	c) Self Help	4	5	3
	d) Mutual Support	3	4	2
2	Women			
	a) Work load	1	3	4
	b) Education Level	2	3	2
	c) Child Birth	3	3	3
	d) Safety in Child Birth	3	3	3
	e) Stimulation of Women	1	2	2
3.	Children			
	a) Workload	1	3	4
	b) Education level	2	3	2
	c) Child Abuse	2	3	2
4	General Issues			
	a) Migration	3	5	5
	b) Landlessness	4	3	2
	c) Population Explosion	2	2	2
	d) Environmental Conservation	2	1	3
	e) Sustainable Development	2	3	3
	f) Income Disparity	3	3	3
	g) Unbalanced Growth	3	3	3
5	Disaster			
	a) Danger in Life	4	3	2
	b) Property Damage	4	3	2
6	Economy			
	a) Regional economic Development	2	4	3
	b) Entrepreneurship	2	3	1
	c) Market Economy	1	3	1
	d) Employment Opportunities	3	3	2
7	Information			
	a) Information Network	2	4	1
	b) Information Imbalance	2	4	1
8	Health/Sanitation			
	a) Public Health Care	1	3	1
	b) Private Health Care	3	3	3

Note : score 1 is minimum impact, score 5 is maximum impact.

Five grades of scores were given arbitrarily by the Study Team to the respective analysis items. The results are shown in Table 5.2.1 for Phedigaon / Phatbazar, Table 5.2.2 for Namtar / Tilar and Table 5.2.3 for Chisapani.

Based on the impact analysis study, the proposed CDPPs were evaluated as follows:

- (1) CDPP for Phedigaon / Phatbazar is expected to distribute the project benefit mainly to landless people who have lost farmland on the alluvium

fan area due to the 1993 disaster, so that the major components of CDPP are disaster prevention and recovery works for the area.

- (2) CDPP for Namtar / Tilar is expected to stimulate rural economic activities by strengthening the transportation and communication to the other areas. It is also evaluated that this CDPP would be highly effective to strengthen the rural society by forming the users' committee to be responsible for various community development activities.
- (3) CDPP for Chisapani is expected to encourage the local people to stay in the community and to continue agricultural activities, through farmland protection and forest conservation measures. It is also expected to improve their living conditions by water supply network development activities.

### 5.3 Overall Project Evaluation

Overall project evaluation for the proposed CDPPs and IDPPs was made based on the results of economic evaluation, project impact analysis, and environmental impact assessment.

For CDPPs, it is found that the economic viability is rather small from the short-term viewpoints, however, the project benefit is mainly distributed to the poor or weak people such as landless people, severely affected people by the disaster, and women. Considering the reduction of regional vulnerabilities, it is judged that the proposed CDPPs are effective. In the environmental aspect, no negative impacts are expected but there are various positive effects such as forest conservation, slope stabilisation, and so on. Taking into consideration the bottom-up effect and environmental improvement effect, it is judged that the CDPPs are recommendable to be implemented.

For IDPPs, they have enough economic feasibility. Based on the economic evaluation, the proposed IDPPs are recommendable to be implemented by the agencies concerned. However, the detailed environmental impact analysis would be required for the Kulekhani reservoir IDPP in view of the eventual effect of sand excavation activities on aquaculture in the reservoir.

## 6. IMPLEMENTATION PROGRAM

### 6.1 Institutional Arrangement for Project Implementation

The many projects formulated under the Study are to a great extent diversified in nature: Some projects are completely engineering-oriented involving sabo works, some are completely community-oriented involving participatory rural development works, and others are mixed ones. These different projects are called subprojects in this chapter. For implementation of those various kinds of subprojects, an implementing organisation with a tremendous flexibility must be required.

DOSC and the Study Team discussed institutional arrangement and came up with the conclusion as diagrammatically illustrated in Figure 6.1.1. The most important point of all is that there must be a very strong and effective unit - it is named "PEU" in the diagram - at the core of the implementing organisation. It can be small, but it needs full understanding and support from DOSC, as a leading agency of HMG/N for implementation. The following is an explanation of each component in the diagram.

#### PEU (Project Executing Unit)

PEU is the heart of the organisation and the engine for project implementation. The major roles assigned to PEU are to promote, support, and, most of all, execute subprojects. Thus PEU will deal with all subprojects proposed by the Study Team.

The Project Manager is appointed from DOSC staff. He/she is responsible for all duties in PEU. PEU must be a small unit in the early stage. Besides the Project Manager, the Project Promoter is assigned to introduce the subprojects to donors to promote their implementation. He/she contacts a variety of possible donors such as international aid agencies, INGOs, private organizations, etc.

Once a donor is found and if it asks PEU to execute the subproject it selects, PEU strengthens its unit by employing some experts, administrators, and other staff based on the nature of the subproject. Basically those additional members of PEU are from DOSC, but it is also possible from other line agencies. Non HMG/N personnel is acceptable, too. Based on the request from and the negotiation with the donor, PEU arranges an appropriate institutional structure for immediate implementation.

#### PCC (Project Co-ordinating Committee)

PCC is formed on the top of the structure. PCC consists of DOSC, DDC, and the line agencies such as DOR, DOF, NEA, and the Ministry of Finance. The main purpose of forming PCC is to co-ordinate all line agencies and to supervise the PEU. A representative of DOSC must be the chairperson of the PCC.

PCC should be a small committee so that it works efficiently and effectively. If it is big, there would be many ideas and plans and it would be difficult to reach consensus among the members in a co-operative way.

Since the subprojects are so diversified in nature there should be some support to project implementation from time to time from the line agencies. PCC is a good place to communicate one another among the line agencies and to find co-operative solutions.

DOSC (Department of Soil Conservation)

DOSC plays a leading role in the project implementation. DOSC must give continuous and sufficient support in many respects to PEU to enable PEU to keep functioning and accomplishing its duties.

The majority of PEU staff may be provided by DOSC. Especially, the Project Manager must be from DOSC and he/she must be quite capable of managing PEU in the implementation of the subprojects.

DDC (District Development Committee)

PEU keeps in touch with and/or works with DDC in implementation. In any project, as long as it is implemented in Nepal, the project site always belongs to a DDC. A good co-ordination of a project implementing agency with a DDC is a key for successful outcomes. DDC is also a member of PCC, but PEU needs a good co-ordination with DDC at the regional level as well for detailed discussion in each subproject.

Basket of Subprojects

The basket shown in Figure 6.1.1 is merely a symbolic representation of several subprojects formulated in the Study and being implemented by PEU. The Project Promoter in PEU goes out with the basket to the street to sell these subprojects to the people walking there - donors. The subprojects can be viewed as vegetables in the basket. A donor who wants to buy a vegetable picks up the best vegetable it wants from the basket. The donor asks PEU to cook it together or returns home for cooking by itself.

Donor Type A

As explained above, the donor type A is the one who buys a vegetable from the basket and wants to cook it together with PEU. It provides PEU with resources such as fund, technology, and manpower. What kinds of resources it provides vary from donor to donor, therefore PEU has to be flexible to accommodate those unpredictables. In addition, the donor type A may request the PEU to implement a subproject in its way. That is, although the whole physical components of the subproject may not change very much, the way or the strategy to implement it may change drastically in accordance with the donor's request.

Donor Type B

Unlike the donor type A, the donor type B is the one who wants to do it by itself. PEU promotes the subprojects and hands them over to the donor type B. In the course of handover, PEU gives full explanation on the subproject and, if asked, gives some support during implementation.

There must be not many type B donors from international aid agencies, but most INGOs might prefer to do it in their own style.

### TA (Technical Assistance)

In case that PEU has not enough technologies for implementing a subproject, a donor is asked to provide technical assistance (TA) to PEU, which makes up for the lack in technology in the PEU. PEU and the donor discuss what types of expertise are necessary in TA and decide the experts to be assigned. TA does not play a leading role in implementation, but it supplements PEU's role with regard to technology.

### UG (Users Group)

Forming UG is a must for implementing participatory community development projects. Most CDPP subprojects definitely call for some contribution from UG. UG plays a significant role in implementation as well as operation and maintenance.

External assistance is required to form UG. A motivator goes to the village and forms UG through group discussion and interviews. He/she can be from PEU or TA, or from VDC. UG should be registered with the HMG/N (related government offices based on types of activities) and legalised.

### NGO

There may be NGOs which want to participate in CDPP subprojects. They may not become donors because they do not have fund and technology. Some NGOs, however, would like to be funded by PEU to implement some community-based subprojects. The diagram shows a possibility of this type of involvement in implementation.

### Monitoring and Evaluation

Since there are multiple subprojects being implemented simultaneously with involvement of multiple parties, there must be an effective monitoring and evaluation unit which reports its analysis to PEU so that PEU can control and manage all on-going subprojects efficiently.

Without the monitoring and evaluation unit, PEU cannot monitor and control on-going subprojects. Even each subproject is disintegrated and cannot provide expected outputs. This unit can be in the PEU, or if a third party is better to do this, it can belong to TA.

The unit must have stronger and much strict functions of monitoring and evaluation than those regulated by HMG/N. This is because there will be many invisible and uncountable things involved in community development which are too crucial to be ignored.

## 6.2 Strategy of Project Implementation

### 6.2.1 Implementation of CDPPs

For implementation of a CDPP in a priority area, PEU which is recommended to be established in DOSC shall take a lead for the necessary arrangement.

Figure 6.2.1 shows the implementation strategy for CDPPs which include three types of the subprograms as listed below:

- (1) Basic disaster prevention subprogram,
- (2) Participatory disaster prevention subprogram, and
- (3) Community development subprogram.

(1) Basic Disaster Prevention Sub-program

In each CDPP, the basic disaster prevention sub-program is proposed, which is defined as "The Frame Project" aims at recovering the damaged community and forming the basic frame for constructing less vulnerable community to further disasters. The basic disaster prevention sub-programs are therefore mainly composed of structural protective measures, which are rather costly and difficult to manage by the people's group themselves for their funding and construction. It is therefore recommended that the government takes responsibility to promote and implement such basic disaster prevention sub-programs.

Taking into account the location of three CDPP priority areas, it is proposed that the basic disaster prevention sub-program shall be implemented in two stages. The first phase would be for Phedigaon and Chisapani, and the second phase for Namtar. Phedigaon and Chisapani are adjacent communities and it is possible to use the same construction equipment at the same time. The damage condition is more severe, and the further disaster potential is much higher than Namtar. Accordingly, it is proposed that basic disaster prevention sub-program for Phedigaon and Chisapani shall be implemented as the first stage prior to Namtar.

Figure 6.2.2 shows proposed implementation schedule for CDPP basic disaster prevention sub-projects. The project period for phase 1 will be four years from 1997 to 2000 including the funding arrangement, detailed design, tendering and construction. Phase 2 will be continued from phase-1 which will be commenced in 1999 and completed in 2004. The annual disbursement schedule for basic disaster prevention sub-programs of CDPPs are summarised as follows:

Funding arrangement schedule  
for basic disaster prevention sub-projects of CPDDs

Unit : NRs.

Year	Phase-1 Phedigaon / Chisapani	Phase-2 Namtar	Total
1997	1,008,044	0	1,008,044
1998	7,728,338	0	7,728,338
1999	39,516,278	4,757,296	44,273,574
2000	47,751,540	16,718,498	64,470,038
2001	0	24,737,941	24,737,941
2002	0	49,043,685	49,043,685
2003	0	91,775,730	91,775,730
2004	0	84,812,350	84,812,350
TOTAL	96,004,200	271,845,500	367,849,700

The required amount is NRs.96,004,200 for Phase 1, and NRs.271,845,500 for Phase 2 respectively.

Based on the above strategies, the DOSC shall commence the action for implementation of the basic disaster prevention project as "The Frame Project" for respective CDPP area.

### (2) Participatory Disaster Prevention Sub-program

The participatory disaster prevention sub-program is consisted of the small scale structural preventive measures such as gully control and hillside works and the non-structural disaster protective measures such as evacuation system. Those schemes are generally designed to be low cost and applying the simple technologies as much as possible so that the people in the community can manage for their implementation, operation and maintenance by forming disaster management committee. However, some assistance from GOs or NGOs would be required in technical and financial aspects. Such participatory disaster preventive measures are like a "muscle" of the community, which will support the frame and the community would be stronger against the further disasters by reducing the natural hazard potential at the community. Table 6.2.1 shows the list of sub-projects in participating disaster prevention sub-program, and the implementation schedule is shown in Figure 6.2.3.

### (3) Community Development Sub-Program

The community development sub-program is mainly carried out under the initiative of the user's committee, which can be defined as "blood" of the community so that the development activities would create benefit in the community and distribute to the local people. As the result, it is expected that the people in the community would be stronger in the economic and social aspects and they can be more capable to manage the disasters. Therefore the community development schemes are essential to realise the participatory disaster prevention activities. As proposed for the participatory disaster prevention schemes, it would be required some assistance from GOs or NGOs for the financial or technical assistance by request of the users' committee.

Table 6.2.2 shows the list of community development and participatory disaster prevention sub-projects, which is composed of 16 sub-projects in three CDPPs. Various sectors are involved in the community development sub-program such as strengthening institution, agriculture, forest, road improvement, income generation, rural electrification, communication, women in development and so on.

In view of the Study Team, the following community development sub-projects will be particularly effective to encourage, empower and spark the local people for disaster prevention and economic development activities:

- |     |        |  |
|-----|--------|--|
| (1) | Na-2C  | Rural road improvement sub-project (Namtar)              |
| (2) | Na-14C | WID through sericulture research sub-project (Namtar)    |
| (3) | Ch-2C  | Water supply network development sub-project (Chisapani) |

In addition, the following sub-projects can be implemented within the existing government programs:

- |     |                     |  |
|-----|---------------------|--|
| (1) | Ph-7C-11C,<br>Ch-4C | Community forestry (Phedigaon / Chisapani) |
|-----|---------------------|--|



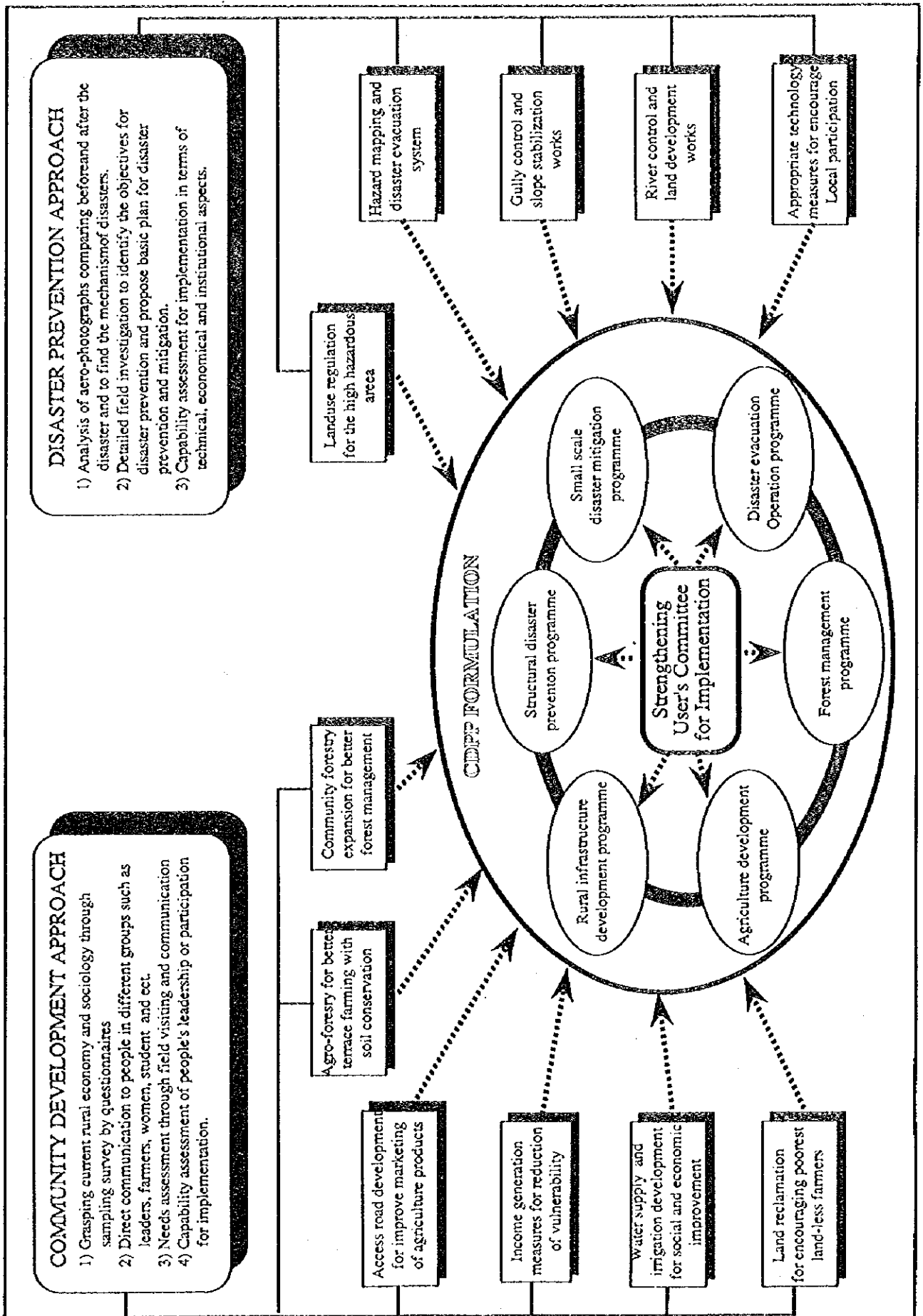
- (2) Na-3C Rehabilitation of irrigation network (Namtar)
- (3) Na-7C VHF wireless telephone installation (Namtar)
- (4) Ch-13C Sloping agriculture land improvement (Chisapani)

For implementation of the community development sub-projects, it is highly expected to participate the INGOs and NGOs for their technical and financial supports to the user's committee. In fact, many INGOs and NGOs have abundant successful and unsuccessful experiences in participatory community development activities in and out of Nepal. Their know-how and experiences are highly required for successful implementation for community development activities.

Important roles of the PEU in the central government are promotion and co-ordination of the community development sub-projects. Many INGOs and NGOs are interested in participating the implementation of community development sub-projects, however, they have less information to realise the sub-projects. The PEU therefore should be ready to disseminate the results of the Study, and approach them to provide technical information. Some INGOs may be interested in both of financial and technical support, but many of them have less budget to implement by themselves. In that case, the PEU is highly expected to arrange or co-ordinate the fund raising to approach the various government, private foundations and foreign donors.

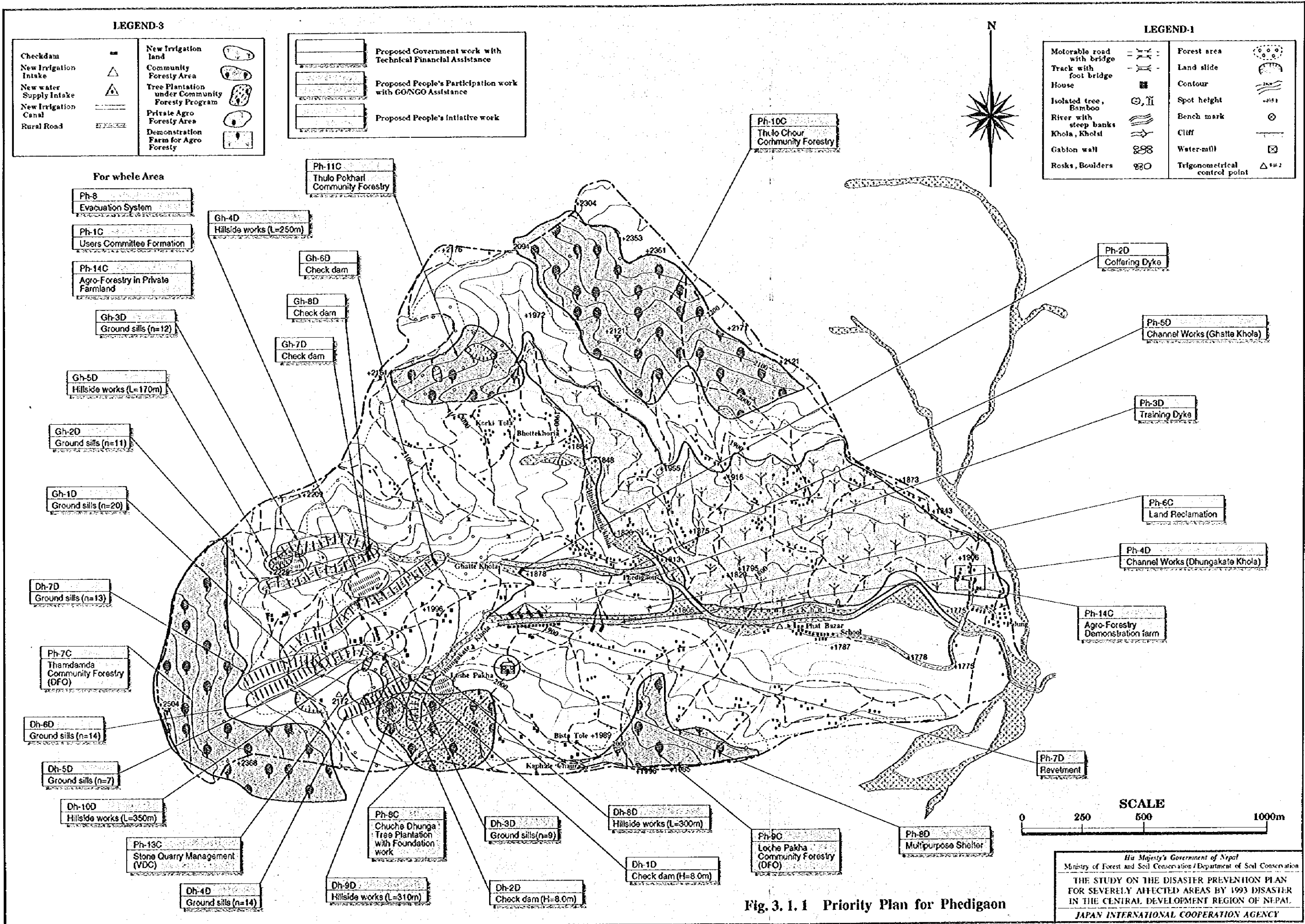
#### 6.2.2 Implementation of IDPPs

The results of economic evaluation confirm that the Mahadevbesi Bridge IDPP and Kulekhani Reservoir IDPP have high economic viability. Considering this condition as well as the importance of the disaster prevention measures on such important national infrastructures, it is recommended to implement the proposed countermeasures by the agencies concerned, i.e. the Mahadevbesi Bridge IDPP by the Department of Road, and the Kulekhani Reservoir IDPP by the Nepal Electricity Authority.



**Fig. 2.2.1**  
**Major Components of the CDDP**

His Majesty's Government of Nepal  
Ministry of Forest and Soil Conservation/Department of Soil Conservation  
THE STUDY ON THE DISASTER PREVENTION PLAN  
FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER  
IN THE CENTRAL DEVELOPMENT REGION OF NEPAL  
JAPAN INTERNATIONAL COOPERATION AGENCY



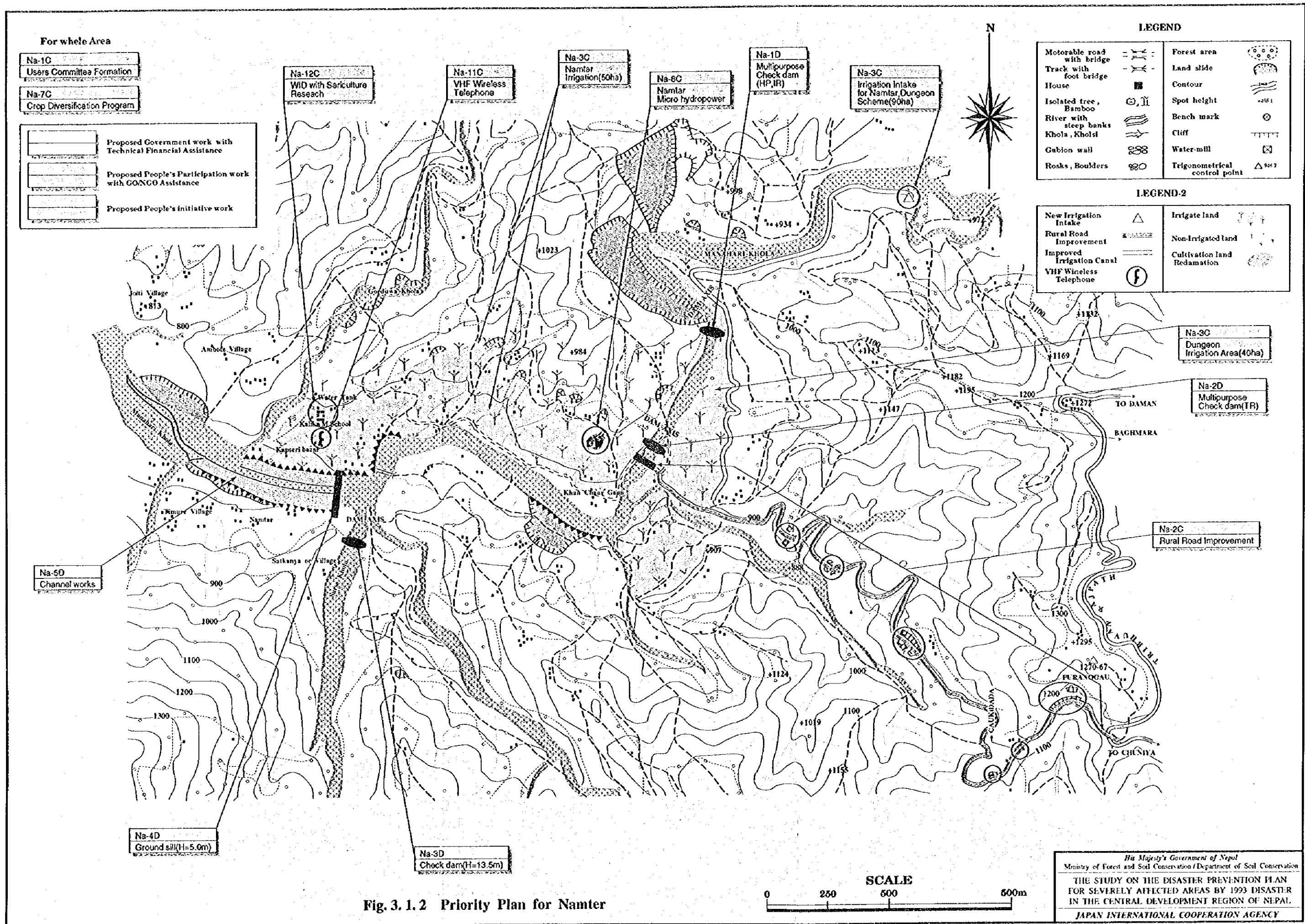
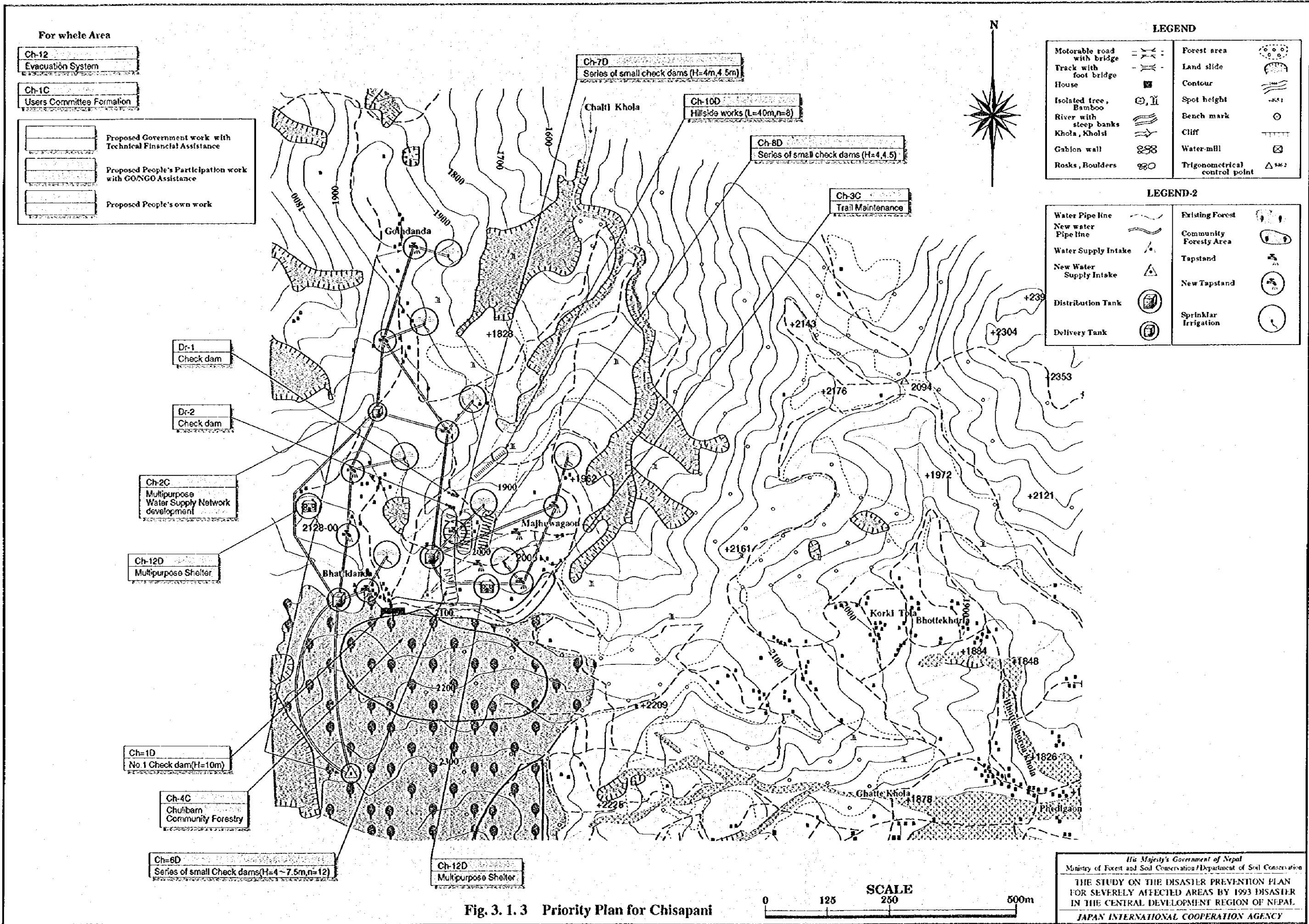
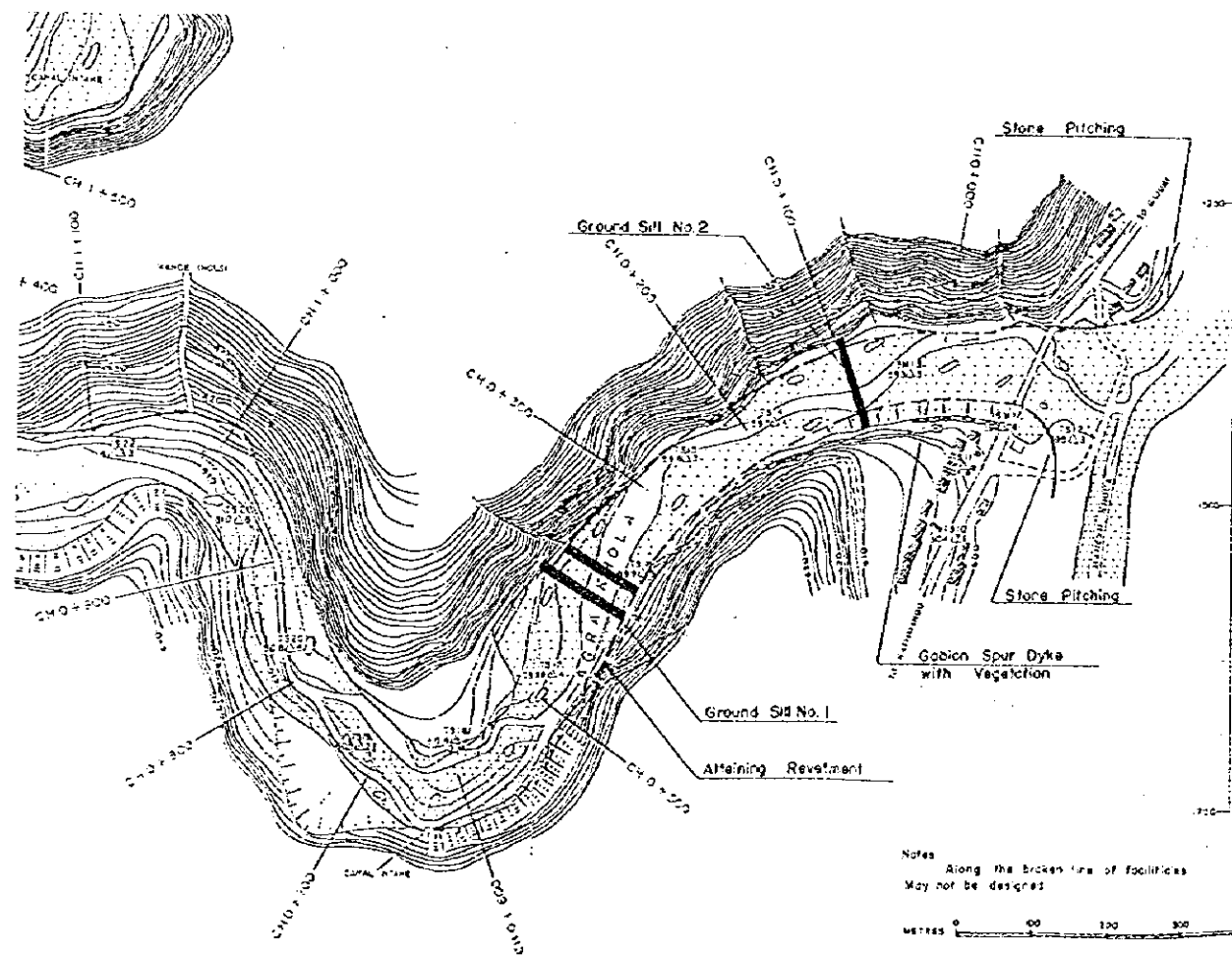
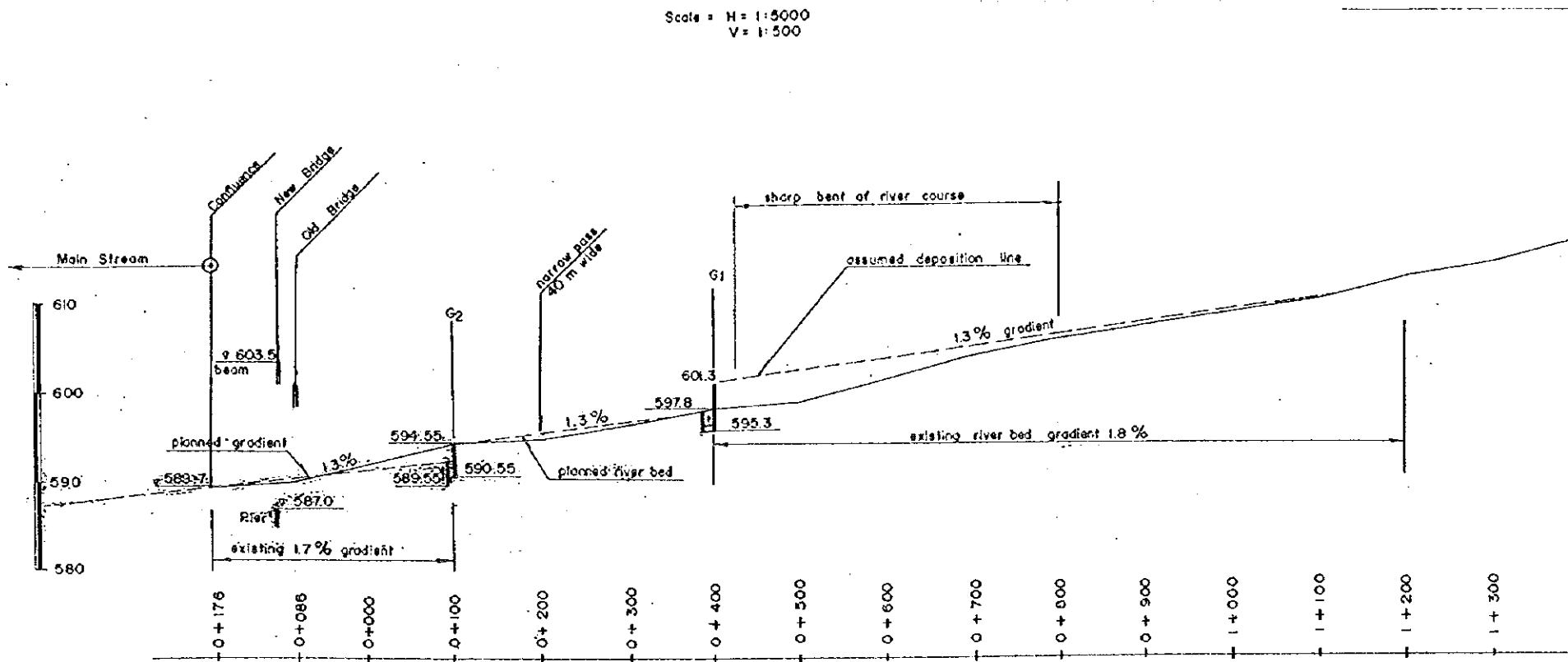


Fig. 3.1.2 Priority Plan for Namter

His Majesty's Government of Nepal  
 Ministry of Forest and Soil Conservation / Department of Soil Conservation  
 THE STUDY ON THE DISASTER PREVENTION PLAN  
 FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER  
 IN THE CENTRAL DEVELOPMENT REGION OF NEPAL.  
 JAPAN INTERNATIONAL COOPERATION AGENCY



His Majesty's Government of Nepal  
 Ministry of Forest and Soil Conservation/Department of Soil Conservation  
 THE STUDY ON THE DISASTER PREVENTION PLAN FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER IN THE CENTRAL DEVELOPMENT REGION OF NEPAL  
 JAPAN INTERNATIONAL COOPERATION AGENCY

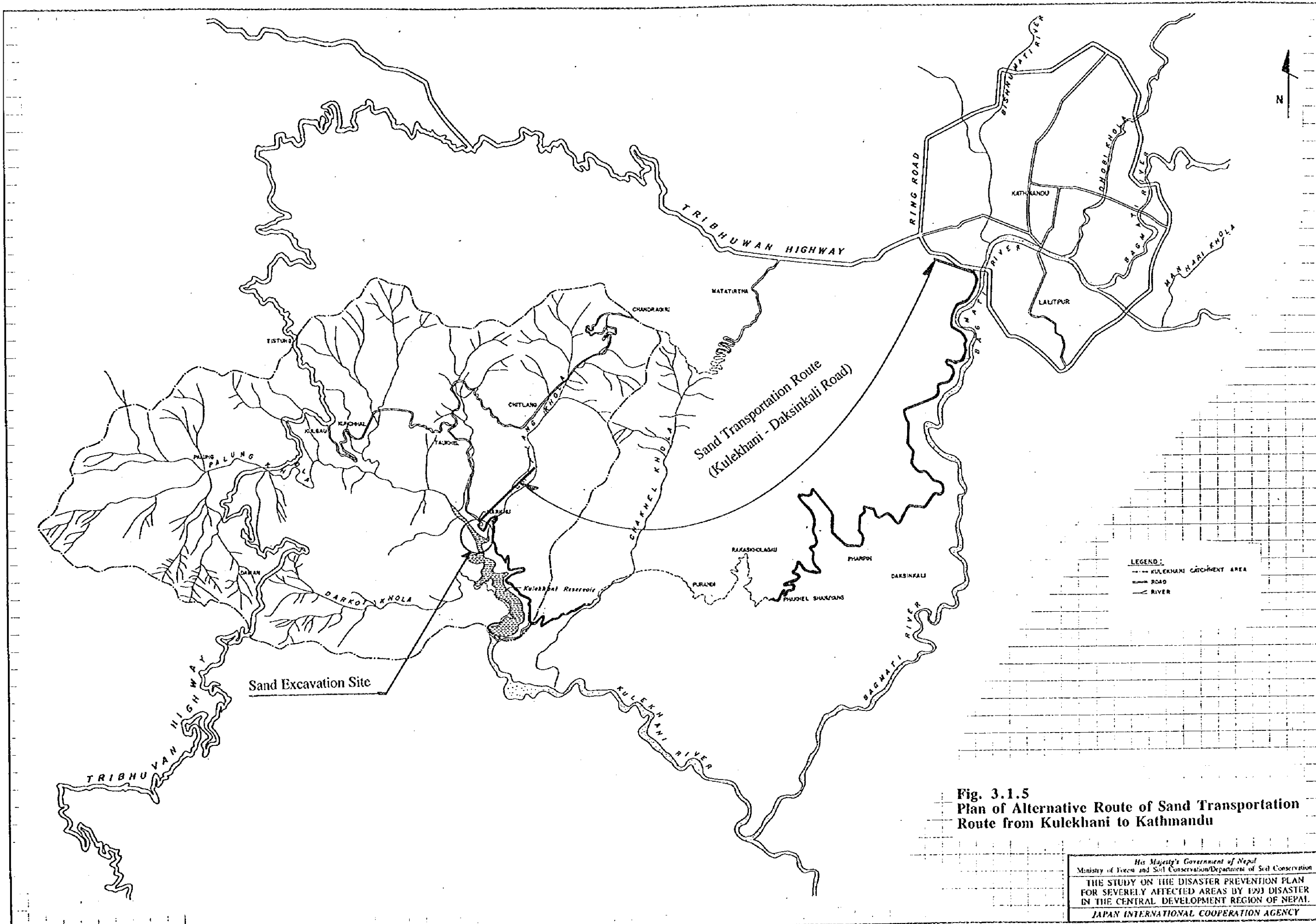


Notes  
Along the broken line of facilities  
May not be designed

0 50 100 200 300 400 METRES

Fig. 3.1.4  
Mahadevbesi Bridge

His Majesty's Government of Nepal  
Ministry of Forest and Soil Conservation/Department of Soil Conservation  
THE STUDY ON THE DISASTER PREVENTION PLAN  
FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER  
IN THE CENTRAL DEVELOPMENT REGION OF NEPAL  
JAPAN INTERNATIONAL COOPERATION AGENCY



**Fig. 3.1.5**  
**Plan of Alternative Route of Sand Transportation**  
**Route from Kulekhani to Kathmandu**

His Majesty's Government of Nepal  
 Ministry of Forest and Soil Conservation/Department of Soil Conservation  
 THE STUDY ON THE DISASTER PREVENTION PLAN  
 FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER  
 IN THE CENTRAL DEVELOPMENT REGION OF NEPAL.  
 JAPAN INTERNATIONAL COOPERATION AGENCY





**Table 5.2.1 Intangible Benefits in Phedigaon/Phatbazar**

S.N.	Category	Description of Intangible Benefits	Score
1	Community		
	1) Empowerment	People are empowered and take initiative for development activities through forming users groups and implementing subprojects.	★★★
	2) Efficiency	United as one, local resources are used effectively and efficiently.	★★
	3) Self Help	People realise the importance of self-help minds and wipe out their dependency attitude through users group activities.	★★★★
	4) Mutual Support	With forming a solid community, people help each other, which contributes to the improvement of living quality.	★★★
2	Women		
	1) Work Load	By increased income and afforestation, women's work load is reduced.	★
	2) Education Level	With more free time, women have more time for education and training.	★★
	3) Child Birth	Higher education leads to understanding of birth control.	★★★
	4) Safety in Child Birth	Higher education and awareness of sanitation contribute to safer delivery.	★★★
	5) Empowerment of Women	More income and higher education make women empowered.	★
3	Children		
	1) Work Load	By increased income and afforestation, children's work load is reduced.	★
	2) Education Level	With more free time, children have more time for attending school and doing homework.	★★
	3) Child Abuse	With less work load and higher income, children are not abused very much.	★★
4	General Issues		
	1) Migration	With flourishing economy around the area, more employment opportunities are available and there is little need for migration.	★★★
	2) Landlessness	Land reclamation and sabo works provide and secure the farmland for landless people and land owners.	★★★★
	3) Population Explosion	Higher education and higher sanitation/health care services contribute to changing people's understanding on reproduction and contain population explosion.	★★
	4) Environmental Conservation	The community control over the forest use and other natural resources helps to conserve the environment.	★★
	5) Sustainable Development	Conserving and effectively using environment by the community leads to attaining sustainable development.	★★
	6) Income Disparity	Increase in income in the area reduces income disparity between urban and rural areas.	★★★
	7) Unbalanced Growth	Too much concentration of development in urban areas is eased by rural development.	★★★
5	Disaster		
	1) Danger in Life	Sabo structures protect human lives from disasters.	★★★★
	2) Property Damage	Sabo structures protect private properties and public infrastructures from disasters.	★★★★
6	Economy		
	1) Regional Economic Development	The project implementation contributes to regional economic development.	★★
	2) Entrepreneurship	Economic development leads to emerging entrepreneurship among the people.	★★
	3) Market Economy	The market-oriented economic system prevails through development activities.	★
	4) Employment Opportunities	Economic development provides more employment opportunities.	★★★
7	Information		
	1) Information Network	Development leads to improvement of telephone and postal systems.	★★
	2) Information Imbalance	With improved information system, information imbalance between urban and rural areas is reduced.	★★
8	Health/Sanitation		
	1) Public Health Care	Development invites further public health care services.	★
	2) Private Health Care	Higher education and higher income improve the awareness of private health care.	★★★
9	Others		

Note: The more ★ marks there are, the better the situation is. (The five ★ marks is the maximum and one ★ mark is the minimum score.)

**Table 5.2.2 Intangible Benefits in Namtar/Tilar**

S.N.	Category	Description of Intangible Benefits	Score
1	Community 1) Empowerment 2) Efficiency 3) Self Help 4) Mutual Support	People are empowered and take initiative for development activities through consolidating the community. Local resources are used effectively and efficiently by developing a strong access to outside markets. People realise the importance of self-help minds and wipe out their dependency attitude. In a community, people help each other, which contributes to the improvement of living quality.	★★★★★ ★★★★ ★★★★★ ★★★★
2	Women 1) Work Load 2) Education Level 3) Child Birth 4) Safety in Child Birth 5) Empowerment of Women	By increased income and good road transportation, women's work load is With more free time, women have more time for education and training. Higher education leads to understanding of birth control. Higher education and awareness of sanitation contribute to safer child delivery. More income and higher education make women empowered.	★★★ ★★★ ★★★ ★★★ ★★
3	Children 1) Work Load 2) Education Level 3) Child Abuse	By increased income and good road transportation, children's work load is With more free time, children have more time to use for attending school and homework. With less work load and higher income, children are not abused very much.	★★★ ★★★ ★★★
4	General Issues 1) Migration 2) Landlessness 3) Population Explosion 4) Environmental Conservation 5) Sustainable Development 6) Income Disparity 7) Unbalanced Growth	With flourishing economy around the area, more employment opportunities are available and there is little need for migration. Land reclamation and sabo works secure the farmland for landless and land owners. Higher education and higher sanitation and health care services contribute to containing population explosion. The community control over the surrounding natural resources helps to conserve the environment. Community activities lead to attaining sustainable development. Increase in income in the area reduces income disparity between urban and rural areas. Too much concentration of development in urban areas is eased by rural development.	★★★★★ ★★★ ★★ ★ ★★★ ★★★ ★★★
5	Disaster 1) Danger in Life 2) Property Damage	Sabo structures protect human lives from disasters. Sabo structures protect private properties and public infrastructures from disasters.	★★★ ★★★
6	Economy 1) Regional Economic Development 2) Entrepreneurship 3) Market Economy 4) Employment Opportunities	The project implementation contributes to regional economic development. Economic development leads to emerging entrepreneurship among the people. The market-oriented economic system prevails through development activities. Economic development provides more employment opportunities.	★★★★★ ★★★ ★★★ ★★★
7	Information 1) Information Network 2) Information Imbalance	Development leads to improvement of telephone and postal systems. With improved information system, information imbalance between urban and rural areas is reduced.	★★★★★ ★★★★★
8	Health/Sanitation 1) Public Health Care 2) Private Health Care	Development invites further public health care services. Higher education and higher income improve the awareness of private health care.	★★★ ★★★
9	Others		

Note: The more ★ marks there are, the better the situation is. (The five ★ marks is the maximum and one ★ mark is the minimum score.)

**Table 5.2.3 Intangible Benefits in Chisapani**

S.N.	Category	Description of Intangible Benefits	Score
1	Community		
	1) Empowerment	People are empowered and take initiative for development activities through consolidating the community.	★★★
	2) Efficiency	Local resources are used effectively and efficiently by developing a strong access to outside markets.	★★
	3) Self Help	People realise the importance of self-help minds and wipe out their dependency attitude.	★★★
	4) Mutual Support	In a community, people help each other, which contributes to the improvement of living quality.	★★
2	Women		
	1) Work Load	By increased income and tapwater system, women's work load is reduced.	★★★★
	2) Education Level	With more free time, women have more time to use for education and training.	★★
	3) Child Birth	Higher education leads to understanding of birth control.	★★★
	4) Safety in Child Birth	Higher education and awareness of sanitation contribute to safer child delivery.	★★★
	5) Empowerment of Women	More income and higher education make women empowered.	★★
3	Children		
	1) Work Load	By increased income and tapwater system, children's work load is reduced.	★★★★
	2) Education Level	With more free time, children have more time to use for attending school and homework.	★★
	3) Child Abuse	With less work load and higher income, children are not abused very much.	★★
4	General Issues		
	1) Migration	With flourishing economy and reduction of fear against disasters around the area, there is little need for migration.	★★★★★
	2) Landlessness	Sabo works secure the farmland for landless and land owners.	★★
	3) Population Explosion	Higher education and higher sanitation and health care systems contribute to containing population explosion.	★★
	4) Environmental Conservation	The community control over the forest use and other natural resources helps to conserve the environment.	★★★
	5) Sustainable Development	Conserved environment and community activities lead to attaining sustainable development.	★★★
	6) Income Disparity	Increase in income in the area reduces income disparity between urban and rural areas.	★★★
	7) Unbalanced Growth	Too much concentration of development in urban areas is eased by rural development.	★★★
5	Disaster		
	1) Danger in Life	Sabo structures protect human lives from disasters.	★★
	2) Property Damage	Sabo structures protect private properties and public infrastructures from disasters.	★★
6	Economy		
	1) Regional Economic Development	The project implementation contributes to regional economic development.	★★★
	2) Entrepreneurship	Economic development leads to emerging entrepreneurship among the people.	★
	3) Market Economy	The market-oriented economic system prevails through development activities.	★
	4) Employment Opportunities	Economic development provides more employment opportunities.	★★
7	Information		
	1) Information Network	Development leads to improvement of telephone and postal systems.	★
	2) Information Imbalance	With improved information system, information imbalance between urban and rural areas is reduced.	★
8	Health/Sanitation		
	1) Public Health Care	Development invites further public health care services.	★
	2) Private Health Care	Higher education and higher income improve the awareness of private health care.	★★★
9	Others		

Note: The more ★ marks there are, the better the situation is. (The five ★ marks is the maximum and one ★ mark is the minimum score.)

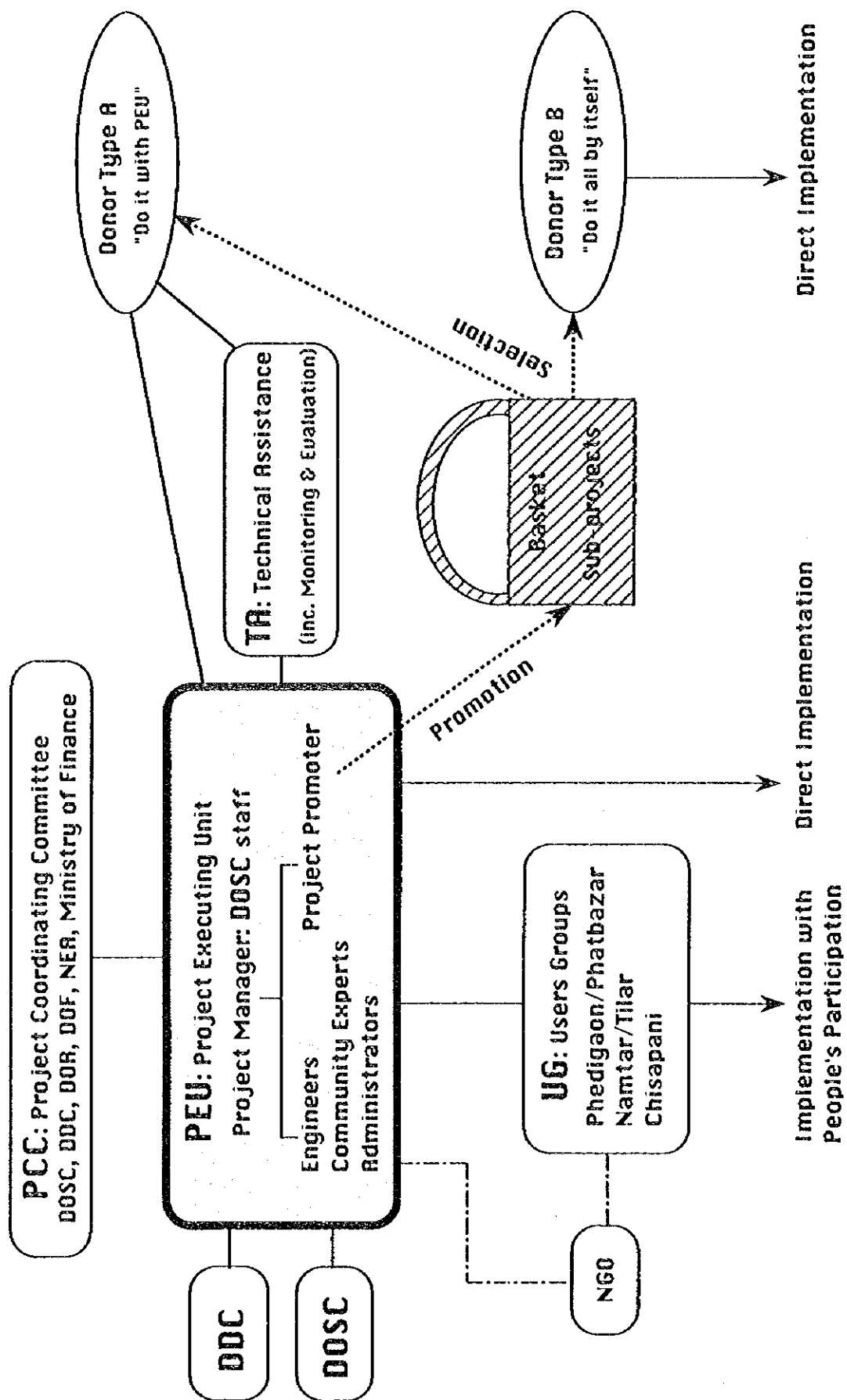
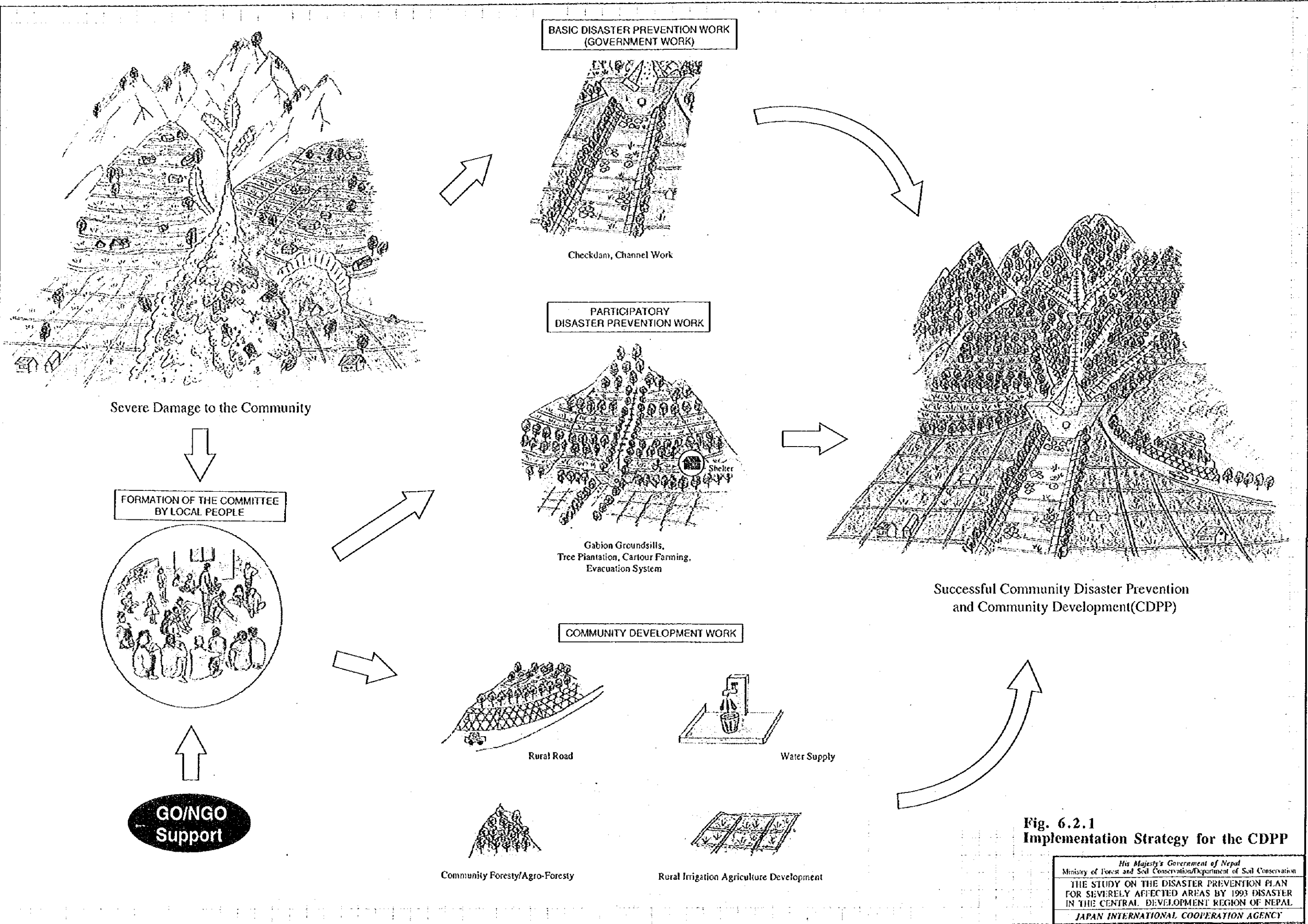


Figure 6.1.1 Institutional Arrangement








**Fig. 6.2.1**  
**Implementation Strategy for the CDPP**

*His Majesty's Government of Nepal*  
Ministry of Forest and Soil Conservation/Department of Soil Conservation  
THE STUDY ON THE DISASTER PREVENTION PLAN  
FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER  
IN THE CENTRAL DEVELOPMENT REGION OF NEPAL  
JAPAN INTERNATIONAL COOPERATION AGENCY



Work Item / Sub-project	Site	Structure ID No.	1997		1998		1999		2000		2001		2002		2003		2004		Remarks
			1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	
CDPP-Basic Disaster Prevention Project Phase-1 (Phedigaon and Chisapani)																			
1	Funding arrangement																		
2	Detailed design																		
3	Tendering																		
4	Construction																		
(a)	Preparatory works on Phedigaon																		
(b)	Sabo works on the Phedigaon	Dh-1D, 2D, Ph-3D, 2D																	
(c)	Sabo works on the Ghate Khola	Gh-6D-8D, Ph-2D																	
(d)	Preparatory works on Chisapani																		
(e)	Basic sabo works on Chisapani	Ch-1D, Dh-1D, 2D																	
CDPP-Basic Disaster Prevention Project Phase-2 (Namtar)																			
1	Funding arrangement																		
2	Detailed design																		
3	Tendering																		
4	Construction																		
(a)	Preparatory works	Namtar Na-2C																	
(b)	Multipurpose checkdam Na-1	Namtar Na-1D																	
(c)	Multipurpose checkdam Na-2	Namtar Na-2D																	
(d)	Checkdam Na-3	Namtar Na-3D																	
(e)	Consolidation works Na-4	Namtar Na-4D																	
(f)	Channel works Na-5	Namtar Na-5D																	

Financial arrangement :   
Detailed design :   
Implementation : 

**Fig. 6.2.2**  
**Implementation Schedule for**  
**Basic Sabo Project on CDPPs**

*His Majesty's Government of Nepal*  
Ministry of Forest and Soil Conservation/Department of Soil Conservation  
**THE STUDY ON THE DISASTER PREVENTION PLAN**  
**FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER**  
**IN THE CENTRAL DEVELOPMENT REGION OF NEPAL**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**



Sub-project	Sub-project ID No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Remarks
Phedigaon / Phatbazar CDPP																						
1	Basic Disaster Prevention Sub-program			///////																		
2	Participatory Disaster Prevention Sub-Programs																					
	(a) Channel works on Dhungakate and Chatte Khola		■																			
	(b) Farmland Reclamation			■																		
	(c) Community Disaster Evacuation System				■																	
	(d) Gully control works on Dh-3D-7D, Ch-1D-3D, Dhungakate and Chatte Khola																					
	(e) Hillside works																					
Chisapani CDPP																						
1	Basic disaster prevention sub-programs			///////																		
2	Participatory disaster prevention sub-programs																					
	(a) Community disaster evacuation system			■																		
	(b) Gully control works on Dharapani Khola																					
	(c) Hillside works																					
Construction of Basic Disaster Prevention Project: ■■■■■																						
Construction of Participatory Disaster Prevention Project: ■																						

**Fig. 6.2.3**  
**Implementation Schedule for Participatory Disaster Prevention Sub-projects of CDPPs**

*His Majesty's Government of Nepal*  
 Ministry of Forest and Soil Conservation/Department of Soil Conservation  
**THE STUDY ON THE DISASTER PREVENTION PLAN FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER IN THE CENTRAL DEVELOPMENT REGION OF NEPAL**  
 JAPAN INTERNATIONAL COOPERATION AGENCY



Table 6.2.1 List of Participatory Disaster Prevention Sub-programs

No.	CDPP Area	Sub-Project ID No.	Name of Sub-Project	Sector	Sub-project Features	Objectives	Sub-Project Cost	Implementation Agency
1	Phedigaon / Phatbazar CDPP	Ph-4D, 5D	Channel works on Alluvium fan Area	Sabo	1) Channel excavation and dry stone masonry on the Dhungakate and the Ghatte Khola on alluvium fan area. 2) Concrete ground sill on the upstream end of the rivers.	1) To fix river channel on the alluvium fan area. 2) To flush sediment / debris flow to the downstream 3) To realise farm land rehabilitation on the alluvium fan area	NRs.9,226,700	DPTC
		Dh-3D-7D Gh-1D-3D	Gully Control Work on the Dhungakate and the Ghatte Khola	Sabo	1) To construct series of gabion ground-sills on 9 tributaries	1) To prevent gully erosion and farmland failures. 2) To mitigate debris flow potential on the alluvium fan area,	NRs. 29,489,600	DOSC / Local people
		Dh-8D-10D Gh-4D, 5D	Hillside Works on the Dhungakate and the Ghatte Khola basin	Sabo/ Bioengineering	1) To provide rubble masonry and tree plantation along the edge of slope 2) To provide line seeding and jute net on the slope	1) To prevent landslide and soil erosion on the slope 2) To mitigate debris flow potential on the alluvium fan area	NRs.6,253,400	DOSC or DFO /Local people
		Ph-8D	Community Disaster Evacuation System with Multipurpose Shelter	Disaster manage. / Agriculture	1) To disseminate hazard map 2) To provide disaster prevention manual 3) To provide evacuation manual 4) To construct multipurpose shelter	1) To mitigate human damage by disaster 2) To save agriculture expenditure by potato seed storage ( multipurpose shelter)	NRs.3,000,000	NGO or DPTC / Local People
3	Chisapani CDPP	Ch-6D, 7D	Gully Control Works on the Dharapani Khola and Tributary	Sabo	1) To provide series of gabion ground-sills on the Dharapani mainstream and 2 tributaries	1) To prevent gully erosion and farmland failures.	NRs.13,479,900	DOSC / Local People
		Ch-10D	Hillside Works on the Farmland slope	Sabo/ Bioengineering	1) To provide rubble masonry and tree plantation along the edge of slope 2) To provide line seeding and jute net on the slope	1) To prevent landslide and soil erosion on the farmland	NRs.5,695,900	DOSC or DFO /Local people
		Ch-12D	Community Disaster Evacuation System with Multipurpose Shelter	Disaster manage. / Agriculture	1) To disseminate hazard map 2) To provide disaster prevention manual 3) To provide evacuation manual 4) To construct multipurpose shelter	1) To mitigate human damage by disaster 2) To save agriculture expenditure by potato seed storage ( 2 multipurpose shelters)	NRs.4,500,000	NGO or DPTC / Local People

Table 6.2.2 List of Community Development Sub-programs

No.	CDPP Area	Sub-Project ID No.	Name of Sub-project	Sector	Sub-project Features	Objectives	Sub-project Cost	Implementation Agency
1	Phedigaon / Phalbarar CDPP	Ph-1C	Formation of User's Committee	Institution	1) To formulate user's committee 2) To foster community organiser	1) To promote community development sub-programs by people's initiative. 2) To empower local people for sub-project implementation, operation and maintenance.	NRs. 500,000	NGO / DOSC
		Ph-6C	Farmland rehabilitation on Alluvium Fan Area	Disaster recovery	1) To remove debris material by bulldozer 2) To provide soil on the devastated area	1) To recover lost farm land by 1993 disaster. 2) To provide farm land to landless farmers	NRs. 5,000,000	DDC / Local people
		Ph-7C- 11C	Community Forestry on 5 Areas	Forest	1) To transfer government forest to user's group. 2) To manage and maintain the existing forest by local people	1) To promote sustainable use of forest resources. 2) To maintain existing forest in the community	NRs. 1,500,000	DFO / Local People
		Ph-14C	Agro Forestry Program on Private Farm Land	Agriculture / Forest / Soil conservation	1) To provide nursery of fruit / medicinal trees in the community 2) To encourage local people to plant trees on sloped farm land	1) Improve agriculture income, 2) Soil conservation on sloped land	NRs. 3,500,000	NGO / Local People
2	Namtar CDPP	Na-1C	Formation of User's Committee	Institution	1) To formulate user's committee 2) To foster community organiser	1) To promote community development sub-programs by people's initiative. 2) To empower local people for sub-project implementation, operation and maintenance.	NRs. 500,000	NGO / DOSC
		Na-2C	Improvement of Rural Road from Chynia to Namtar	Road improvement / Disaster prevention along Road	1) To provide slope protection measures on 5 areas. 2) To provide drainage along the road.	1) To pass the road during the rainy season 2) To encourage cash crop production in Namtar, 3) To stimulate rural economic activities	NRs. 4,739,000	NGO or DDC / Local People
		Na-3C	Rehabilitation of Irrigation Network	Agriculture / Disaster recovery	1) To rehabilitate the broken irrigation system for 50ha.	1) To recover the disaster damage 2) To improve agriculture income	NRs. 5,026,000	DIO / Local People
		Na-7C	Crop Diversification Program	Agriculture	1) To provide nursery and technical demonstration farm 1) To change cropping patten from cereals to cash crop (Garlic, Ginger)	1) To increase agriculture income 2) To stimulate rural economic activities	NRs. 2,500,000	NGO / Local People
		Na-8C	Micro-Hydropower Plant Installation	Rural electrification	1) To divert water from Checkdam Na-1 2) To construct micro-hydropower Plant (20kW)	1) To realise rural electrification 2) To collect electricity tariff and to save for community development activities	NRs. 7,836,000	NGO or MOLD / Local People
		Na-11C	VHF Wireless Telephone Installation	Communication	1) To install VHF telephone 2) To formulate user's committee for operation and maintenance	1) To improve communication measures for emergency case, 2) To improve agriculture marketing for getting market price information 3) To collect telephone fee from users and to save for development activities	NRs. 50,000	NTC and NGO / Local People
		Na-14C	WID through Sericulture Research	WID / Income generation / Environment	1) To provide vocational training class in school for girls in Class 9 and 10. 2) To provide sericulture research center in Namtar School.	1) To educate schoolgirls for sericulture technologies 2) To realise sericulture and disseminate in and around the community 3) To provide job opportunities for women	NRs. 1,000,000	NGO / Local People
3	Chisapani CDPP	Ch-1C	Formation of User's Committee	Institution	1) To formulate user's committee 2) To foster community organiser	1) To promote community development sub-programs by people's initiative. 2) To empower local people for sub-project implementation, operation and maintenance.	NRs. 500,000	NGO / DOSC
		Ch-4C	Community Forestry on Chuliban	Forest	1) To transfer government forest to user's group. 2) To manage and maintain the existing forest by local people	1) To promote sustainable use of forest resources. 2) To maintain existing forest in the community	NRs. 1,000,000	DFO / Local People
		Ch-2C	Water Supply Network Development	Water supply / Agriculture	1) To develop water pipe network, storage tank, and individual tank, and sprinkler	1) To attain efficient usage of limited water. 2) To connect water-tap for all houses 3) To realise sprinkler irrigation for vegetable farming	NRs. 3,070,000	NGO / Local People
		Ch-13C	Sloping Agriculture Land Improvement	Agriculture / Soil conservation	1) To level the farm land on the slope 2) To plant trees on the edge of sloped farm land with protection works	1) Soil conservation on sloped farmland 2) To provide livestock feed by tree plantation	NRs. 2,500,000	DFO or NGO / Local People
		Ch-14C	Agro Forestry Program on Private Farm Land	Agriculture / Forest / Soil conservation	1) To provide nursery of fruit / medicinal trees in the community 2) To encourage local people to plant trees on sloped farm land	1) Improve agriculture income, 2) Soil conservation on sloped land	NRs. 3,500,000	NGO / Local People











JICA