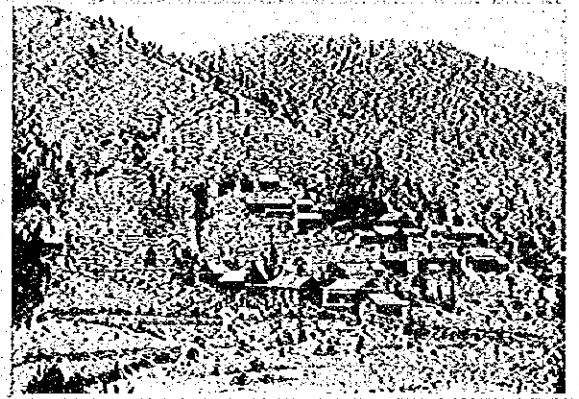
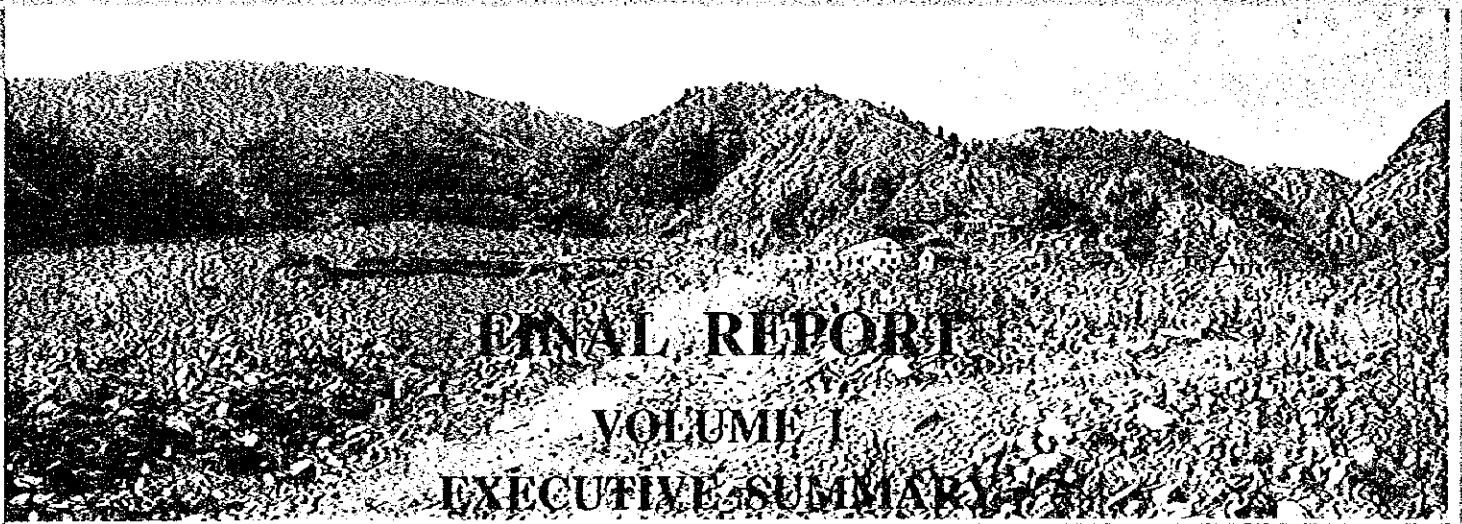



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**THE STUDY ON THE DISASTER PREVENTION PLAN  
FOR SEVERELY AFFECTED AREAS BY 1993 DISASTER  
IN THE CENTRAL DEVELOPMENT REGION OF NEPAL**



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**The Study  
on The Disaster Prevention Plan  
for Severely Affected Areas by 1993 Disaster  
in The Central Development Region of Nepal**

**Composition of Reports**

- Volume I : Executive Summary**
- Volume II : Main Report**
- Volume III : Supporting Report - I**  
**Annex-1 : Disaster Analysis**  
**Annex-2 : Disaster Prevention Plan**  
**Annex-3 : Hydrology**
- Volume IV : Supporting Report - II**  
**Annex-4 : Preliminary Design for Disaster Prevention Measures**  
**Annex-5 : Community Disaster Evacuation System**
- Volume V : Supporting Report - III**  
**Annex-6 : Participatory Community Development Plan**  
**Annex-7 : Agriculture**
- Volume VI : Supporting Report - IV**  
**Annex-8 : Community Forestry**  
**Annex-9 : Preliminary Design for Community Infrastructures**  
**Annex-10 : Environmental Studies**
- Volume VII : Data Book - I**  
**1. Questionnaires and answers for Households Sampling**  
**2. Minutes for Discussion with People**  
**3. Report on Geological Investigation of Kulekhani Reservoir**  
**4. Collected Meteo-hydrological Data**  
**5. Material for Seminar**  
**6. Manual for Mulberry Tree Plantation (Nepalese Version)**
- Volume VIII : Data Book-II**  
**1. Topographic Maps Produced by the Study**

**Exchange Rate**

The exchange rates used in this Study are:

NRs.55.75 = US\$1.00 = ¥109.1  
as of June, 1996



## PREFACE

In response to the request from His Majesty's Government of Nepal, the Government of Japan decided to conduct the Feasibility Study on the Disaster Prevention Plan for Severely Affected Areas by 1993 Disaster in Central Development Region of Nepal and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Kingdom of Nepal a study team headed by Mr. Tatsuro Terai of Nippon Koei Co., Ltd. associated with INA Corporation, three times between January 1996 to January 1997.

The team held discussions with the officials concerned of His Majesty's Government of Nepal, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of His Majesty's Government of Nepal for their close cooperation extended to the team.

March, 1997



---

Kimio Fujita

President

Japan International Cooperation Agency

March, 1997

Mr. Kimio Fujita  
President  
Japan International Cooperation Agency  
Tokyo, Japan

Dear Sir,

#### LETTER OF TRANSMITTAL

We are pleased to submit herewith the Final Report of the Study on The Disaster Prevention Plan for Severely Affected Areas by 1993 Disaster in The Central Development Region of Nepal.

The Report presents the results of the Feasibility Studies on the disaster prevention plans for three communities ( Phedigaon, Nantar and Chisapani), and two major infrastructures ( Mahadevbesi bridge, Kulekhani reservoir ) which were severely damaged by the 1993 disaster. For Community Disaster Prevention Plans, the plan is formulated not only to rehabilitate rural infrastructures, but also to encourage people's participation to disaster prevention activities and to stimulate rural economic activities. For Infrastructure Disaster Prevention Plans, the plan is formulated to consider maximum economic viability by the countermeasures.

The Report consists of eight volumes, the Summary, Main Report, four Sector Reports, and two Data Books. The Summary presents main outputs of the Study. The Main Report covers all the study results including analysis of the respective disciplines. The Sector Reports give additional and supporting information, and the Data Book provides data obtained from the basic field survey and investigations carried out in Nepal.

We would like to express our heartfelt thanks to the personnel of your Agency, Advisory Committee, the Embassy of Japan in Nepal, and also to officials and individuals of His Majesty's Government of Nepal for the assistance and advice extended to the Study Team. We sincerely hope that the results of this Study will contribute to the national and regional development of the country.

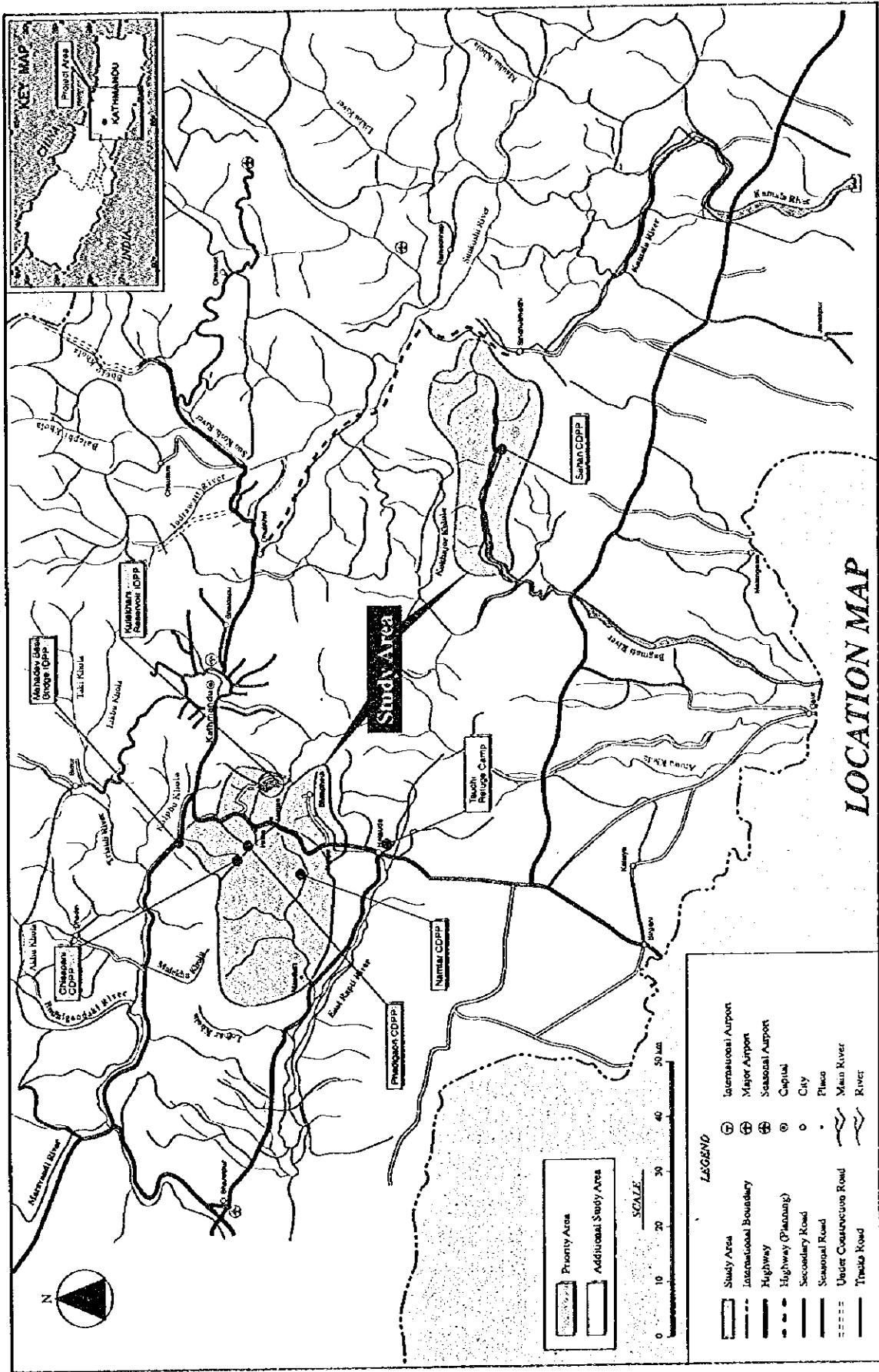
Yours faithfully,



---

Tatsuro TERAI  
Team Leader

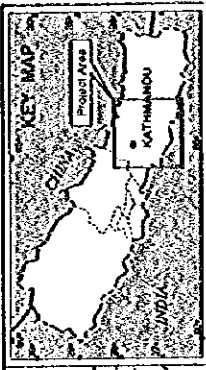
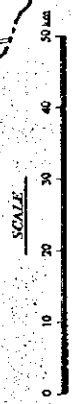
The Study on The Disaster Prevention Plans  
for Severely Affected Areas by 1993 Disaster  
in The Central Development Region of Nepal

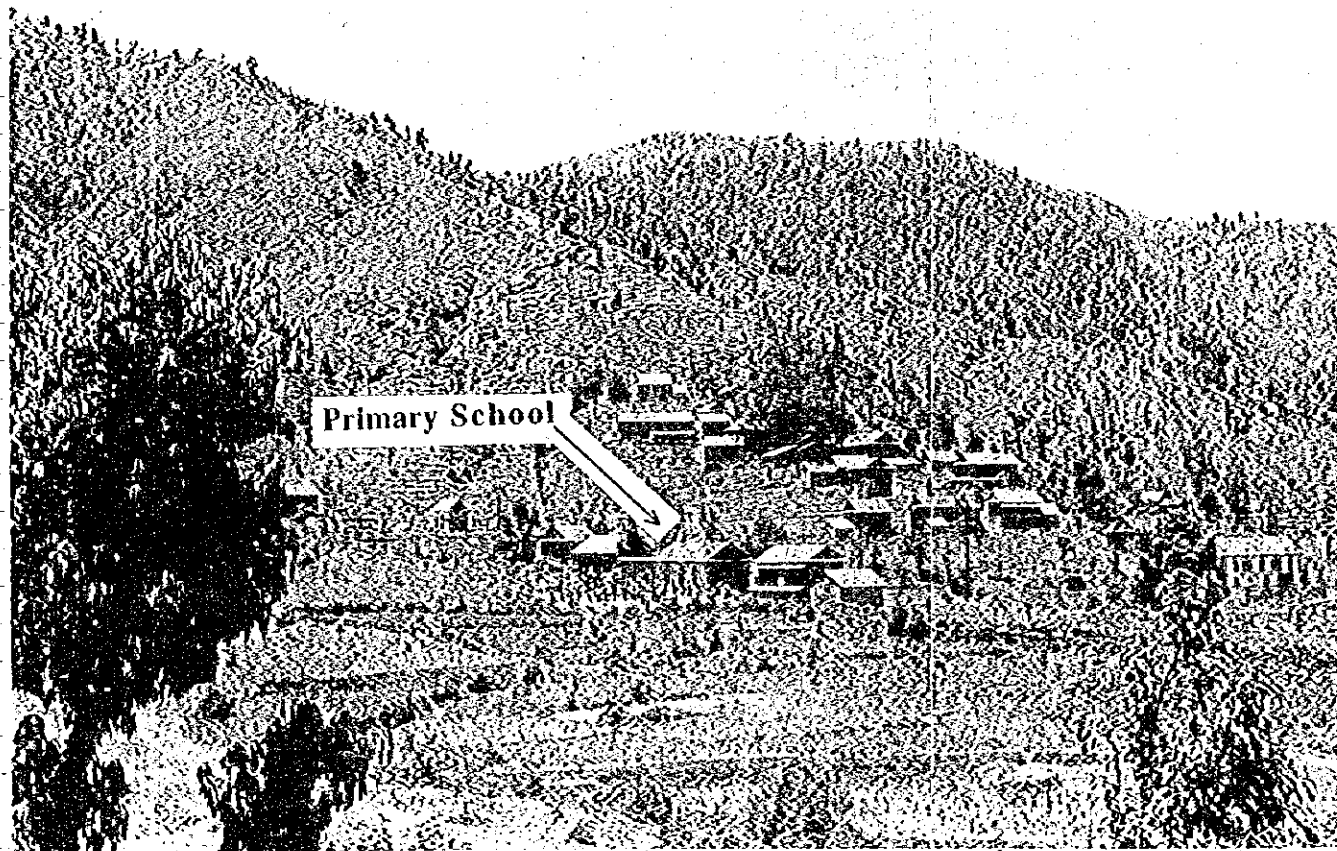


**LOCATION MAP**

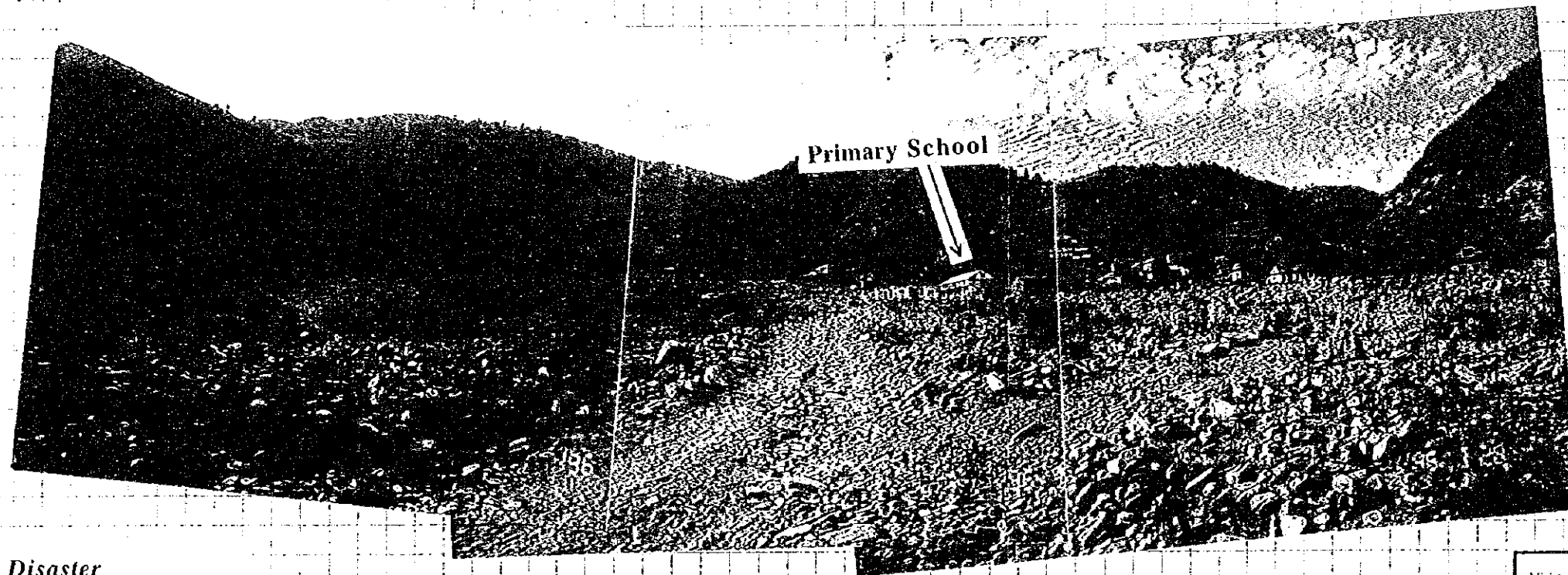
**LEGEND**

	Priority Area		International Airport
	Additional Study Area		Major Airport
	Study Area		Seasonal Airport
	International Boundary		Capital
	Highway		City
	Highway (Planning)		Town
	Secondary Road		Place
	Seasonal Road		Main River
	Under Construction Road		River
	Track Road		





*Before the Disaster  
(Taken by a villager in 1991)*

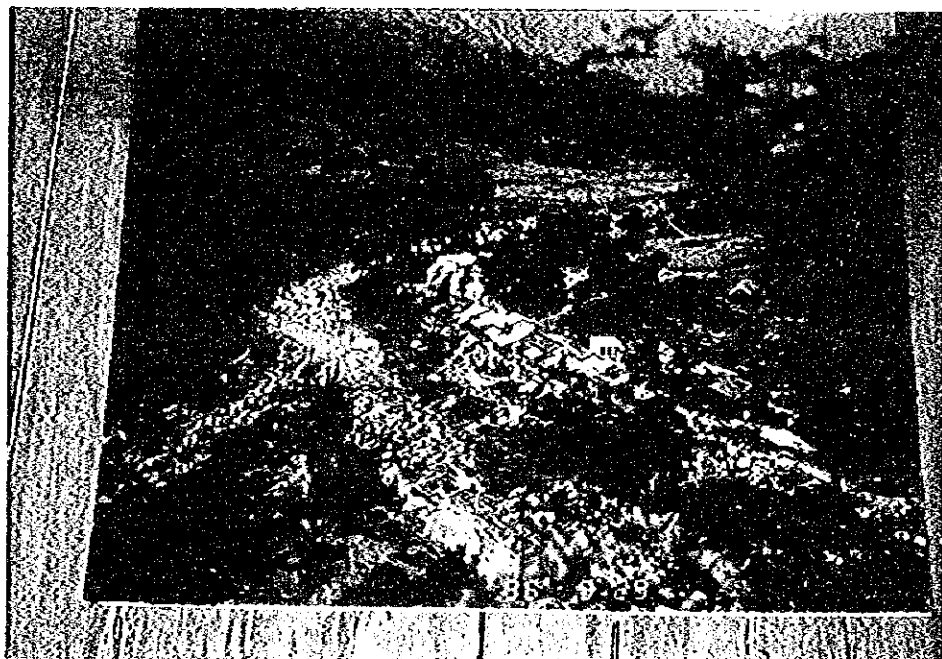


*After the 1993 Disaster  
(Taken by the Study Team in 1996)*

**Photo 1**  
**Contrast of Phedigaon Community before and after the 1993 Disaster**

*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**  
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**JAPAN INTERNATIONAL COOPERATION AGENCY**





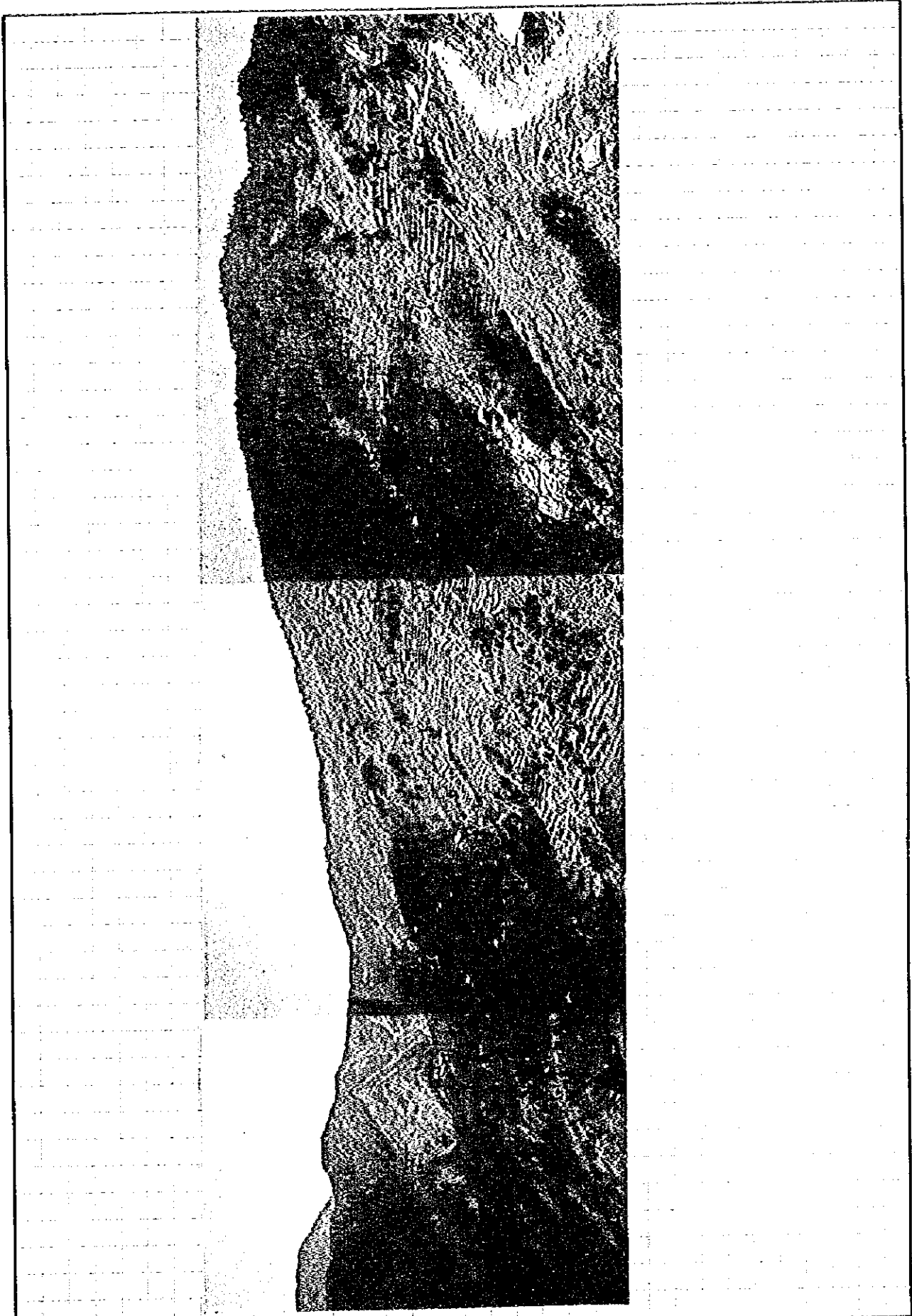
*An Overview of Namtar Bazar before the 1993 Disaster (Date is unknown)*



*An Overview of Namtar Bazar after the 1993 Disaster (Sep. 1996)*

**Photo 2**  
**Contrast of Namtar Community**  
**before and after the 1993 Disaster**

*His Majesty's Government of Nepal*  
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**Photo 3**  
**General View of Chisapani**

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**in Phedigaon**



**in Namtar**



**in Chisapani**

**Photo 4**  
**Discussions on the Study Team's Plan**

*His Majesty's Government of Nepal*  
Ministry of Forest and Soil Conservation/Department of Soil Conservation  
**THE STUDY ON THE DISASTER PREVENTION PLAN  
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at Phedigaon (16 January, 1997)



at Namtar (17 January, 1997)

Photo-5 Seminar of Transfer Technology at Project Site

*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  
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## OUTLINE OF THE STUDY

### 1. Background

On July 19 to 21, 1993, an unprecedented disaster by floods, landslides, and debris flows occurred and severely damaged the Central Development Region of Nepal, killing about 1,500 people and destroying the national infrastructures such as Kulekhani Dam and its hydropower stations, Tribhuvan and Prithivi Highways, and so on.

The damage to the communities was also quite serious. About 500,000 persons suffered from the damage to rural infrastructures such as buried farmland and disconnected rural roads. Many people have lost their houses and farmland, and families. Although three years have passed after the disaster, they are still suffering from the damage without farmland and job opportunities. Moreover, such damaged communities are still dangerous to future disasters since unstable debris remaining along river courses and hill slopes can be easily collapsed and flown down to the communities triggered by even a small storm. Even they stay in the high hazardous areas and some people wishes to resettle somewhere, they are forced to stay there due to financial constraints.

### 2. Objectives of The Study

The objectives of the Study are:

- (1) To investigate 15 areas and to select 5 severely affected areas by the disaster of July 1993 to form disaster prevention plans in the upper basins of Bagmati, East Rapti and Trisuli Rivers. The following matters should be taken into consideration:
  - a) Disaster prevention plans of the community which are not only to rehabilitate rural infrastructures, but also to encourage people's participation to disaster prevention activities and to stimulate rural economic activities. Improvement of the women's situation shall be also considered. This is called Community Disaster Prevention Plans, hereinafter as "CDPP" in the Study.
  - b) Disaster prevention plans for major infrastructures such as Kulekhani Hydropower Stations and Tribhuvan and Prithivi Highways shall not contain massive structures to prevent huge disasters, but appropriate technologies in Nepal aiming at the maximum economic viability with the concept of disaster management and mitigation are considered. This is called Infrastructure Disaster Prevention Plans, hereinafter as "IDPP" in the Study.
- (2) To transfer relevant planning and designing technologies to the Nepalese counterpart in the course of the Study.

### 3. Study Area

The Study Area is shown in the location map. The five priority areas to carry out feasibility studies and one additional area to continue the study were selected in the steering committee in February, 1996 as shown below:

- 1) Phedigaon/Phatbazar CDPP in Makwanpur District,
- 2) Namtar/Tilar CDPP in Makwanpur District,

- 3) Chisapani CDPP in Makwanpur District,
- 4) Mahadev Besi Bridge IDPP in Dhardin District, and
- 5) Kulekhani Watershed IDPP in Makwanpur District.

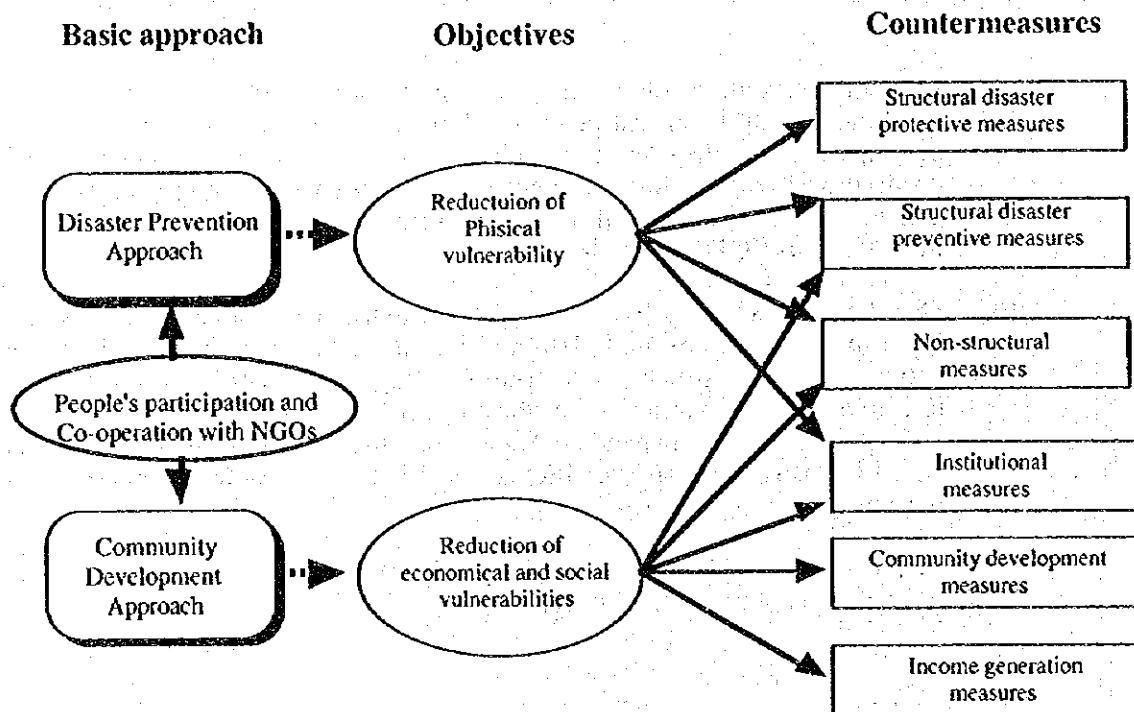
#### 4. Outline of The Proposed Plan

##### 4.1 Basic Concept of The Study

Disaster Prevention Project is generally consisted of the disaster protection or prevention measures such as checkdams, slope stabilisation works, gully control works and so on. The disaster prevention plan formulation is usually carried out based on the disaster potential in the area and the scale of the countermeasures are designed to be balance with the estimated scale of the disaster. Such approach is however very costly particularly for Nepal. The natural hazard potential in Nepal is very high and if the traditional disaster prevention approach is taken for Nepal, the proposed structural measures would be quite massive and it could not be realised in the financial viewpoints.

Taking into account such conditions in Nepal, the basic concept for the disaster prevention plan formulation in the Study are to minimise the structural disaster prevention measures, and to be covered with the non-structural measures or disaster preventive measures by appropriate technologies for the disasters beyond the design scale. At the same time, the community is to be strong against the further disasters by reducing social and economic vulnerabilities by providing the community development measures.

Along with the above basic concepts in the Study, two different approaches are taken to formulate the CDPP in the Study. They are disaster prevention approach and community development approach as shown in the following figure:



Basic Approach for the CDPP

Disaster prevention approach is mainly concerned with the potential of natural hazard in the community. The measures are assessed based on the results of the hazard analysis in the viewpoints of topography, geology, meteorology, land use, and so on. Based on the

estimated natural hazard potential, the countermeasures to prevent, mitigate, and evacuate from disasters will be proposed.

Community development approach is mainly concerned with the vulnerability of the community which is damaged by natural hazard. The measures are assessed based on the vulnerability assessment of the people in the view of economic and social conditions. The countermeasures will be proposed to empower the people to recover from and manage by themselves disasters.

#### 4.2 *Proposed Disaster Prevention Plan*

Along with the proposed basic concept of the Study above, the disaster prevention plans for the five priority areas are formulated. The proposed disaster prevention plans are consisted of the three different types of the measures, which are basic disaster prevention measures, participatory disaster prevention measures and community development measures. Integration of the three different measures would be the only solution to make less vulnerable community against the further disasters. The concepts of the each type of the countermeasures are as summarised below:

The basic disaster prevention project is defined as "The Frame Project" to recover the damaged community and to form the basic frame of the less vulnerable community against the further disasters. The basic disaster prevention project is therefore mainly composed of the structural protective measures, which is rather costly and it is difficult to manage by the peoples' group themselves for their funding arrangement and construction. It is recommended that the government shall take responsibly to promote and implement such basic disaster prevention projects so that the basic disaster prevention schemes are essential to form the less vulnerable communities against the further disaster.

The participatory disaster prevention schemes are 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 less costly 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 GO or NGO 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.

The community development schemes are mainly carried out under the initiative of the users' 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 GO or NGO for the financial or technical assistance by request of the users' committee.

the components of the disaster prevention plan for respective area is summarised as follows:



No.	Project Area	Basic Disaster Prevention Measures	Participatory Disaster Prevention Measures	Community Development Measures
1	Phedigaon/Phatbazar CDPP	a) Two checkdams on Dhungakate Khola, b) Three groundsills and a coffering dike on Ghatte Khola	a) Gully control works on upper part, b) Hillside works on upper part, c) Channel Works on Alluvium fan area d) evacuation system and multipurpose shelter	a) Formation of users committee, b) Community forestry program for 5 areas, c) Agro forestry on private farmland, d) Land reclamation on alluvium fan area
2	Namtar/Tiral CDPP	a) Two checkdams on Manhari Khola, b) Check dam on Syarse Khola, c) Groundsill and channel works on Manhari Khola	None	a) Formation of users' committee, b) Rural road improve, c) Irrigation rehabili. d) VHF telephone, e) Eri-silkworm rearing, f) cash crop promotion, g) micro-hydropower
3	Chisapani CDPP	a) Checkdam on Chisapani Khola, b) Two checkdams on Dharapani Khola,	a) Gully control works on Dharapani Khola b) Hillside works, c) Evacuation system with multipurpose shelter,	a) Formation of users' committee, b) Potato seed storage, c) Water supply network, d) community forestry at Chuli Ban, e) Sloped Agriculture Land Technology introduction, f) Agro-forestry on private fam land.
4	Mahadev Besi Bridge IDPP	a) Two groundsills	a) Spur dikes with bio-engineering support b) Riverside park	None
5	Kulekhani Reservoir IDPP	a) Procurement of excavation equipment	a) Improvement of Kulekhani-Daksinkali road	a) Construction of Kulekhani-Daksinkali road

## 5. Project Cost

Project cost is estimated based on the three different mode of implementation by each subprojects, which are International Competitive Bidding (ICB) basis, Local Competitive Bidding (LCB) basis and Peoples' Participation Program (PPP) basis. The project cost for each CDPP and IDPP are summarised as follows:

No.	Project Name	Project Cost
1	Phedigaon / Phatbazar CDPP	NRs. 111,688,100
2	Namtar / Tiral CDPP	NRs. 293,496,500
3	Chisapani CDPP	NRs. 77,231,300
4	Mahadev Besi Bridge IDPP	NRs. 92,247,200
5	Kulekhani Reservoir IDPP	NRs. 352,261,700

## 6. Project Evaluation

### 6.1 Economic Evaluation

The EIRR, the NPV and the B/C (the benefit cost ration) of the proposed CDPPs as well as the IDPPs are shown as follows. For calculation the NPV and the B/C, the discount rate of 10% is 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	Mahadev Besi Bridge	14.90	27,992,616	1.49
5	Kulekhani Reservoir	24.67	628,296,112	3.61

Except for Chisapani, at least positive benefits are obtained. Namtar/Tilar gives the best result for the CDPPs while Chisapani gives a negative result. The EIRR for Mahadev Besi Bridge and Kulekhani reservoir indicate high economic viability.

### 6.2 Impact Analysis

Impact analysis are carried out to assess the intangible benefits by implementation of the CDPP. In the case of the CDPP, the intangible benefit is rather important than the economic evaluation so that the major objectives of the project is to be empower the community as well as people by the various activities.

According to the results, the CDPPs are expected to distribute the project benefit to landless people in Phedigaon, to strengthen the rural institution in Namtar, and to encourage the local people to continue the agriculture activities and to decrease women's load in Chisapani.

### 6.3 Environmental Impact Assessment

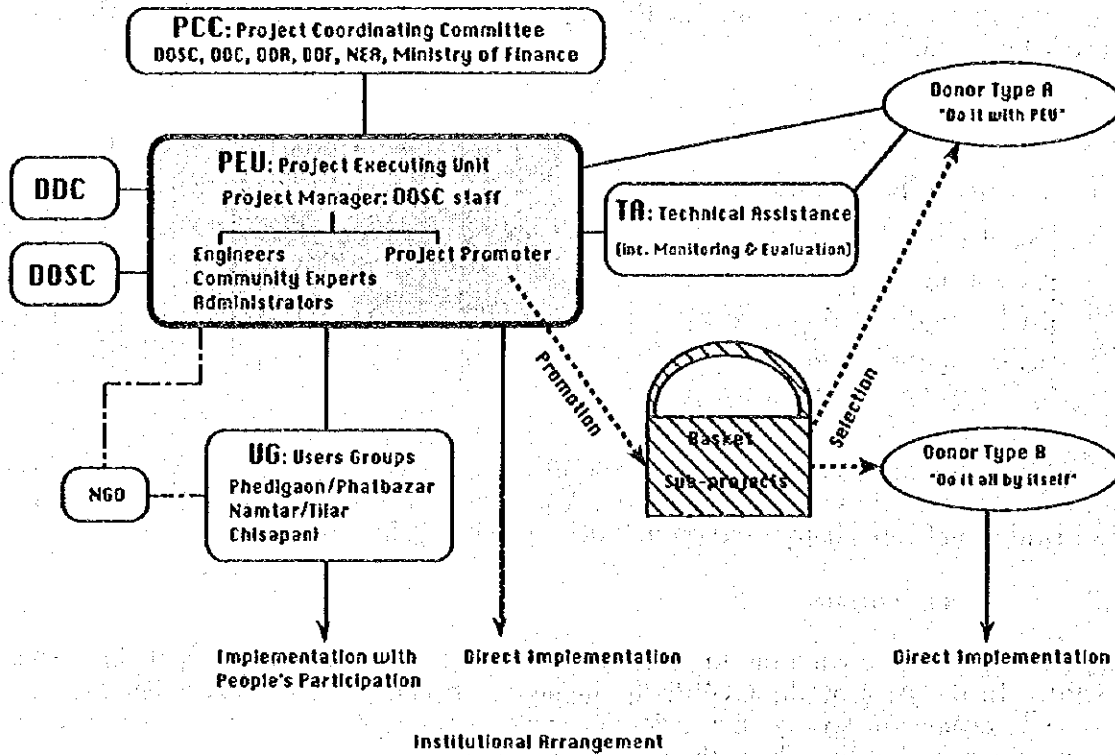
Environmental impact assessment was carried out for the five priority areas and it was concluded that all the proposed plans are less negative environmental impacts but they would have rather positive environmental impacts such as social environment and forest conservation and so on. However, the following actions are recommended to provide as the environmental measures at the implementation stage.

- (1) For Namtar CDPP, it is worried that the construction of check dams will prevent the migratory fishes from moving upstream or downstream of the river. Considering to the above it is recommended to release young fishes to the upstream of check dams.
- (2) For Kulekhani IDPP, it is worried that sand excavation from the reservoir may be influence to the existing aqua-culture activities in the reservoir. The detailed EIA and discussion with the concerned agencies are recommended prior to the implementation.

## 7. Implementation Program

The DOSC and the Study Team discussed about institutional arrangement and came up with the conclusion whose diagrammatic outlook is shown below. 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 the DOSC, as a leading agency of the IMG for implementation. The following is the explanation of each component in the diagram.



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EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Background

On July 19 to 21, 1993, an unprecedented disaster caused by floods, landslides, and debris flows occurred and inflicted severe damage to the Central Development Region of Nepal, killing about 1,500 people and destroying national infrastructures such as the Kulekhani Dam and its hydropower stations, Tribhuvan and Prithivi Highways, and so on.

The damage to the communities was also quite serious. About 500,000 people suffered from the damage to rural infrastructures such as buried farmland and disconnected rural roads. Many people lost their houses and farmland, and families. Although three years have passed since the disaster, they are still suffering from the damage due to deprivation of farmland and job opportunities. Moreover, such damaged communities are still in a dangerous condition because they are being subject to future disasters since unstable debris remaining along river courses and hill slopes may easily collapse and flow down, if triggered by even a small storm. Although some people living in the highly hazardous areas wish to resettle somewhere, they are forced to stay there due to financial constraints.

Urgent remedial measures to the damaged infrastructures have been carried out and major infrastructures such as the Kulekhani Hydropower Stations, Tribhuvan and Prithivi Highways have been rehabilitated and are currently under operation. However, there are still many remedial measures to be done in order to mitigate damage which might be caused by similar natural phenomena in the future.

Under such conditions, His Majesty's Government of Nepal (HMG/N) requested the Government of Japan (GOJ) for technical assistance for "the Study on the Disaster Prevention Plan for Severely Affected Areas by 1993 Disaster in the Central Development Region of Nepal" in October 1994.

Considering that there are many people still in difficulties in their living and recognising that disaster prevention is essential for the national and rural socio-economic development, GOJ has decided to cooperate with HMG/N in carrying out the Study.

## 1.2 Objectives of the Study

The objectives of the Study are:

- (1) To investigate 15 areas and select 5 areas severely affected by the disaster of July 1993 to formulate disaster prevention plans for the upper basins of the Bagmati, East Rapti and Trisuli Rivers. The following matters should be taken into consideration:
  - a) Disaster prevention plans for the communities should not only aim at rehabilitating rural infrastructures, but also at encouraging people's participation in disaster prevention activities and at stimulating rural economic activities. Improvement of the women's situation shall be also considered. These are called Community Disaster Prevention Plans ("CDPP") in the Study.
  - b) Disaster prevention plans for major infrastructures such as the Kulekhani Hydropower Stations, Tribhuvan and Prithivi Highways shall not contain massive structures to prevent huge disasters, but technologies appropriate to Nepal and aiming at the maximum economic viability with the concept of disaster management and mitigation are to be considered. These are called Infrastructure Disaster Prevention Plans ("IDPP") in the Study.
- (2) To transfer relevant planning and designing technologies to the Nepalese counterpart in the course of the Study.

## 1.3 Study Area

The Study Area is shown in the location map. Five priority areas were selected for execution of feasibility studies and one additional area for continuation of the Study as shown below:

- 1) Phedigaon/Phatbazar CDPP in Makwanpur District,
- 2) Namtar/Tilar CDPP in Makwanpur District,
- 3) Chisapani CDPP in Makwanpur District,
- 4) Mahadevbesi Bridge IDPP in Dhardin District, and
- 5) Kulekhani Reservoir IDPP in Makwanpur District.

In addition, the Community Disaster Prevention Plan for Sahan Village, Sindhuli District was conducted in compliance with a strong request from HMG/N. The study for Sahan is, however, only preliminary without topographic survey, cost estimate as well as environmental impact assessment (EIA).

Furthermore, it was additionally proposed to establish a vocational training centre at Tsuchi Disaster Refugee Camp in Makwanpur District. In the course of the Study, the Study Team has visited the camp many times, and found that the living conditions in the camp are quite severe due to less job opportunities. Many refugees have actually no farmland nor job opportunities though they have been given houses in the camp by a Taiwanese NGO group. The Study Team has assessed current problems and possible solutions, thereto, then finally proposed to install a vocational training centre for eri-silk spinning at Tsuchi refugee camp.

## 2. BASIC CONCEPT OF THE STUDY

### 2.1 Basic Concept

If disaster prevention measures are provided in the areas in which the people have no experiences of disasters, there are less possibilities to encourage the people's participation as well as to promote economic development through the disaster prevention program. The people in such areas do not recognise the hazard potential and they do not fear disasters.

Another issue which the Study Team has taken into account is how to encourage the people to participate in and operate the disaster management system and to recover from the damage by future disasters by themselves. The UNDP commented that "A strong economy must be the best defence against disasters," in their disaster management training manuals. The Study Team fully agrees with the concept of disaster prevention, and encouraging community development must be one of the best disaster prevention measures by which the vulnerability of society is reduced.

In addition, the Study Team fully understands that nobody is interested in implementing the structural disaster prevention works without any economic advantage, but if there is a clear economic advantage in the disaster prevention activities, they will be realised. Based on the above circumstances, all the structural disaster prevention measures shall be assessed in the feasibility study. The disaster prevention works will bring about various benefits, tangible and intangible. In the Study, mainly direct benefits of disaster prevention activities will be taken into account.

For example, the land damaged by a disaster such as debris flow and bank erosion can no more be utilised for farming purpose. The disaster prevention with rehabilitation measures, however, can make it productive again. That is the direct benefit of disaster prevention activities. In other cases, if most people are fully discouraged by the disaster and hope to migrate to other areas, only disaster prevention measures can encourage them to stay there and continue farming activities, which must be a benefit of the disaster prevention measures.

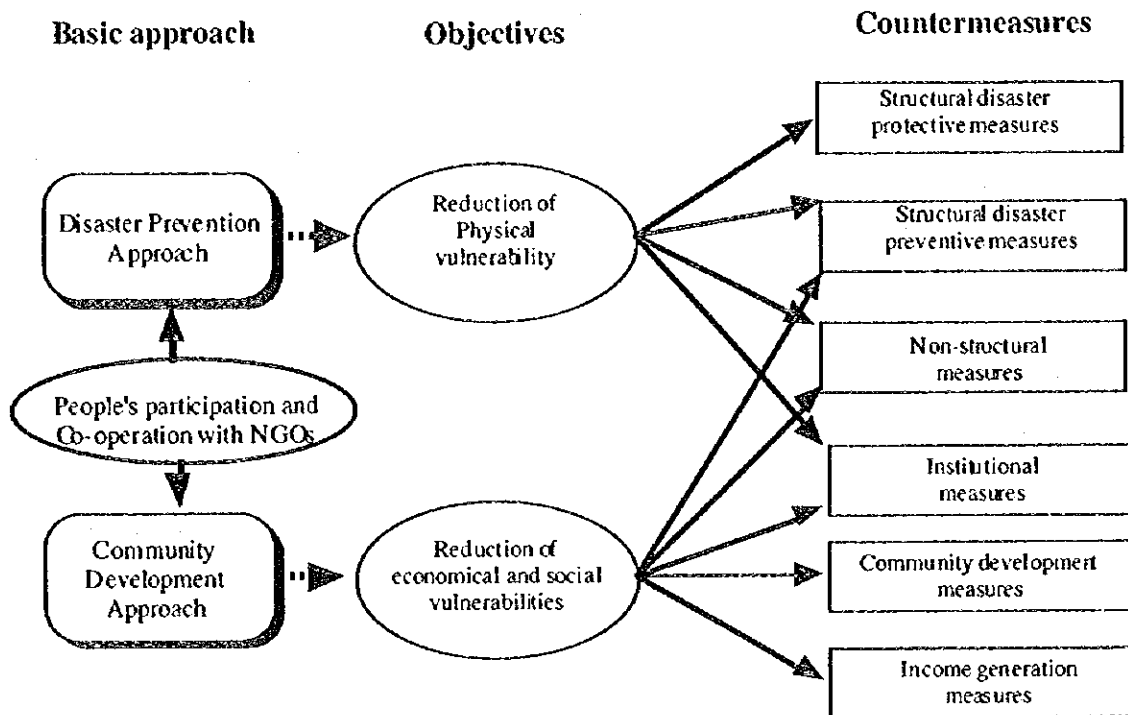
Taking into account the above current activities and background regarding disasters, the basic concepts are proposed in the Study as follows:

- (1) "Disaster prevention through disasters"
- (2) "Disaster prevention for development"
- (3) "Community development under people's initiative"

### 2.2 Basic Approaches to the Plan Formulation

Along with the above basic concepts of the Study, two different approaches were taken to formulate the CDPP in the Study. They are disaster prevention approach and community development approach as shown in the following figure:





Basic Approach for the CDDP

The disaster prevention approach is mainly concerned with the potential of natural hazard in the community. The measures were assessed based on the results of the hazard analysis from the viewpoints of topography, geology, meteorology, land use, and so on. Based on the estimated natural hazard potential, the countermeasures to prevent, mitigate, and evacuate from disasters were proposed.

The community development approach is mainly concerned with the vulnerability of the community which is damaged by natural hazard. The measures were assessed based on the vulnerability assessment of the people in terms of economic and social conditions. The countermeasures were proposed to empower the people to recover from and manage disasters by themselves.

Details of both approaches are explained in the following subsections:

### 2.2.1 Disaster Prevention Approach

In mountainous areas, the natural slopes sometimes become unstable due to topographical and geological activities, and natural hazard phenomena such as failure, landslide, debris flow occur. In such areas debris activation is generally called "mass movement", which is just a part of natural process of land formation. However, once this phenomenon happens in human society, and threatens human life and/or properties, it would be called "disaster".

To prevent such disasters, there are basically two kinds of approaches as follows:

- (1) To prevent or mitigate the natural hazard potential before the condition of natural phenomena becomes critical,

- (2) To protect the objective human society against disasters under the critical condition of natural hazard phenomena.

The former approach is called "Preventive measure" or "Indirect measure" which will be taken before the condition of natural phenomena becomes critical. The latter is called "Protective measure" or "Direct measure" which will be taken against the critical condition of natural hazard phenomena in human society. Sabo planning is generally considered the best combination of both approaches to prevent disasters in the long term. In this Study also, both measures are taken for the CDPP and IDPP formulation.

In the course of the Study, HMG/N requested to apply the bio-engineering disaster prevention measures as much as possible instead of the structural measures. Bio-engineering measures includes vegetated riprap and gabion, sod facing on the slope, tree-planting along river bank and edge of contour farm, and so on.

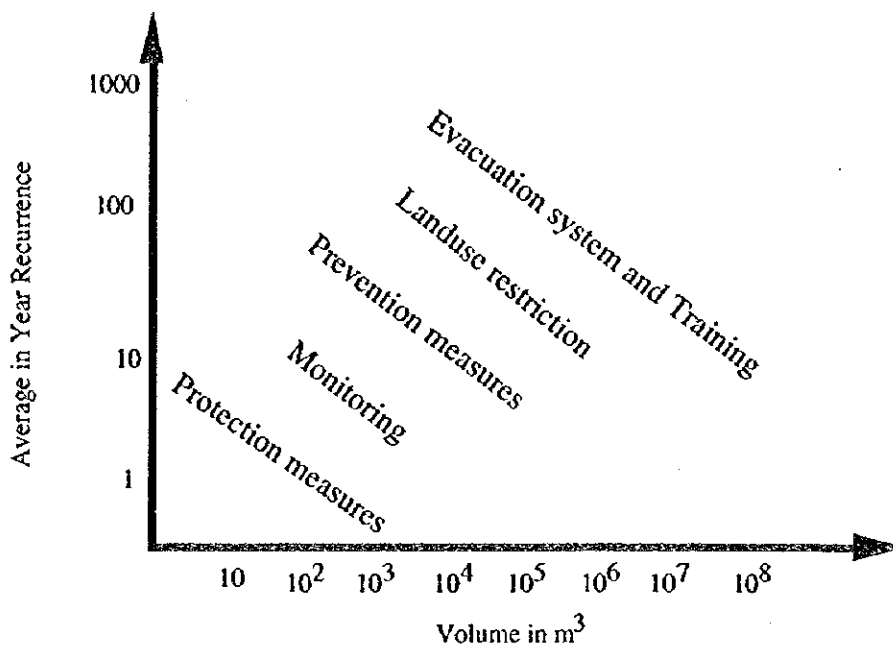
Based on the results of detailed field investigation, the Study Team felt that the non-structural preventive measures such as afforestation and soil conservation measures can be applied only in limited places in which the slope stability is still guaranteed. Once the slopes or gullies became unstable, foundation works as structural preventive measures would be required prior to the non-structural preventive measures. On the other hand, the areas in which non-structural preventive measures are applicable, are usually attractive as productive areas for sloped agriculture activities, or sources of firewood or pasture. Then, the candidate areas for non-structural preventive measures almost overlap the potential areas for community development. With regard to the land availability and development potential of the community, the area for non-structural preventive measures will be treated in the community development aspects with due attention to the environmental impact and not concerned with the disaster prevention planning.

In addition to the above measures, non-structural disaster prevention measures were applied to formulate the disaster prevention plan. Non-structural disaster prevention measures include hazard map dissemination, evacuation and monitoring systems, land use regulation, and so on. The measures are generally less costly and proposed to cover the effect beyond the structural measures.

Accordingly, the disaster prevention plan in the Study was formulated basically according to the following concepts:

- (1) To propose minimum structural protective measures to be undertaken by the Government;
- (2) To apply non-structural protective measures to be undertaken with the people's participation to cover the effects beyond the structural protective measures; and
- (3) To propose structural preventive measures with appropriate technologies to be applied with the people's participation.

The concepts of the three measures of disaster prevention approach are shown in the following schematic figure:



Schematic Concept of Disaster Prevention Measures

### 2.2.2 Community Development Approach

In the discussion made so far, the community development approach is restricted to the people's participation and the integration with technical disaster prevention plans, but this is not the end of the whole approach. The aspect of regional development is also very important in a sense that it helps to generate jobs and income, which will contribute to community development by upgrading the living standard and reducing women's burden. The ultimate goal of any public project is to make people better off. Disaster prevention projects are for making people's living better, not for preventing disasters themselves. In the Study, regional development is considered as one of the important components in the community disaster prevention plan. Successful regional development programs will improve people's living standard and contribute indirectly to disaster prevention in many ways. With increased income, women will not have to work hard to collect firewood because they can afford to use kerosene, which will deter deforestation, thus prevent disasters and relieve women from painstaking works as well.

By regional development it is meant that economics is taken into account for development of a region. In community development or rural development, sociology and anthropology are mainly used among disciplines in social sciences. On the other hand, in regional development, economics is the major discipline used. Therefore, for the CDPP, an interdisciplinary approach - sociology, anthropology, and economics - is to be taken.

The reduction of vulnerability of the community to disasters is also important. Through community development, it is expected that vulnerability will be reduced and people will get stronger against disasters. One of important aspects in disaster prevention is to reduce vulnerability of people/community to disasters. If people are no longer vulnerable to disasters, they will be able to recover from disasters by themselves, or they can recover and even develop their living conditions from the aftermath of disasters. Although the reduction of vulnerability of the community to disasters does not directly prevent disasters, it should be regarded as one of important aspects in disaster prevention.

In the Study, the community development plan was formulated with due attention to the needs of local people for reduction of their social and economic vulnerabilities. Based on the results of detailed field investigation and assessment, the following community development measures are proposed as components of CDP:

- (1) Formation of Users' committee;
- (2) Rehabilitation of rural irrigation system, development of water supply network;
- (3) Technical support for cash crop production (such as garlic, ginger, and fruits);
- (4) Improvement of rural road, installation of VHF wireless telephone;
- (5) Reclamation of damaged farmland;
- (6) Introduction of community forestry, agro-forestry programme;
- (7) Development of micro-hydropower plants using the water diverted from concrete check dam;
- (8) Construction of multipurpose shelter for the disaster evacuation system, which will be used for evacuation shelter and potato seed storage; and
- (9) Women in development through sericulture industry.

Measures to improve agricultural productivity are important at the beginning stage of restoration of the damaged community because most people in the damaged community can depend on the agricultural sector for their living.

For example, the beneficiaries of the land reclamation programme for damaged farmland in Phedigaon will be the people most severely affected by the disaster in the community. They lost farmland and have no income generation means so far. The water supply network in the Chisapani area is expected to provide not only tapped water but also sprinkler irrigation water for their vegetable production, which will make possible double cropping of cauliflower in the area. Rural road improvement in Namtar will change the current cropping pattern in the community from cereals to cash crops as they can transport the products to the vegetable market in Hetauda and other cities.

Afforestation programmes such as community forestry and agro-forestry are not only to stabilise unstable slopes and to prevent soil erosion from slopes but also to encourage the sustainable usage of forest resources. Multipurpose shelters in the disaster evacuation system will be utilised for potato seed storage in summer and farmers can save expenditures to buy potato seeds every year. They can be also used for shelter at the time of severe natural events.

Furthermore, the Study Team strongly proposes to implement a sericulture industry research programme in the school in Namtar. The schoolgirls in classes 9 and 10 (about 15 or 16 years old) are targeted for transfer of knowledge on the sericulture industry. They are expected to be capable of handling eri-silkworm rearing, cocoon production and spinning yarn. After graduating from the school, they will return to their villages around Namtar and disseminate the know-how to the women in their villages. The women will have opportunities to generate income in their villages and are expected to improve the women's situation from a long term viewpoint.

A key issue for successful community development activities is to establish the users' committee. With this committee, the common needs and requests of the community will be much easier to reach the donors like local government, central government and NGOs to receive their technical and financial assistance. It is also possible to realise some community development activities by the people themselves if they form the committee.

Sustainability is an important aspect to be considered in development projects, and it is recognised in the world that community development with people's participation is very effective to achieve this sustainable development. It has been frequently seen in the past development projects that without people's participation many projects failed to achieve their goals, or even though looked successful in the short term, they were recognised as failed projects as the time went by due to circumstantial changes. It is concluded that people's participation is the key to attain sustainable development, and thus community development approach with people's participation should be explicitly considered in the Study.

Since Nepal has received so many foreign aids, it is said that the people of Nepal have, to some extent, a dependency syndrome. When the future of Nepal is pondered seriously, such a dependency in people's minds should be wiped out and they have to help themselves for their future. To do so, community development with people's participation would be very effective to make Nepali people realise the importance of self-help development. In this sense, too, the community development approach should be seriously carried out in the Study.

The countermeasures to reduce physical, economic, and social vulnerabilities of the community are listed up, which are the components of the CDPP. Figure 2.2.1 shows the major components and formulated of programmes of the CDPP.

### 2.2.3 People's Participation and Co-operation with NGOs

In the Study, people's participation is strongly encouraged to carry out community development. It is fully understood that people's participation is indispensable for community development. The definition of people's participation in the Study, however, is slightly different from what is usually perceived by many development planners and practitioners in the world. Put differently, people's participation in the Study is much weaker than what it usually implies. In an ordinary people's participatory project, people take the initiative from the beginning of the project and are being involved till the end. That is, people, in a positive attitude, do everything such as planning, design, construction, operation, and maintenance. In other words, people's participation is realised by the bottom-up approach.

On the contrary, people's participation in the Study is interpreted as a mix of the bottom-up approach and the top-down approach. This mixed approach is due to the time limitation and the necessity of integration with physical disaster prevention plans. Usually it takes a long period of time to implement a participatory project. To find out what people really want and to make people participate in a project, it can be said from the experience in the last two decades by the United Nations, the World Bank, etc., that it usually takes five to ten years. But the Study should be completed within a year plus during which there is less than a half-year field research, thus people's participation is hardly realised in a usual way. Moreover, the integration of community development plans with technical/physical disaster prevention plans is also an important factor in the Study. Disaster prevention plans designed by engineers are highly technical and are not easy for people to understand and make their own plans in a co-operative way. In this sense, the integration with technical disaster prevention plans leads us inevitably to take the top-down approach to some extent.

In the course of the Study, the following processes have been taken with regard to people's participation in plan formulation:

No.	Timing	Investigation Method	Investigation Area	Target Group	Research Items
1	Feb. 1996	Questionnaire Survey	9 villages in the Study Area	30 HH x 9 villages	living condition, education level, income level, job opportunities, damage condition by 1993 disaster, development needs, etc.
2	Mar. 1996	Focus group discussion	Phedigaon, Namtar, Chisapani, Sahan	Village chairman, teachers, public health nurse, farmers, women's representative	Background of the village, problems, development needs, etc.
3	May 1996	Rapid rural appraisal	Phedigaon, Namtar, Chisapani	Different groups (village representative, men's group, women's group, farmers' group, etc.)	Problems and development needs of each group
4	Jun. 1996	Discussion about draft plan	Phedigaon, Namtar, Chisapani	People's representative group	Explanation of draft plan, comments and discussion
5	Sep. 1996	Discussion about people's role/responsibility	Phedigaon, Namtar, Chisapani	People's representative group	Discussion about people's roles and responsibilities in implementation stage.
6	Oct. 1996	Hearing survey for evacuation activities	Phedigaon, Namtar, Chisapani	50 households x 3 villages	Evacuating destination, timing, route, safer zones in the village, etc.
7	Jan. 1997	Seminar for transfer of knowledge	Phedigaon, Namtar	About 500 people in each village	Advice for project implementation

A questionnaire survey was firstly conducted at the beginning stage of the Study. Objectives of the survey were mainly to select priority areas among 9 communities in the Study Area. The criteria for the selection were living condition, severity of disaster damage, further disaster potential, and so on. The results of the survey were also useful for assessment of the education level and trend, income level, and people's needs.

Focus group discussion and rapid rural appraisal were conducted in the priority areas, Phedigaon, Namtar and Chisapani villages in Makwanpur District. Discussions between the Study Team and various people's groups were carried out to search problems and needs of different groups such as representative group, men's group, women's group, farmers' group and so on. Based on the analysis of various issues of different groups,

the common issues were determined and reflected in the CDPP formulation. Particularly, rapid rural appraisal was intensively done by the expert of the Study Team and the local sociologist from NGO. As a result, various community development measures were proposed in due consideration of the needs of different people's groups.

For example, the rural road improvement programme in Namtar was considered attractive by many people's groups. For the farmers' group, it is quite useful to transport agricultural products to the vegetable market in Hetauda. For the women's group, their children who migrated to cities are easier to return to the village, increasing opportunities to meet the family. For the health post workers, the severely sick and injured people can be transported to the hospital in time.

Draft community development plans were formulated based on the results of discussions with the people's groups, and were revealed to them in June 1996. There were no significant comments from the people's groups, therefore it was assumed that their problems and needs were basically reflected in the draft plans. However, the Study Team found that the people's groups largely depend on the implementation arrangement by the Government and the Study Team, and there was less sense of people's initiative in the project implementation.

The Study Team seriously assessed the high dependency syndrome of the people's groups, and suggested them to think of their roles and responsibilities in the project implementation. A discussion of the people's roles and responsibilities was held in September 1996. At that time, the people's groups proposed the following activities to be under their roles and responsibilities:

- 1) Supply of unskilled labour force,
- 2) Collection of construction materials such as stones and sand from nearby the village,
- 3) Land provision for stock yard, administration camp, demonstration farm.

It was revealed that a big discrepancy existed between the Study Team and the local people in terms of people's participation. "The community development measures shall be implemented on the people's initiative, and support from others if necessary" is the basic policy of the Study Team.

Considering this discrepancy, seminars for transfer of knowledge were conducted in January 1997 at the final stage of the Study. The message of the Study Team "Stand on your legs first, and then only seek donors' help" was expressed through a street drama which was performed by a professional actor/actress group in respective villages. The scenario of the street drama was prepared by the Study Team to remind the disaster of 1993, the problems after the disaster, and the solutions thereto. The drama presented that "the donors and technical support team come only tentatively, and they will not stay permanently. The restoration and development of the community will take a long time, and the initiative of the local people is essential to realise the long term activities." The seminars were successful with an attendance of about 500 in each community, but the Study Team wondered whether local people really understood the message or not.

As explained above, the people's participation aspect in plan formulation was particularly emphasized in the course of the Study. In this regard, advice and suggestions from NGOs were quite effective because they have had abundant successful as well as unsuccessful experiences in participatory development activities. For co-ordination with NGOs, the Study Team held seminars with NGOs three times (February and May 1996, and January 1997) during the Study.