CHAPTER 5

COMMUNITY DISASTER PREVENTION PLAN FOR CHISAPANI

5. COMMUNITY DISASTER PREVENTION PLAN FOR CHISAPANI

5.1 Background of Community

5.1.1 Topography and Geology

The topography of the upper catchment of the Agra Khola (i.e. around Chaubas, Damdabas, Chisapani, and Deaurali), is characterised by the formation of cuestas and steep sloped terraces, due to the geological structure. In this area, gentle slopes of 25° to 30° and steep slope of 50° to 55° appear alternately.

Figure 5.1.1 shows the topography and the geology in and around the Chisapani village. There are three tributaries flowing in the Chisapani village: The Majhuwa, Chisapani, and Garchi Khola. The Majhuwa Khola exists on the eastern part of the village where big scale landslides and river erosions are observed, and no settlement exists on the right bank. The Chisapani Khola originates from the southern mountain of the village and flows to the northeast through the residential area of the village mainly on its left bank. Many villagers depend on the Chisapani Khola for their drinking water. The Garchi Khola originates from the south-western part of the village and flows to the east.

The three tributaries meet the Chalti Khola in the northern part of the village and flow to the north as the major tributary of the Agra Khola.

On the left bank of the Majhuwa Khola, there is a range of gentle slopes which faces the north-east and flows in the direction of the south-west. It has a width ranging from 600 to 1000 m and a height of 400 - 600 m. On the right bank there are steep slopes of 50°-55°. Most of the human residents and the farmland are distributed on these gentle slopes (see Figure 5.1.1).

The Chisapani area is located in the upper most part of the above-mentioned gentle slopes. The elevation ranges from 1,640 m (at the confluence of the Majhuwa Khola and the Chisapani Khola) to 2460 m.

The geology of Chisapani and its outskirts is composed mainly of schist of the Kulekhani Formation. Within the Chisapani area, as shown in Figure. 5.1.1, the bed strikes to the NW - WNW and dips 20° to 35° to the NE. But the dip has a tendency to change sharply from the upper slope to the lower slope.

5.1.2 Land use Condition

As shown in Figure 5.1.2, the land use pattern in the Chisapani area is mainly divided into wood land and farmland. The foot path near the 2,100 m contour line forms a rough boundary between the two areas. Besides, after the 1993 disaster, some parts of farmland have changed to barren and bush land.

Most of the wood land consists of copse, and the remaining (near the foot path) consists of shrub. In this area, there are many fresh cracks due to landslides and the slope is very unstable. Thus, cultivation is not possible.

The gently sloped area on the right bank of the Chisapani Khola is utilised as farmland. The upper part of the Majhuwa Khola was ruined by the 1993 disaster and the left bank is barren land. The left bank slope of the Majhuwa Khola, facing Garchi Khola, cannot be

used as farmland because hard rocks are exposed with steep slopes and cliffs. On the west side of the Chisapani area, most of the human residents and public facilities are located on the ridge.

5.1.3 Socio-economy

Chisapani belongs to Ward No. 4 of Agra VDC, Makwanpur District. It takes about one and a half hours on foot from Phedigaon, Palung VDC. Even though Chisapani belongs to Agra VDC, Chisapani has a closer tie with Palung VDC in many respects than those villages in Agra VDC: The Chisapani people sell their agricultural outputs in Phedigaon and Phatbazar, receive medical treatment at a health post in Thanabazar, buy consumer goods, chemical fertilisers, seeds, etc. in Palung VDC, receive banking service from the ADB and other private banks in Thanabazar, commute to primary and secondary schools in Phedigaon and Phatbazar, and so on. As such all economic, financial, and social activities are conducted through interaction with Palung VDC.

According to the Central Bureau of Statistics, the population of Agra VDC was about 6,800 in 1994. As there are no available statistical data with respect to ward-wise population, the exact number of the population of Ward No. 4 where Chisapani is located is unknown, but it is said that there are about 120 households in Ward No. 4. Assuming the average family size to be are 6.6 people per household in Ward No. 4, the total population of this ward would be about 800.

Based on the sampling survey by Questionnaire (I) and the qualitative survey by Questionnaire (II) carried out by the Study Team, Tamang is the major caste group in Chisapani accounting for about 73 % of the total population. The second is Gurung with about 24 %, and the last is Chhetri with only 3 %. Table 5.1.1 shows the total population and the populations of caste groups. The total population in the table is about 500 which is different from 800 estimated above. This discrepancy is due to the fact that the population data in this table are based on the survey conducted in February while the figure of 800 is estimated from the information collected in May. Since no census on Ward No. 4 is available, it is not known which figure is correct.

The elevation of Chisapani is around 2,000 m above the sea level, which is 300 m higher than that of Phedigaon and 700 m higher than that of Kathmandu. As the name of Chisapani implies (the literal meaning of Chisapani is "a place of cold water") that the temperature is cool and it is quite comfortable to live there.

Nobody knows exactly when the first settlers started residing in Chisapani. Around a half century ago, a couple of clans of Tamang immigrated to Chisapani. Tamang form the majority of population these days. It is said that until cauliflower and potato became the major income sources about twenty years ago, the people had been moving in and out frequently. Since they had been able to make profits from cauliflower and potato, their living standard had been improved and migratory minds had gradually disappeared.

The people in Chisapani have experienced major disasters such as landslide and earthquake at least four times in this century. Those disasters occurred in 1933, 1954, 1970, and 1993. The 1993 disaster was the biggest disaster. Since they experienced the 1993 disaster, they have been very anxious to migrate to a safer place, like Hetauda in the Terai. But they know that without enough money in their hands the life in other place will be disastrous. Therefore they unwillingly remain at the same place in Chisapani.

They know that their lives will be subject to the danger of another landslide, and think that nobody, even the JICA, can stop a future landslide. If someone gives them enough land for agriculture and houses somewhere for free, they are pleased to move there to start up a new life. In fact, 50 out of 120 households in Ward No. 4 are making a plea to the HMG/N for free houses and land in the Terai.

As lots of houses and land have been slid away, there are a number of landless people in Chisapani. Fourteen households have been given free houses in Banaspati, Hetauda. Only one household, however, has been permanently living there, and all the others are frequently returning to Chisapani. Even though they were victimised by the 1993 disaster, many of them still have some farmland. They come back to Chisapani and cultivate their land to make living. The living condition there is extremely terrible due to low wages, few job opportunities, no tap water, no electricity, and no farmland. Those people who have not been given free houses also cannot go out of Chisapani due to lack of money and stay in Chisapani.

Tamang and Gurung have a similar life style and both prefer to live in forests in hilly areas rather than to live and run business in flat areas. They have difficulties in living without farmland and forest. Under the condition that their land is gradually sliding away and nobody can stop it, they are in trouble to maintain their lives.

The Study Team recently tried to plant 40 seedlings of mulberry trees in Chisapani. The village people were asked to participate voluntarily in this activity, most part of which should be done by the people, and they did it quite nicely. What the Study Team did was to provide mulberry seedlings and technical advice only. This activity has proved that they are ready for community development with people's participation.

Not many INGO's and foreign assistance activities are observed in Chisapani, maybe it is because Chisapani is located in a remote area. So far, only one INGO, World Education, is established in Chisapani, but it simply has given some money to run a literacy class in Chisapani, not acting directly on the site.

As often in other rural areas in Nepal, agriculture is the only industry in Chisapani. The villagers are producing mainly cauliflower, potato, and maize. Cauliflower is the product that makes Chisapani better off than the national average and the richest village in Agra VDC. Other villages in Agra VDC have no good access to markets while Chisapani has an easy access (only one to one and a half hours on foot to Phedigaon).

Chisapani is heavily connected with and depends economically and socially upon Phedigaon and other villages in Palung VDC. Local people sell their agricultural products in Palung VDC.

Cauliflower and potato with chemical fertiliser have made Chisapani richer for the last twenty years. Indigenous potato had been cultivated for a long time, but since a new variety of potato was introduced to Chisapani, intensive potato production has been conducted. In recent years, carrot is being produced, though it does not generate income yet.

5.2 Description of the Disaster

5.2.1 Assessment of Damage due to the 1993 Disaster

The people in Chisapani live on vegetable farming. Cauliflower and potato are the major products harvested there. The difference of elevation brings about considerable profits from vegetable production: The price of cauliflower is very high because the Chisapani people can deliver their cauliflower at a particular period during which other cauliflower producers cannot provide it to Kathmandu.

The life in Chisapani, however, is not easy. All houses and farmland in Chisapani are located along the steep hillside which is gradually slid and eroded in every monsoon season. The people's lives are quite in danger and they are basically anxious to migrate to a safer place, but they do not have enough money to do so, thus they feel like being forced to stay there.

In the 1993 disaster, four people, a single family in Chhap of Ward No. 4, were killed and 32 houses were fully damaged. It is said that they could not even move out of their houses for evacuation due to the downpour and the fierce surface water flow.

The condition of the 1993 disaster is shown in Figure 5.2.1. At the time of detailed field investigation, slope material and gully sections were observed and surveyed.

The disaster area is divided into four areas based on inducement and its topographical character. The condition of each area is as follows (area numbers are shown in Figure 5.1.2).

Area (I):

In this area, there is a thick weathered rock layer in the upper slope from the foot path and landslides had already occurred before the 1993 disaster. In 1993, these old landslides slid again. As a result, there are many fresh cracks and head scarps in almost all parts of the slopes. At present, these areas are used for pasture and as wood land because of their unstable condition. In the slope near the foot path, there are many small landslides due to the toe cutting of the slope by the foot path construction.

Area (II):

There are numerous fresh cracks all over the area (II) due to plane slide. Hence, at present, this area has changed to barren land from farmland.

In this area, there is no sharp knick line, so it is expected that the range where the loose materials will be lost by plane slide will extend over the ridge and the foot path to the Phedigaon village will be lost.

As the hard rock is underlain by the weathered rock layer, it is not possible to use this land for any activity if the weathered rock layer is lost.

Area (III):

This is a cultivation area in the Chisapani village. Gully erosion occurred in this area. As a result of this gully erosion, the weathered rock layer and the soil used for farmland were washed away. There are many cracks on the slopes along the gully due to plane slide caused by gully erosion.

If the gully is left as it is, it will spread and also plane slide will be activated. As a result, it is expected that farmland will be lost in the future and economic activities can be hardly continued. The river bank failure is spreading in the slope facing the Chisapani Khola, and farmland is lost. Once the farmland is lost, it will be impossible to restore it. There are some houses on the margin of the gully and the slope where plane slide occurred. The probability of losing human lives is high in such a hazardous zone.

Area (IV-1):

On the slope facing the Majhuwa Khola, many plane slides have occurred retrogressively at the foot of the river bank and at the head scarps. If they are left as they are, the loose materials will be lost.

Area (IV-2):

There is a sharp head scarp at the top of the slope facing the Galchhi Khola, caused by previous landslides. At present, the lower part of the landslide mass slips down abruptly and it is impossible to re-use it as farmland. If it is left as it is, this slope will be lost abruptly and will become rock-exposed land.

Area (V):

In this area, there is a sharp head scarp due to previous landslides. On the steep slope facing the Chisapani Khola, there are many fresh cracks caused by river bank failure. If these conditions are left as they are, the foot path will be destroyed by bank failure in the future.

Other areas:

There are many cracks and abrupt drops near the top of the river bank failure and the plane slide in the areas III, IV and V. Some parts of these cracks and abrupt drops are near the houses. Therefore, if the slope mass with cracks and abrupt drops fails down, the houses will be destroyed.

5.2.2 Mechanism of Disaster

(1) Result of Topographical Analysis

Figure 5.2.2 shows three directional longitudinal profiles of the Chisapani area.

It can be seen from Figure 5.2.2 that there is a knick line near the elevation of 2,100 m to 2,150 m above sea level along the contour lines. These locations are near the foot path and the boundary between the wood land and the farmland. Generally, in the upper slope from the knick line, the weathered rock layer is thick in comparison with the lower slope. This fact is also recognised by the field investigation in the Chisapani area. In addition to this, there are another knick lines near the elevation of 1,995 m to 2,015 m above sea level. But these knick lines show the top of the river bank failure due to the 1993 disaster and do not show the difference of weathering condition.

(2) Result of Aero-photo Investigation

Figure 5.1.2 shows the result of aero-photo investigation, conducted before and after the 1993 disaster.

The results are summarised below:

- Near the foot path of the lower slope from the knick line, gully erosion and river bank failure occurred abruptly due to the 1993 disaster;

- It is observed that some sharp head scarps have occurred due to the landslide before the 1993 disaster in the upper slope from the knick line. This fact shows that this area had been a landslide-zone for a long time. A head scarp has 100 m to 200 m width, thus it is presumed that the sliding surface of these landslides are considerably deep. During the 1993 disaster, these landslides repeatedly occurred and at the present time there are many cracks on the land.

- The gullies developed up to the uppermost reaches of the Majhuwa Khola and Chisapani Khola show that they enclose the deformation area due to landslides and that the ridge which continues near the elevation of 2,100 m to 2,150 m disappears around there. These facts suggest that the whole area surrounded by the above-mentioned gullies and knick line may be a whole deformation area separated from the lower slope.

(3) Causes of Disaster

The 1993 disaster was caused mostly by plane slide due to the dip slope. It is pointed out that especially in the Chisapani area, the slope was unstable because of slope angle and the bedding plane angle are almost parallel. And it is also pointed out that plane slide was caused by lateral erosion and river bank failure and that most of the plane slides occurred along the river and the stream. In addition to this, as the weathered rock layer is thin, this layer became easily saturated with infiltrated water and pore water pressure was built up. As a result, the rock lost its strength and the slope becomes unstable. In the upper Chisapani area, as the surface running water concentrates easily in the gully and the stream is hollow, gully erosion grows easily. As a result of gully erosion, the weathered rock materials along the gully were washed away and the foot of slope was cut abruptly.

5.3 Needs of Disaster Prevention and Community Development

5.3.1 Current Major Issues in the Community

Through the survey and frequent visits, the Study Team has been noticing many problems in the communities from major ones to minor ones. Several major problems that should be paid attention to in the Study are described in the following. Please note that the order of presentation of each problem does not necessarily represent the degree of importance.

(1) Landslide and pessimism

Chisapani has very dangerous places. All houses and farmland are on steep slopes in the hillside. The villagers recognise this dangerous situation and are so pessimistic that they incline to migrate to somewhere, hoping the HMG/N or some foreign donor to give them free houses and farmland around the Terai. Unless some protective measures are taken, they have no incentive to develop their community because all their efforts for development will be slipped away and wind up with nothing as a result of landslides.

The pessimism could be the most formidable obstacle toward development. The people are sick of disasters and tend to give up all hopes in Chisapani. Something that can wipe the pessimism out of the villagers' minds should be done first so that all development projects coming afterward will go well.

(2) Lost land

Unfortunately the land slid away by the 1993 disaster will not be able to be regained by whatever measures. It seems that all possible farmland has been cultivated and no additional arable land is left in Chisapani. This implies that those who lost their land have no chance to regain the same a mount of land in future in Chisapani.

(3) Frequent destruction of road to Phedigaon

The road between Chisapani and Deorali, which is located near the border line between Agra and Palung VDCs, goes horizontally across the steep hillside many portions of which frequently slid during the monsoon season and required to be repaired. The road is not motorable all the way to Phedigaon at all.

(4) Lack of drinking water

The number of water pipelines are not sufficient and they are not arranged in a systematic way. The tap stands are mostly located in rich and/or influential persons' houses and neighbours come to ask for use. The water sources are usually far from their houses and the water quantity of each water source is small. A well designed water supply system with pipelines and tanks seems to be necessary to solve the problem of water shortage.

5.3.2 Hazardous Condition in the Community

Based on the condition of the 1993 disaster, hazardous areas were examined and a hazard map is prepared for the local disaster prevention activities. The procedures mentioned in Section 1.4 in this report are taken for hazard mapping.

The hazard map for Namtar community is shown in Figure 5.3.1. The following disaster phenomena are considered in preparing the hazard map for Namtar.

	Type of Disaster	Description
I	Plain slide, failure due to the 1993 disaster	All the areas in which plane slide and failures are occurred by 1993 disaster are marked in the Hazard Map. There is no hazard level classification which is considered as high hazard. The plane slide and failure zones are spread on the lower part of the community along the Majuwa, Chisapani and Garchi Khola.
II	Safety zone	The zones in this category is relatively safer than the other areas. The safety zones are mainly located on the ridge with relatively wide portion on the western area of the community.
III	Semi safety zone	Semi safety zone are defined which is not defined in any other categories as hazardous zone but not enough to be safe as the safety zone. Semi safety zone are found in the farm land of which it is far from the gullies, and on the ridge of which the width is rather narrow on the western part of the community.
IV	Dangerous houses	All the houses located in the zone of high and medium hazard are defined as dangerous houses.
V	Integrated hazard zone	Integrated hazard zone are classified into three hazard levels, A (high hazard), B(medium hazard) and C(low hazard). The determination of hazard level are considered integrated viewpoints among landslide, failure, stream bank erosion and slide of the stream bank. High hazard zone are mainly found around the knick line along the trail to Phedigaon.

5.4 Overall Plan

5.4.1 Disaster Prevention Aspects

Overall disaster prevention plan for Chisapani is formulated as shown in Figure 5.4.1. The detailed procedures for the plan formulation are explained as follows:

The Study Team carried out the detailed field investigation, and found that more than half of the community have already been lost by severe gully erosions, land slides, and collapses. There area three major gullies in Chisapani area, Majuwa, Chisapani and Garchi Khola. Among the three tributaries, the whole Majuwa Khola basin were almost disappeared. No residents and farmland exists except at the most upper basin of devastated forest area. At the Garchi Khola basin, the gully gradient is more than 45° and the gully was deeply eroded and expanded remarkably. No fertile soil is remained in the basin and the there is almost no possibility to recover the lost land in the basin.

On the other hand, the Study Team found out that the disaster activation in Chisapani

Khola and the tributary basin is actually serious but it is possible to sustain the community by the structural measures for a few decade at least. Major part of farm land is still remained with fertile soil, and the community exists along the western ridge of the basin. It is difficult to recover the lost land also in Chisapani Khola basin but there is a possibility to sustain the existing residential area and farmland against the further disaster for a few decades.

The mechanism of residential area and farmland erosion are considered as follows:

a) Along with the progress of undercutting and deepening, the layer of weathered rocks and the top soil are eroded. The toes of slopes are eroded through gully erosions, and then the plane slides occurred. As a result, these natural phenomena will bring about another massive landslide.

b) As the gully erosions and collapses expand, the plane slides around the layer of weathered rocks and the top soil above the erosions and collapses are generated gradually toward the upstream.

c) Since the 1993 disaster, the headwaters have been totally devastated. Thus it is expected that a debris flow, made of eroded and collapsed soils, will break out by a heavy rain.

The main causes of the disaster in the community are plain slides, collapses, landslides and failures due to gully erosion. There are some countermeasures to mitigate such disaster phenomena such as series of consolidation works on the gully and hillside works on the lower part of the slopes. To carry out such measures would also expect that the people in the village will have a hope to stay and continue the productive activities to improve their living standard, which would be possible to migrate themselves in future if they like.

Considering such a technical acceptability to the disaster prevention works as well as the people's needs for provision the sustainable farming activities, overall disaster prevention plan for Chisapani area are formulated.

Prior to the designing the structural plan, it is noted that the disaster evacuation measures are essentially required for Chisapani so that the structural measures could not prevent the disaster potential completely but to mitigate the disaster potential and to sustain the activities for a few decades.

The objective of structural measures are therefore:

1) To sustain the existing community and farm land in the Chisapani Khola and the tributary basins, particularly to protect soil erosion and collapses due to development of the gully erosions.

2) To prevent the gully bank erosion and washing out of the upper cultivation area on the right bank of Chisapani Khola.

3) To prevent the debris flow which will be occurred at the headwater of Chisapani Khola attacking to the downstream community.

Taken into account the above major causes of disaster at Chisapani area, the following countermeasures are proposed as the components of the structure plan.

Countermeasures	Objective Areas	Anticipated Effect
Gully control works (Series of small check dams)	- Chisapani Khola - Dharapani Khola - Two small gullies	- gullies are protected against gully bank and bed erosion, - toe portions of gully bank slopes are protected and plane slide in the residential area and farmland along the gully is mitigated, - top soil on the sloped agricultural land is sustained, - existing residential area is secured.
Check dams at the lower edge of the sloped land	- Downstream part of the Chisapani Khola	- gully erosion at Chisapani Khola is mitigated, - series of groundsills can be constructed by provision of foundation by construction of check dams, - gully bank slopes are stabilised and the residential area and farmland along the gully are stabilised. - lower part of the sloped land and western ridge of the community are secured.
Hillside works	- Right bank of the Chisapani Khola at the lower edge of the sloped land, - At critical portions on the sloped land	- existing forest and pasture land are sustained, - afforestation activities will be possible by provision of the foundation by hillside works, - soil loss from existing farmland is mitigated by slope stabilisation.
Check dams downstream of large scale failure	- large scale failure at headwater of the Chisapani Khola	- instability of large scale failure is mitigated and the disaster potential in the downstream residential area is mitigated. - gully erosion on the Chisapani Khola is mitigated and the surrounding residential and farmland are sustained.

The arrangement of structures a long the Chisapani and Dharapani Khola is shown in Figure 5.4.2, and the longitudinal design profiles are shown in Figure 5.4.3 through 5.4.5. The detailed design of gabion structures was not carried out but a schematic idea of gabion check dams and revetment works is shown in Figure 5.4.6.

5.4.2 Community Development Aspects

Figure 5.4.7 shows the general layout of the overall community development plan for Chisapani, which is formulated by the specialists based on the local peoples' needs as well as the development prospects in rural economy.

The Study Team visited Chisapani from May 5 to 7, 1996 and discussed the development priorities. The results of the discussions are described in this section. As explained in Chapter 4, various types of survey had been conducted prior to this period. The procedure to determine the development priorities for Chisapani is also the same as that adopted for Phedigaon/Phatbazar and Namtar/Tilar. That is, women's group discussion, men's group discussion, and key informant interviews were carried out before the final

overall discussion in which the development priorities were finalised with heterogeneous participants consisting of male and female, rich and poor, young and old, landlord and landless, and so on. Photos 5.4.1 and 5.4.2 show those group discussions.

Development Priorities for Chisapani

No. 1: Landslide Protection Works
No. 2: Income Generation and Employment Opportunities
No. 3: Road Improvement Works
No. 4: Installation of Electricity
No. 5: Increase in Drinking Water Supply Capacity
No. 6: Establishment of Health Posts

The villagers in Chisapani think that any development measure is meaningless without the protection of their farmland. They are so irritated and at the same time frightened by gradual loss of farmland every year. They know that their lives are in danger: They are likely to be washed away by landslide at any moment in the future. They also think that nothing can stop landslide, so that they are in fact pessimistic for the development of their village.

They need employment opportunities in their village. To find a job, they usually have to go to Palung or Kathmandu. Without having any concrete idea on what kind of industry is possible to establish in Chisapani, they are asking for job opportunities.

As a matter of fact, at the beginning of the discussions, the local people gave the highest priority to the development of a motorable road which leads to the Palung area, but the Study Team explained its technical and economic feasibility and concluded that a motorable road was impossible. They still, however, insisted to have a road which is to be well maintained with gabions and bio-engineering works. At present, they have their own users' group to maintain the road to Phedigaon which is frequently destroyed in the monsoon season.

Their fourth priority is given to electricity. The Study Team was not able to perceive any necessity for electricity, rather the people seemed to want to obtain a similar quality of life as in Phedigaon where electricity is available. No particular eagerness for electricity was found.

Basically there is not enough drinking water supply right now. The people suggested to install a new water pipeline to a new water source. Also they suggested to install water tanks for efficient use of water. Since there is not a perennial river or stream that maintains year-round water flow, almost all villagers rely on the existing water pipelines the number of which is not enough to sustain a convenient life style. It seems that the tap stands in Chisapani are all located in or near rich and/or influential peoples houses and that they let the poor neighbours use their tap stands for the sake of mercy.

Health post is their sixth priority. In their village, there are no health care facilities. Even in Agra VDC to which Chisapani belongs, there is only one sub health post which has a lower grade of service in health care than a health post has. At present if someone gets sick, he is taken to a health post in Tanabazar, Palung VDC, which is on Tribhuvan Highway.

Table 2.6.2 shows the transition of development priorities given by the villagers from February to May 1996. Like in the other study areas, drinking water was the first priority by the household sampling survey where the people did not have a mind of

community development and sought to fulfil only self interest. Through a series of discussions, they have come to understand the importance of community development and stop asking for unrealistic demands like a motorable road.

5.5 Priority Plan

Figure 5.5.1 shows the selected priority plan of the CDPP for Chisapani. For the respective selected schemes, the proposed modes of implementation are indicated. A detailed description of the selected priority schemes is given below.

5.5.1 Structural Disaster Prevention Measures

(1) Criteria for Selection of Priority Schemes

Based on the basic concept of disaster prevention for the Chisapani area, which is to protect the existing residential area and farmland, an overall disaster prevention plan is formulated for the whole Chisapani Khola basin. In this chapter, the priority schemes among the components of the overall plan are assessed according to the following criteria:

(a) Urgency of countermeasures

The urgency of the countermeasures is closely related to the hazard potential in future. Accordingly, the urgency of the countermeasures is assessed based on the hazard map provided in Annex-1. Zones identified as high hazard ones are along Chisapani, Dharapani and the other gullies, to which the countermeasures would be defined as the urgently required measures.

(b) Cost effectiveness of the countermeasures

In the case several countermeasures are judged to have the same level of urgency, the higher cost effective measures shall be given priority. This is because the budget for disaster prevention would be usually not sufficient to satisfy the prevention needs completely. As such, the preventive measures should be so planned as to obtain the maximum effect with a limited budget.

For example, gully erosion on the Chisapani Khola is quite serious and the bed rock is already exposed at a depth of 10 to 20 m. The objective area along the Chisapani Khola is on the bank with fertile soil on the slope. Thus check dams with foundation as deep as 20 m will be required. These must be massive concrete structures and therefore their cost will be quite high. In that case, the measures with have low cost effectiveness.

(c) Importance of the Objective Area

Even in some areas which are defined as highly hazardous, if there are no residents, farmland or some important rural infrastructures, i.e. no expected possible damage to human lives and property, the need for disaster prevention could not be confirmed.. Accordingly the importance of the objective area in terms of population, infrastructure density, and area productivity will be one of the criteria for selection of priority schemes.

(2) Priority Structures

According to the three criteria proposed above, the priority assessment is carried out for all the structures nominated in the overall plan. The results are as follows:

Structure	Urgency of Counter-measures	Cost Effectiveness	Importance of Objective Area	Overall Evaluation
Check dams on Chisapani Khola Ch-2, Ch-3, Ch-4	b	c	c	B
Prop wall on Chisapani Khola Ch-9	a	b	b	B
Check dam on Chisapani Khola Ch-1	a	a	a	A
Series of small check dams on Dharapani Khola Ch-6	a	a	a	A
Series of small check dams on Dharapani tributary1 : Ch-7	a	a	a	A
Series of small check dams on Dharapani tributary2: Ch-8	a	a	a	A
Hillside works on Chisapani Khola Ch-10	a	a	b	A
Series of small check dams on Chisapani Khola : Ch-5	b	b	a	B
Prop wall on the sloped land Ch-11	a	a	b	A

Note : a: high priority, b : medium priority, c : low priority
A : Priority schemes, B : Semi-priority scheme

(3) Selected Priority Structures and Order of Performance

Based on the priority assessment mentioned above, the priority schemes of implementation of disaster prevention structures are selected as shown in the following table. The order of performance which is considered based on the mechanism of disaster is also proposed in the table.

ID No.	Structure	Function	Order of performance
Ch-1	Check dam on Chisapani Khola	To trap debris flow	1
Ch-6	Series of small check dams on Dharapani Khola	To prevent gully erosion	2
Ch-7	Series of small check dams on Dharapani tributary 1	To prevent gully erosion	2
Ch-8	Series of small check dams on Dharapani tributary 2	To prevent gully erosion	2
Ch-10	Hillside works on Chisapani Khola	To protect gully bank against erosion	1

The preliminary design of check dams Ch-1 is shown in Figure 5.5.2, and the typical design of hillside works is shown in Figure 5.5.3.

5.5.2 Non-Structural Disaster Prevention Measures

(1) Chisapani Community Disaster Evacuation System

The generally defined highly hazardous area in Chisapani is located on the slope which is gradually eroded by landslide or gully erosion. On the other hand, the residential area is mainly located on the eastern ridge and about 80% of the population is concentrated along the ridge.

According to the hazard assessment in Annex-1, the ridge area is classified as rather safer than the other areas on the slope. The villagers know well about the hazard situation in the village, and most of the villagers have evacuated to this ridge except those who could not pass the Chisapani Khola from the eastern part. The evacuation planning therefore basically follows the existing evacuation pattern which was observed in the 1993 disaster.

Figure 3.5.7 shows the evacuation system plan for Phedigaon and Chisapani. Four evacuation units are proposed in the area as shown in the figure. The details of each respective evacuation unit is described in Annex-5 and summarised as follows:

Summary of Community Disaster Evacuation System for Phedigaon/Phatbazar

Unit No.	Name of Community	Number of Households			Monitoring Measures	Evacuation Place	Priority
		In safe area	Out of safe area	Total			
A	Gothdanda	9	1	10	Failure/ Landslide	Residence	High
B	Thindanda	11	9	20	Failure / Landslide	School	High
C	Kailashdanda	22	8	30	Failure / Landslide	Shelter	High
D	On the sloped farmland	2	18	20	Gully erosion / Failure	Shelter	High

5.5.3 Community Organisation Set-up

As noted in Section 3.5.3, detailed descriptions are often omitted due to the fact that there is a considerable degree of redundancy between the CDPP for Phedigaon/Phatbazar and the ones here.

(1) Formation of Users' Groups

This project should be implemented prior to any community development projects. Since the Chisapani people are very pessimistic toward the development of their community, group formation is definitely necessary to do right away, so that they will get ready to face the reality and step forward.

After forming users' groups, a users' committee should also be formed. Then other committees will be formed accordingly when a development project comes to Chisapani.

(2) Disaster Management Training

Chisapani is so susceptible to landslides that disaster management training is definitely required to help local people become less vulnerable to disasters. Physical structures cannot completely stop landslides at all, thus every possible non-structural measures should be taken in Chisapani.

With disaster management training, the people will become aware of disasters and know how to deal with disasters in many ways such as preparedness, mitigation, response, recovery, development, and prevention. It is a cost-effective way to cope with disasters.

(3) Training of Community Organisers

This project can be done with small expense, along with other study areas. The community organisers will surely boost the development of Chisapani. Since no one approaches Chisapani, the organisers should go out and make contact with the HMG/N, foreign aid agencies, and INGOs, and try to use the services and resources available among those organisations.

(4) Construction Works with People's Participation

There are many construction works planned in Chisapani. Participation in construction works will enable the people in Chisapani to wipe out their pessimistic minds and become positive in their community development, as well as to earn some cash income. Participatory construction works should be definitely promoted in Chisapani.

5.5.4 Agricultural Development

(1) Promotion of Cash Crops Production

(a) Cauliflower

Cauliflower was found to be the most profitable crop, having a benefit cost ratio of 1.97 (refer Table 5.5.1). By introducing adequate cultural practices, productivity can be increased. Timely supply of chemical fertiliser, pesticide, nutrients and technical support will generate more income and will elevate the living standard of the people. According to the farmers they are cultivating early varieties of cauliflower and are getting more profit by exporting it from August to October which is off season in other parts of the country. Per hectare yield of cauliflower is comparatively higher than that in other parts of the study areas. Still there is a great potentiality to increase the productivity. According the Vegetable Development Division, Ministry of Agriculture, potential yield of cauliflower is 1,500 kg per ropani. As mentioned before, most of the land in Chisapani area is non irrigated and if the water resources around the area are properly utilised, cauliflower can be produced twice a year.

Farmers in Chisapani reported that they were more interested in the production of cauliflower than any other crops, simply due to the fact that it gave them higher return. Considering the positive impact on the standard of living of the farmers, it is assumed that cauliflower lacks any alternative in the area.

(b) Potato

Most of the farmers produce potato in Chisapani . Their living standard is improved as a result of cash crop production. Production of cereals like maize is declining in this area as the land traditionally utilised for cereals is being utilised for potato and cauliflower cultivation. Some farmers sale potato seeds at high prices because they can preserve them, owing to the area's high altitude and cool climate. The cultivation of potato would be more profitable if they sale it at the time of the sowing season instead of the harvesting season. For this purpose, the farmers need technical support from the related agencies.

(c) Carrot

Some farmers are cultivating carrot in small volume and they have a difficulty in marketing. The price of carrot is high in Kathmandu in August to February and if the farmers produce more and manage to export it to Kathmandu in big volumes, they will get more income.

(2) Construction of Potato Seed Preservation (Storage) House.

In the harvesting season farmers sell potato seeds at a price of about NRs. 6 per kilo. But in the sowing season the price is more than NRs 10 per kg. Because of cool climate, farmers can preserve the seeds for the next season by themselves, but they cannot store more potato seeds for marketing purposes due to the lack of space. If a potato seed preservation house is constructed and farmers store their production there and sell them in the sowing season, their income from potato will increase by more than 65%.

(3) Plantation of Medicinal Herbs

Some medicinal herbs are found around Chisapani . Those herbs have been used as a source of drugs for treating human ailments traditionally. Some local 'Baidhyas' (indigenous herb practitioners) are using some herbs, and occasionally some brokers from India, Kathmandu and other areas of the country buy the herbs from the local people. The main medicinal herbs described here are found in Phedigaon area as well. Planting those species systematically on marginal land, community forest area, ridges of terraces, etc. will generate more income. The following species which are found wide in the Chisapani and Phedigaon areas are proposed .

(1) Chiratio (Swertia Chirayita)
(2) Jatamansi (Nardostachys)
(3) Sugandhawal (Valeriana Wallichii)
(4) Pakhanved (Bergenia Ciliate)
(5) Indrayani (Indereni, Bitter Apple)

In addition to the above-mentioned medicinal herbs the following species may be considered only for Chisapani.

(a) Peppermint (Mentha Piperita)

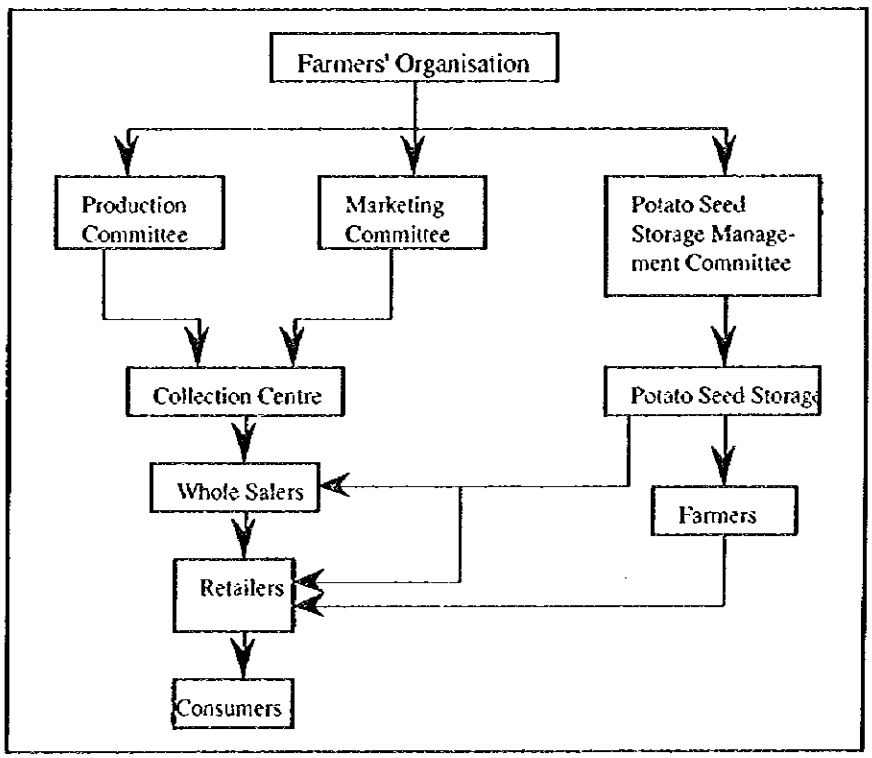
This species can be grown in the Chisapani area. This is a medium sized shrub that reaches a height of up to 50 cm. Leaf stalks are more or less absent.

Peppermint is the trade name of the drug obtained from this plant. It is used for the treatment of flatulence, vomiting, diarrhoea, and nausea etc. Medicinal herbs processing companies will buy the product and the estimated net-profit from one ropani of land is about NRs 700.

(4) Formation of Farmers' organisation

The objective of formation of farmers' organisation is to increase income from vegetable farming and marketing. It also will help them to initiate savings. Presently, individual farmers deal with small volumes, working in group will enhance their bargaining power and confidence in production.

Activities of the organisation are the same as those proposed for Phedigaon/Phatbazar . In Chisapani there should be an additional committee which manages potato seed storage. Within farmers' organisation three committees are proposed. The structure of the organisation will be as shown in the chart below. This organisation should work in co-ordination with the organisation of Phedigaon/Phatbazar. The organisation of the Chisapani area may use the collection centre in Phatbazar.



5.5.5 Forestry Administration

(1) Community Forestry Programme

The Chisapani area is situated in the upper reaches of the Agra Khola, a tributary of the Trisuli River. The altitude is higher than 2,500 m on the whole and Quercuss spp. and Castanopris spp. dominate like in the Phedigaon area. The artificial cause of forest deterioration is also the same as in Phedigaon as mentioned above. Besides, most of the

area is located on a great mass of landslides with remarkable dip slopes in geology. Under these circumstances it is obvious that the forest land in the Chisapani area, has been gradually lost since a long time ago. A conspicuous fact is that landslides are actively creeping at places and therefore even the surface soil is subject to incessant erosion.

The detailed plan is explained in sub-section 3.5.6 together with Phedigaon / Phatbazar. The proposed community forestry area, Chuli Ban, is shown in Figure 3.5.10.

(2) Agroforestry Programme for Chisapani

(a) Promotion of Fodder Trees Plantation

The farmers in Chisapani are more dependent on trees for fodder during the dry season than in other seasons. Declining forest resources around the area is leading the farmers to become more dependent on private resources for meeting their basic requirement. Problems faced by the farmers in Chisapani are similar to those in Phedigaon. The villagers do not want many trees in their farmland which will affect their production of vegetables. But after the 1993 disaster, the awareness of planting trees in their land has developed, but they do not want fodder plants with heavy crown. The following fodder tree species are recommended for Chisapani.

Kimbu (Silkworm mulberry)
Khanyu (Ficus semicordata)
Kabro (Ficus locor)
Dudhilo (Ficus nemoralis)

An agroforestry programme with some trees with light foliage and if possible nitrogen fixing leguminous trees might be good. There are many successful examples in the villages in the eastern districts of Nepal where agroforestry practice with leguminous tree species such as Albizia spp. and Epil epil has been successfully developed. A similar trial will be a good first step to take for agroforestry development.

(b) Promotion of Improved Grass Plantation

Introduction of improved grass species such as Napier (Pennisetum purpureum) and Amriso (Thysanolaena maxima) which have strong binding qualities and are good fodder may help to mitigate soil erosion and fodder scarcity. Those grasses can be planted on the ditches of terraces and community forest areas when the users' groups become more confident in their role as forest managers.

(3) SALT Technology Implementation

In Tistung, the ICIMOD has put up trails to test suitability of the Sloping Agriculture Land Developing Technology (SALT) technology in vegetable farms. The information obtained so far is quite encouraging and the demonstration effort of these trails will be coming soon. If it could be implemented in the Phedigaon and Chisapani areas the SALT will give long-term benefits to the villagers.

Basically two important aspects of the SALT technology will be of great interest to these project sites, namely:

- conservation of slope agriculture farming, and

- maintaining the fertility of slope agriculture farms.

Adaptability of this technology might take some time because at the initial stage farmers have to plant hedges in a row along the contour, which means that they have to give up some part of their farmland. The long-term benefits from conservation of their farmland will be understood by the villagers only if this programme has a strong extension back-up.

(4) Forest Nursery Development and Plant Distribution Programme

The villagers in the Study Area have developed a strong aptitude for planting trees, but forest nurseries are very far from their locations and transportation of seedlings is quite difficult. Thus, a forest nursery with flexibility of developing other plants such as fruit trees, hedge plants and medicinal herbs will be of great interest to the community.

The nursery development and plant production could not be achieved in a short period. But a quick delivery of seedlings could be done by bringing in plants from nearby nurseries and distributing them in situ. In this plant distribution centre a new forest nursery could be developed. Thus, from this centre a combined activity of production, collection and distribution of tree seedlings could be achieved. When the seedlings of required species are produced in this nursery, the centre will become a plant production and distribution centre for this region. As the needs of these sites are more than the capacity of a small community forestry nursery, such a nursery will be able to support much larger plantation activities. Afterwards this nursery could be privatised or handed over to the community forestry committee. If the nursery foreman of the nursery could run it, that will be the best. But this transfer of responsibility must be done through the community forestry committee so that the development and the production will continue uninterrupted.

5.5.6 Community Infrastructures

(1) Rural Water Supply Network Development

The village of Chisapani Ward-2 in Agra VDC, was one of the most severely damaged area by the 1993 disaster, which washed away a large number of houses as well as cultivated land in this village. On account of intermittent loss of farmland, many villagers feel it is not safe to keep living in the village. However, most of the migrants from this as well as other villages have been facing the pack that although residential area with a tiny piece of land had been donated by foreign and local agencies in the suburbs of Hetauda, they cannot grow sufficient crops nor find jobs to buy food and sustain their family. More worse, it is quite pessimistic for those migrants to buy farmland in the suburbs of Hetauda and Terai region and that they have a strong tendency to return to their former farmland in damaged villages for farming, which is their only choice. In the course of the field study over the community and hazard assessment, it has been identified that some of the land in this village is quite safe and stable, and that the key issues of the community for a further development, in terms of infrastructure, are protection and stabilisation of unstable land and water resource management. Since the 1980s, the village has been developed in its own sustainable way of cash crop farming, cauliflower in particular, taking advantage of its cool weather and the seasonal timing allows farmers to sell their products at high market prices in large cities.

(a) Objective

A rural water supply network development project under people's participation

program, has been proposed to fulfil and assist the following demands and potential activities:

i) Supply water for domestic use (drinking and house use) by a systematic method;

ii) Supply water for sprinkler irrigation supplemental during non-monsoon season; and encourage farmers to grow two vegetable crops, such as cauliflower, and

iii) Assist villagers in sustainable development and reduce their vulnerability through forming water users' groups and activating economy on both household and regional bases.

Some of the community water sources in the stream had been destroyed, and the villagers have either recovered or created new sources by themselves. Three main water sources have been identified; upper part of the Chhap Khola West tributary (Chhap W), Chhap Khola East tributary (Chhap E), and Majuwa on the hillside at mid elevation of the village. At present, villagers in the area have a high feeling for water scarcity, mainly due to lack of storage facilities. However, it has been assessed and estimated that these sources have a potential to supply about 60 litres /min.in total, which is equivalent to over 1,000 litres of water per capita per day (Table 5.5.2). Therefore, the construction of storage tanks and delivery system in the area would be highly feasible and contribute to water supply for domestic use (standard requirement: 45 litres/day/capita) as well as for agricultural production activities (additional cultivation of winter cash crops). A proper water resource management is expected to be accomplished by the community through the proposed network system, coupling with people participation program. Figure 5.5.4 shows the layout for the water supply network system development in the Chisapani area.

(b) Plan Formulation

A general layout of the existing water supply system is given in Figure 5.5.4.

In the course of the Study, several discussions among the villagers have been held besides the baseline survey as well as the communication meetings with the Study Team. The Study Team and villagers have confirmed that the villagers are willing to form water users' groups and solve the water scarcity problem and enhance fair water distribution through discussion among themselves. For instance, the Source S-1B and S-1E were creased privately after the 1993 disaster by a small number of farmers, who reside over a ridge in Kailashdanda. They deserve to receive a higher amount of water compared to other farmers after their inventory effort, but they are willing to give right of the source S-1 E to be connected to the storage tank S-1 exclusively for the community use. Although irrigation has not been commonly practiced due to the feeling of water scarcity caused by lack of storage facilities, advanced farmers have been demonstrating a good practice and performance to the community; they have been storing the surplus water in drum-cans, and irrigating cash crops by locally made plastic sprinklers connected to drum-cans through HDP siphon pipes. Such a simple pressurised type irrigation system enables farmers to grow two crops of cauliflower or other cash crops as well as their staple food, potatoes, during the dry winter season. Therefore, the village has a good potential of sustainable develop means through proper management and systematic use of the

available water resources with awareness and participation of both the community and individuals and this scheme will largely contribute to additional agricultural production. Moreover, excess water can even be transferred to the adjacent villages.

The Study Team has also assessed that it is not feasible to install a gravity type hill irrigation system, mainly for the following reasons: The total amount of regional water supply is not sufficient to run a gravity system of which the conveyance efficiency is low; water requirement of vegetables, in general, is low, and crops prefer well drained soil; and construction of a canal system may induce a further landslide over the region, by increasing the unit weight of the soil around the canals, running around edges of terraces.

(c) Major Components of the System

The proposed network forms a "star-like" delivery system, so that the total length of pipelines will be reduced in a whole system, and maintenance should be done by each small users' group. As described in the previous section, the network consists of the following components: Intake structures; HDP pipelines; Storage tanks; Distribution tanks; Delivery tanks; Household storage tanks with sprinkler irrigation units; and related structures such as break pressure tank and valve chambers.

Intake:
A precast intake protection unit is installed at each water source site in both stream and spring/ seepage. It is also protected by a dry rubble wall from debris flow.

Pipelines:
There are 4 types of pipelines, the first 3 of which fall into the category of "community line". A transmission main connects primary level tanks (storage/ major distribution tanks), while distribution lines send water from primary level tanks to secondary level tanks. Community delivery lines supply water from distribution to delivery tanks, and private delivery lines lead water to household storage tanks.

Tanks:
There are 4 types of water tanks. Storage tanks are categorised as primary tank, and designed to store water, supply water to distribution tanks within a system, and transmit surplus water to lower primary tanks in other systems, through the transmission main. A distribution tank plays a role of either primary or secondary tank. Secondary level distribution tanks primarily supply to household storage tanks as well as delivery tanks to fulfil their basic demands. Water is delivered through delivery lines or distribution lines, and tanks are regulated by float valves to avoid storing surplus water (types II-c, II-b). Primary level distribution tanks are additionally designed to transmit surplus water to lower storage/ distribution tanks (type II-a). A delivery tank is located in the centre of a group of houses to supply to those houses through delivery lines, and also plays a role of a "tap stand". A household storage tank is the minimal unit, which primarily stores water for individual house use and then surplus water can be used for sprinkler irrigation. Both household tanks and delivery tanks are regulated by float valves, to prevent from introducing excess water and thus from overflow.

Related structures:
Break pressure tanks are provided along community pipelines (transmission mains, distribution lines and community delivery lines) where static pressure within a pipeline exceeds 60 m. It releases an excess pressure to avoid breaking of the pipeline. Air valves and/ or vent valves for flushing soil, etc., are provided every 200 m (at least 1 unit) along community pipelines, and they are protected by precast valve chambers.
It is noted that a HDP (Heavy Duty Pipe) strainer unit is installed at every outlet on intake structure and tanks of all levels, in order to filter small particles and suspended substances. Figure 5.5.5 shows the sketch drawing of major components in the network.

(d) Quantity of Network Components

The quantity of major components for the proposed network in the Chisapani area is summarised in Table 5.5.3. It is noted that a sprinkler unit consists of a single piece of sprinkler and 30 metres of extension HDP pipeline, so that villagers can feed surplus water to their own individual farmland. It is also important to store some extra pipes and materials for operation and maintenance as well as for future extension purposes.

(2) Installation of Telephone System

Compared to Namtar, the possibility for the VHF to be installed in Chisapani is low. According to a staff in the local NTC in Hetauda, it would not be technically feasible to install the VHF in Chisapani because no relay station exists nearby. Moreover, the expected volume of demand for telephone may be so small to sustain the operation financially.

The Study Team, therefore, has decided not to promote the VHF installation in Chisapani, rather the Study Team has informed the Chisapani people of the VHF and let them decide what to do.

5.5.7 Income Generation Measures

(1) Silkworm Rearing

The farmers can generate more income from their marginal land by planting mulberry and rearing silkworms than cultivating traditional cereal crops. Mulberry trees can be grown in marginal lands, steep slopes edges of the terraces and road sides, etc. According to the Eighth Five Year Plan, degraded forest land with potentialities for sericulture will be more available through the assistance of forestry development programme to farmers or farmers' groups on lease. The government farms will take care of the production and supply arrangements for silkworm eggs.

As mentioned before, good quality cocoons can be sold at a price of NRs 150 per kg and NRs 3,000 can be generated from one ropani of land. A main characteristic of sericulture is that it creates jobs for women. The increase in job opportunity will improve the social status of women.

Mulberry trees planted in marginal land, slopes, ridges, etc., help to conserve the environment and control soil erosion. Mulberry leaves can be used as fodder and its branches can be used as fire wood.

Table 5.1.1 Demographic Information in Chisaspani

No.	Kind of Information			
1	Household and Population	Household (Nos.)	Population (person)	Average Family (person)
		75	497	6.63
2	Poplulation and Household by Caste Group	Household (Nos.)	Population (Nos.)	Share (%)
1	Tamang	55	365	73%
2	Gurung	17	119	24%
3	Chettri	3	13	3%
3	Damages by 1993 Disaster			
1	Human damage	Dead persons	Injured persons	
		4	0	
2	House damage	Fully	Partially	
		32	0	

Source: The various field survey by the Study Team, 1996

Table 5.5.1 Cost of Production and Net Profit from Potato and Cauliflower Production in Chisapani

	Potato	Cauliflower
Yield Kg/Ropani	1,300	950
Value (Rs)	7,800	17,100
Cost per Ropani (Rs)	4,660	4,558
(Variable and Fixed Cost)		
Marketing Cost (Rs)	1,625	1,188
Total Cost (Rs)	6,285	5,746
Net Profit (Rs)	1,515	11,345

Source : Based on Hearing Survey

Table 5.5.2 Potential Water Supply for Network Development in Chisapani Area

Name of Group	Number of Household	Nos. / Name of Source	Amount of Water Supply (l/min.)				Potential Amount of Water Supply				
			Chhap W	Chhap E	Majuwa	Total	l/ day	-	l/ hh/ day.	l/ hh/ hr.	l/ hh/ 10 min.
S-1	36	6	20.0	10.0	-	30.0	43,200.0	-	1,200.0	50.0	8.3
S-2	21	2	-	10.0	-	10.0	14,400.0	-	960.0	40.0	6.7
S-3	21	3	-	-	20.0	30.0	43,200.0	-	1,600.0	66.7	11.1
Total	**78**	**-**	**20.0**	**20.0**	**30.0**	**70.0**	**100,800.0**	**Average**	**1,292.3**	**53.9**	**9.0**
Bhatudanda (D-1-3, T-1-2)	17	S-1	16.0	-	-	16.0	23,040.0	-	1,355.3	56.5	9.4
Upper West (D-1-2)	5	S-1	4.0	-	-	4.0	5,760.0	-	1,152.0	48.0	8.0
Mid West (D-1-1)	14	S-1	-	10.0	-	10.0	14,400.0	-	1,028.6	42.9	7.2
Lower west (D-2-1, 2-2, 2-3)	21	S-2 / S-3	-	10.0	10.0	20.0	28,800.0	-	1,371.4	57.1	9.5
Majuwa (D-3-2)	11	S-3	-	-	10.0	10.0	14,400.0	-	1,309.1	54.5	9.1
Mid Majuwa (D-3-1)	5	S-3	-	-	5.0	5.0	7,200.0	-	1,440.0	60.0	10.0
Lower Majuwa (D-3-3)	5	S-3	-	-	5.0	5.0	7,200.0	-	1,440.0	60.0	10.0
Total	**78**	**-**	**20.0**	**20.0**	**30.0**	**70.0**	**100,800.0**	**Average**	**1,292.3**	**53.8**	**9.0**

Source: Simulated by the Study Team in July, 1996

Note: hh = Household, hr = Hour

Table 5.5.3 Summary of Quantity for Rural Water Supply Network System in Chisapani Area

Name of Major Component	Description	Unit	Quantity S-1	S-2	S-3	Total	Remarks
1 Intake Protection Structure		nos.	6	2	3	11	Precast Unit
2 Storage Tank	9,000 lit.	nos.	1	-	-	1	
	6,000 lit.	nos.	-	1	1	2	
	Sub-Total	nos.	1	1	1	3	RCC (1:4) Tank
3 Distribution Tank	3,500 lit.	nos.	1	-	-	1	
	3,000 lit.	nos.	1	1	1	3	
	2,500 lit.	nos.	-	1	1	2	
	1,500 lit.	nos.	1	1	1	3	S-2: School Tank
	1,000 lit.		-	1	-	1	
	Sub-Total	nos.	3	4	3	10	RCC (1:4) Tank
4 Delivery Tank	1000 lit.	nos.	4	-	-	4	
	750 lit.	nos.	3	5	3	11	
	400 lit.	nos.	-	1	2	3	
	Sub-Total	nos.	7	6	5	18	Plastic Tank
5 Household Tank	200 lit.	nos.	36	21	21	78	Plastic Tank
6 Related Structures	BP Tank	nos.	6	3	-	9	Plastic Tank
	Valve Ch.	nos.	24	22	10	56	Precast Unit
	Sub-Total	nos.	30	25	10	65	
7 HDP Pipeline	12.5 mm	m	6,043	2,214	1,428	9,685	
	25.0 mm	m	464	1,846	165	2,475	
	38.0 mm	m	0	1,415	744	2,159	
	Sub-Total	m	6,507	5,475	2,337	14,319	10 kgf / cm2
8 Burying length of pipeline	Burying	m	4,800	4,100	1,800	10,700	75 % of Pipeline

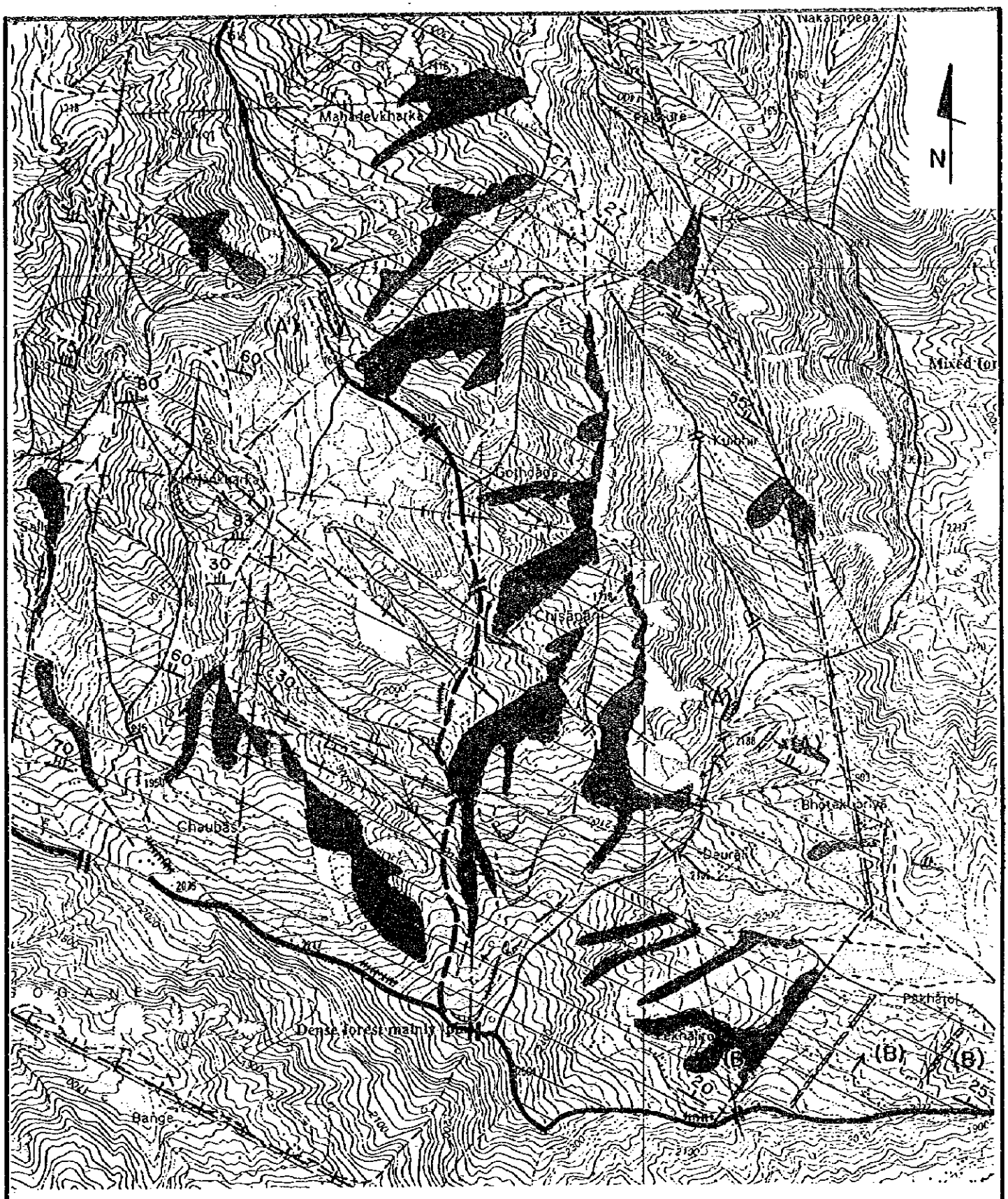
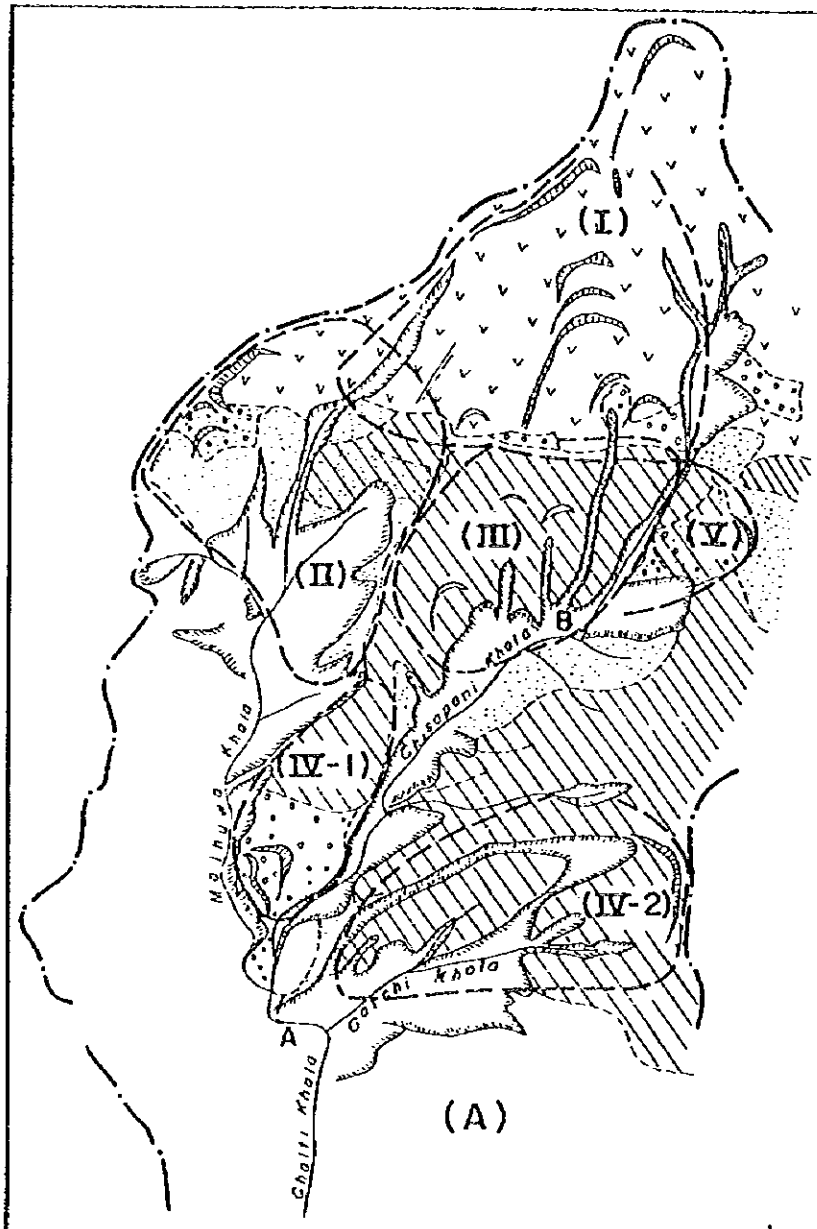


Fig. 5.1.1 Outline of Topography and Geological Structure

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



(A)

Used photo
Scale = 1:42,000
(November, 1992)

(B)

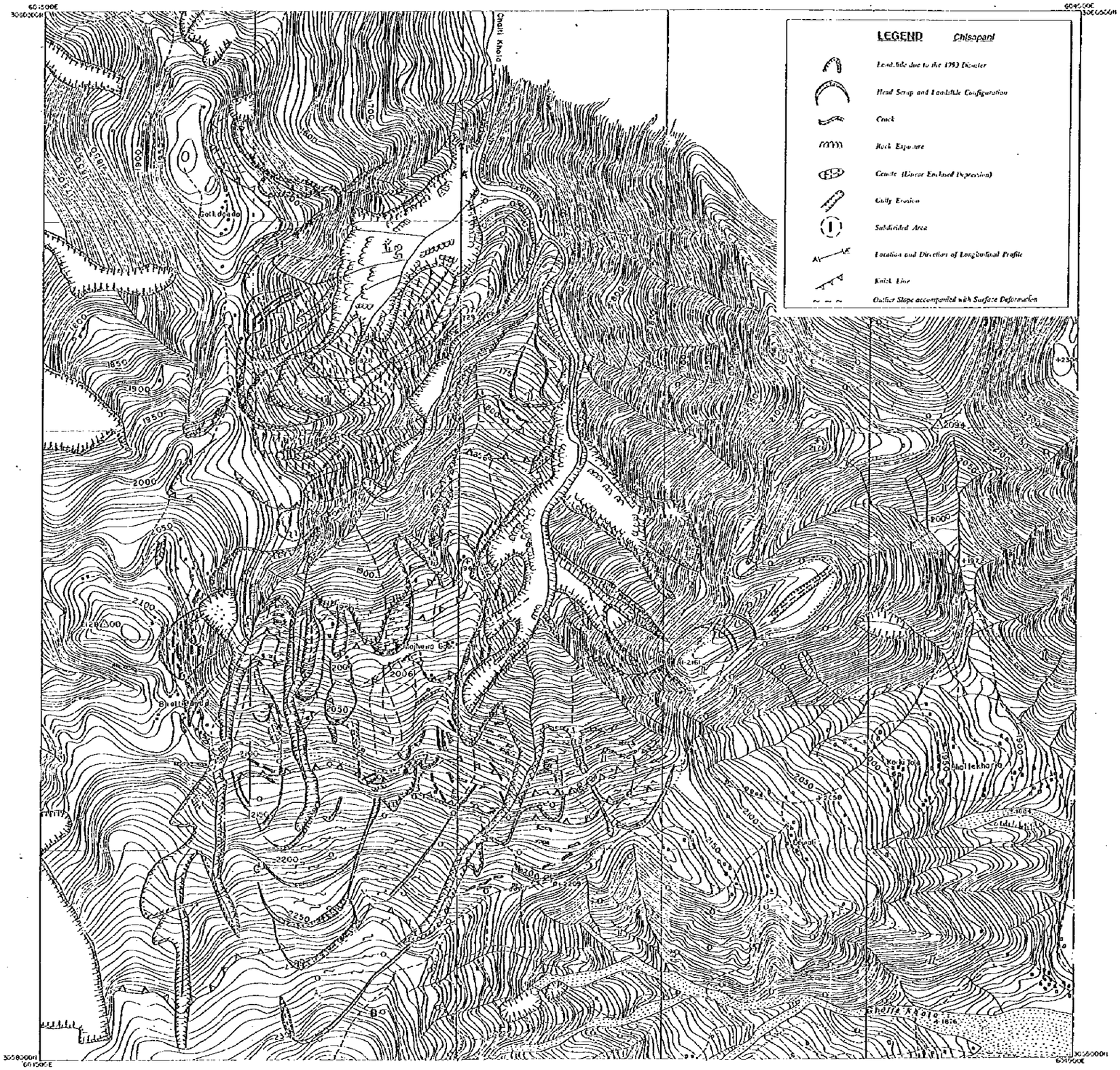
Used photo : L-4, 9401-23~24
Scale = 1:20000 enlargement
(24 March, 1994)

LEGEND

- forest (coose)
- shrub forest (shrubbery)
- thin shrubbery mixed with bush
- bush, barren land
- farmland
- farmland shifted to barren land due to surface deformation (Not use)
- thin shrubbery shifted from farmland due to surface deformation
- (I) divided area
- landslide due to 1993 disaster
- head scarp of landslide
- ridge
- Valley

Fig. 5.1.2
Land Use Pattern by Aero-Photo Investigation

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



LEGEND

Motorable road with bridge		Forest area	
Track with foot bridge		Land slide	
House		Contour	
Isolated tree, Bamboo		Spot height	
River with steep banks		Bench mark	
Khola, Khotsi		Cliff	
Gabion wall		Water-mill	
Rosks, Boulders		Trigonometrical control point	

Fig. 5.2.1
Disaster Map of Chisapani Area

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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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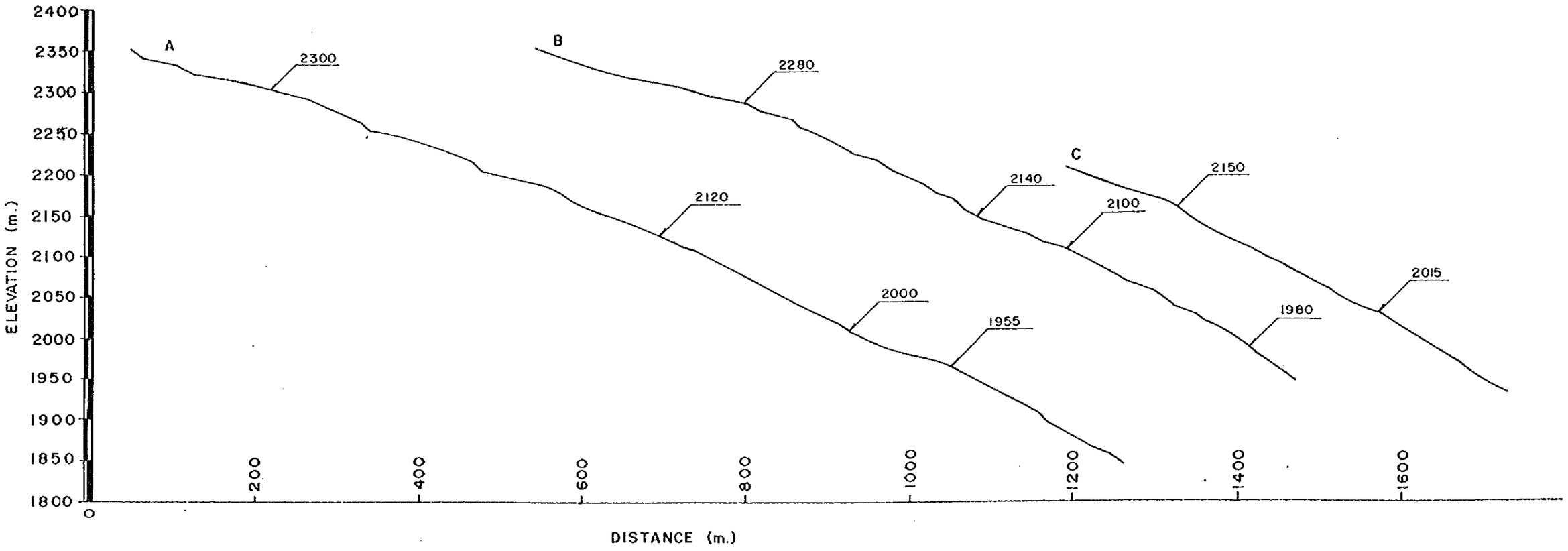

Fig. 5.2.2
Longitudinal Profiles of Chisapani Area

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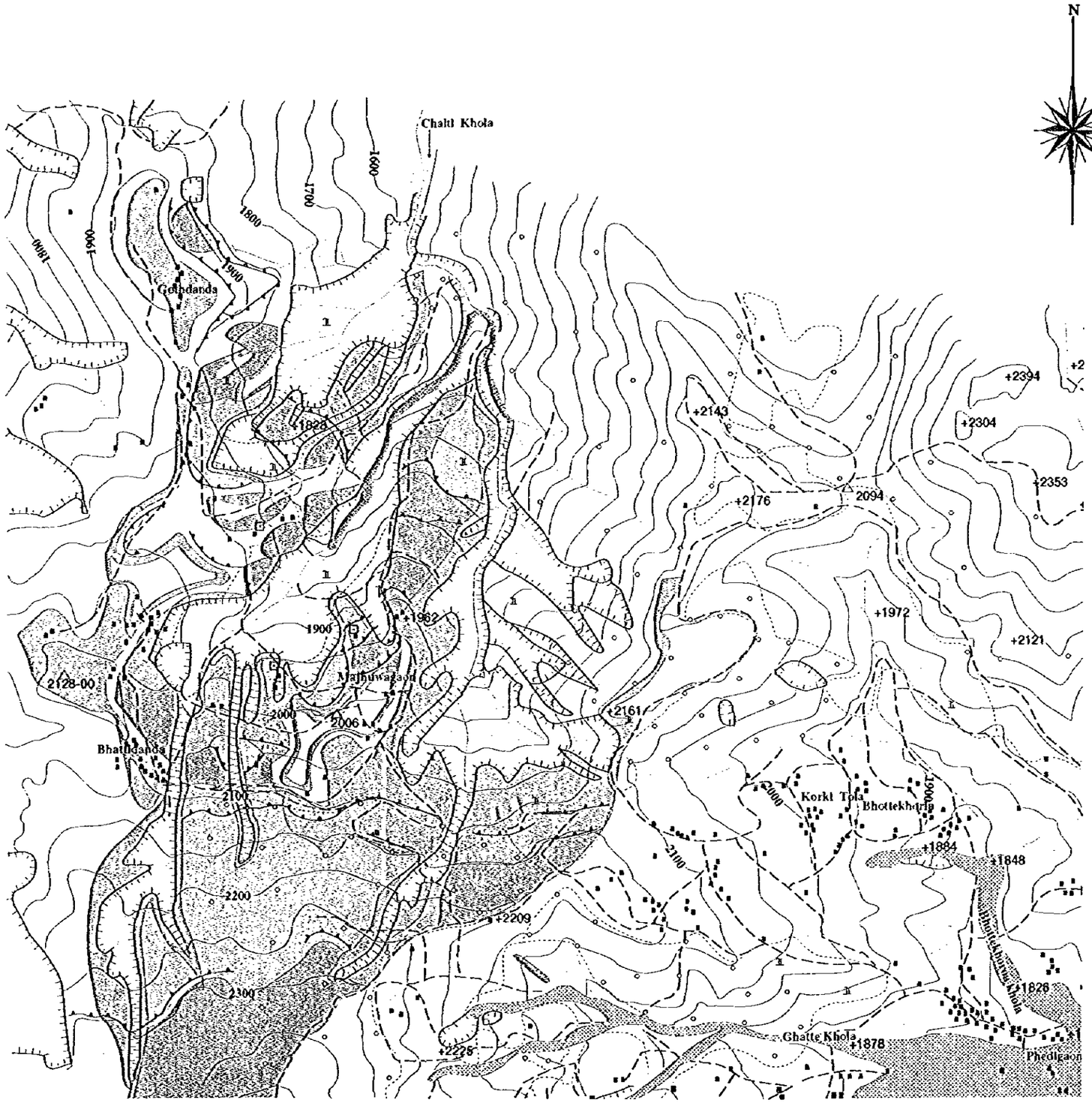

N

LEGEND

Motorable road with bridge		Forest area	
Track with foot bridge		Land slide	
House		Contour	
Isolated tree, Bamboo		Spot height	
River with steep banks		Bench mark	
Khola, Kholsi		Cliff	
Gabion wall		Water-mill	
Rosks, Boulders		Trigonometrical control point	

LEGEND

- Plane Slide, Failure due to the 1993 Disaster (hard rock exposed)
- Semi-Safety Zon
- A little Zone
- Hazardous House (need to take refuge in heavy rein)

Integrated Disaster Types

- Hazard Level A (High Hazard)
- Hazard Level B (Medium Hazard)
- Hazard Level C (Low Hazard)
- Knick Line

SCALE
0 125 250 500m

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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

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure. 5. 3. 1 Hazard Map of Chisapani Area

LEGEND-2

Priority Plan

Overall Plan

For whole area

Ch-12
Evacuation System

N

LEGEND

Motorable road with bridge		Forest area	
Track with foot bridge		Land slide	
House		Contour	
Isolated tree, Bamboo		Spot height	+2651
River with steep banks		Bench mark	
Khola, Kholsi		Cliff	
Gabion wall		Water-mill	
Rosks, Boulders		Trigonometrical control point	△ 2462

Chalti Khola

Gothdanda

Majhuwagaon

Bhattidanda

Korki Tola

Bhottekhola

Ghatte Khola

Phedigaun

Dr-1
Check dam

Dr-2
Check dam

Ch-12
Multipurpose Shelter
(Existing School)

Ch-4D
Check dam(H=20m)

Ch-9D
Prop wall(L=130m,n=1)

Ch-3D
Check dam(H=20m)

Ch-2D
Check dam(H=10m)

Ch-12
Multipurpose Shelter

Ch-5D
Series of small Check dam(H=5~8m,n=7)

Ch-1D
No.1 Check dam(H=10m)

Ch-6D
Series of small Check dams(H=4~7.5m,n=12)

Ch-12
Multipurpose Shelter

Ch-10D
Hillside works (L=40m,n=8)

Ch-8D
Series of small check dams (H=4,4.5)

Ch-7D
Series of small check dams (H=4,4.5)

Ch-11D
Prop wall(L=100m,n=2)

1600 1700 1800 1900 2000 2100 2200 2300

+1828 +1932 +1900 +2006 +2161 +2209 +2226 +2143 +2176 +2394 +2304 +2353 2094 +1972 +2121 +1884 +1848 +1826 +1878 2128-00

SCALE
0 125 250 500m

Fig. 5. 4. 1
Disaster Prevention Plan for Chisapani

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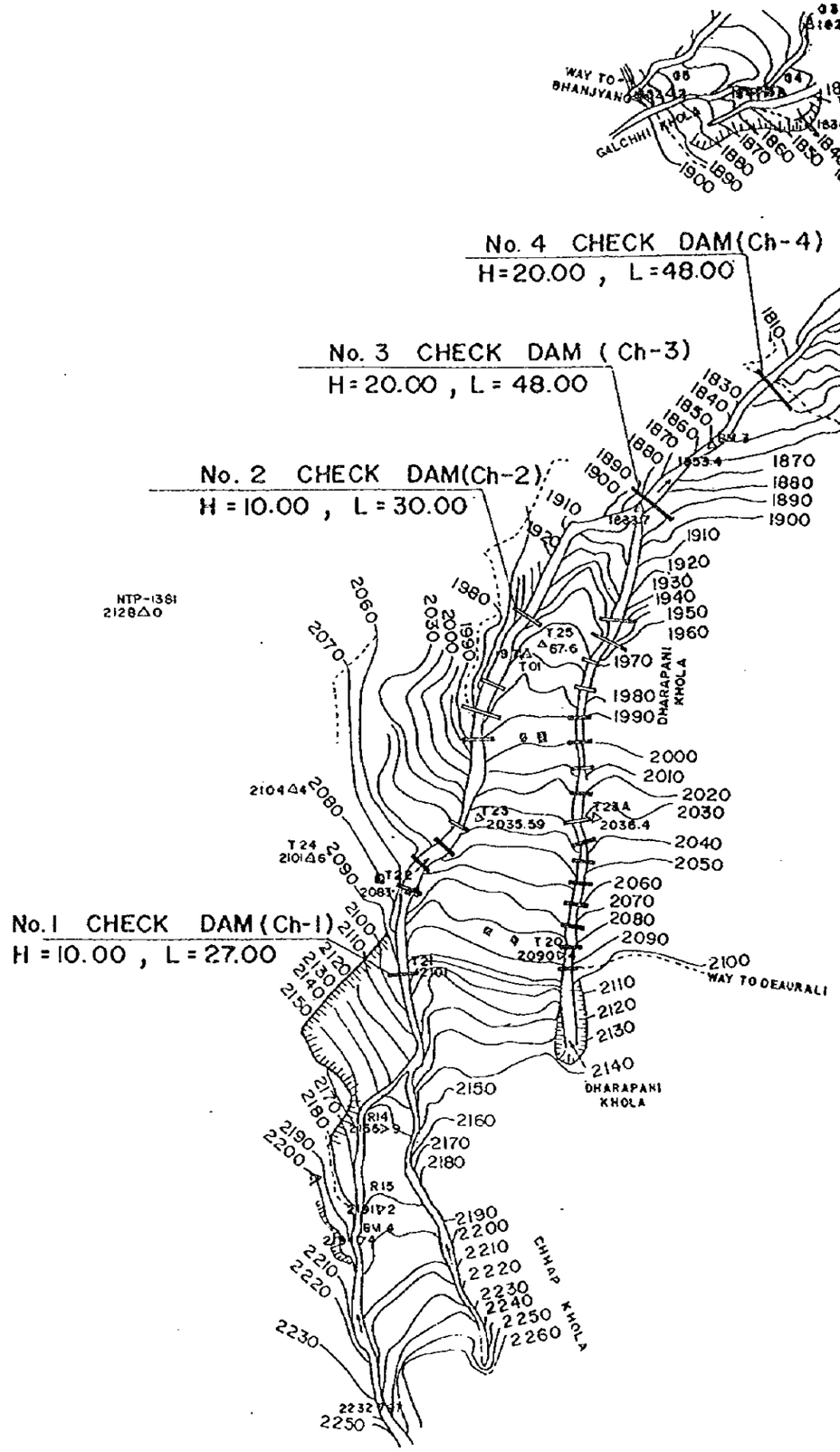

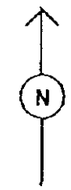

LEGEND

Motorable road with bridge	
Metalled road with bridge	
Track with foot bridge	
Suspension bridge	
Isolated Tree	
River with steep banks	
Khola, Kholsi	
Gabion wall	
Rocks, Boulders	
Trigonometrical Control Point	595△80
Forest Area	
Land Slide	
Contour	620
Spot height	650.00
Bench Mark	
Cliff	
Water mill	
House	
Top	

SCALE 1: 5000

M100 50 0 100 200 300M

Fig. 5.4.2
Arrangement of Structure in Chisapani Khola and Dharapani Khola

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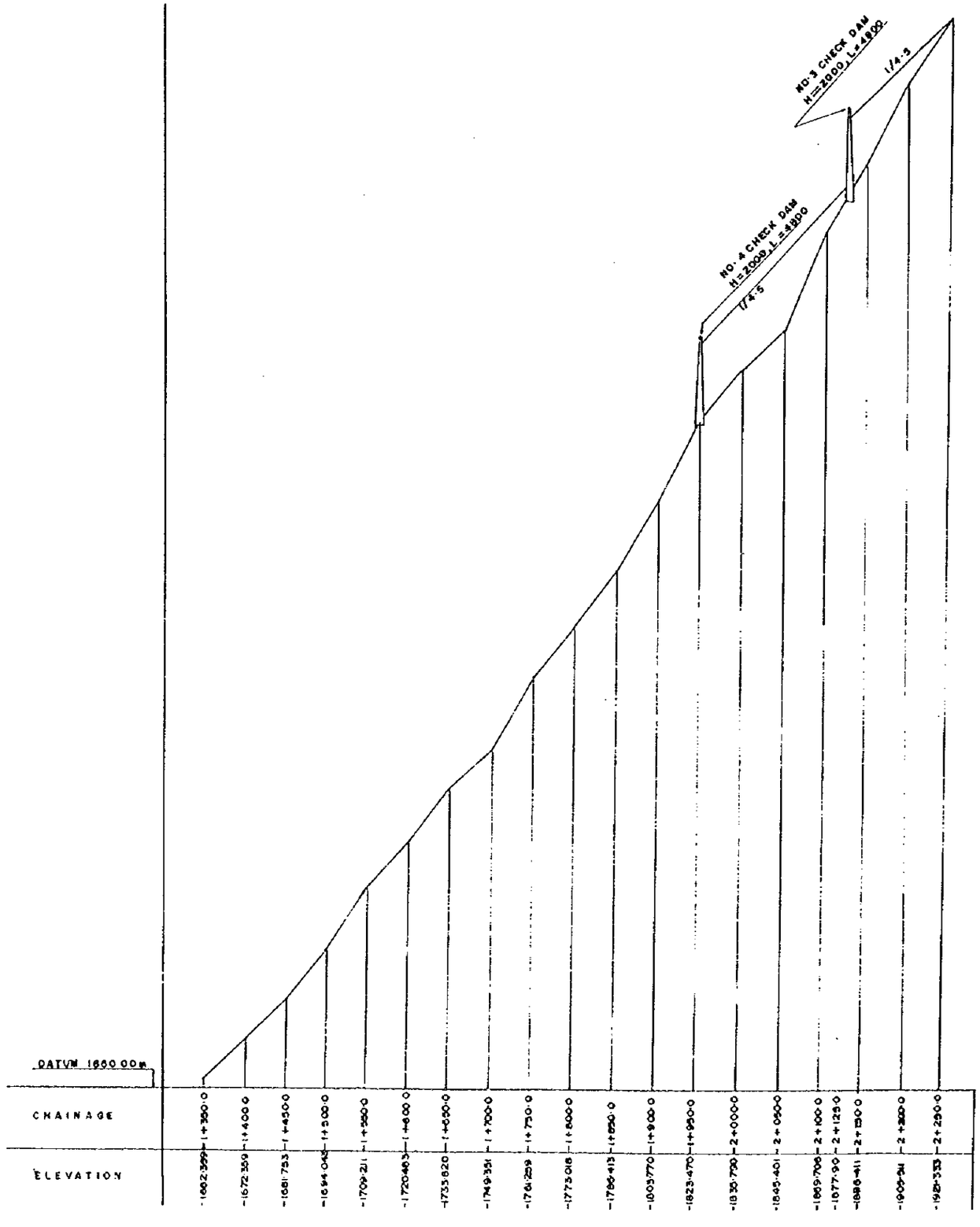

Fig. 5.4.3
Longitudinal Profile of Chisapani Khola (Downstream)

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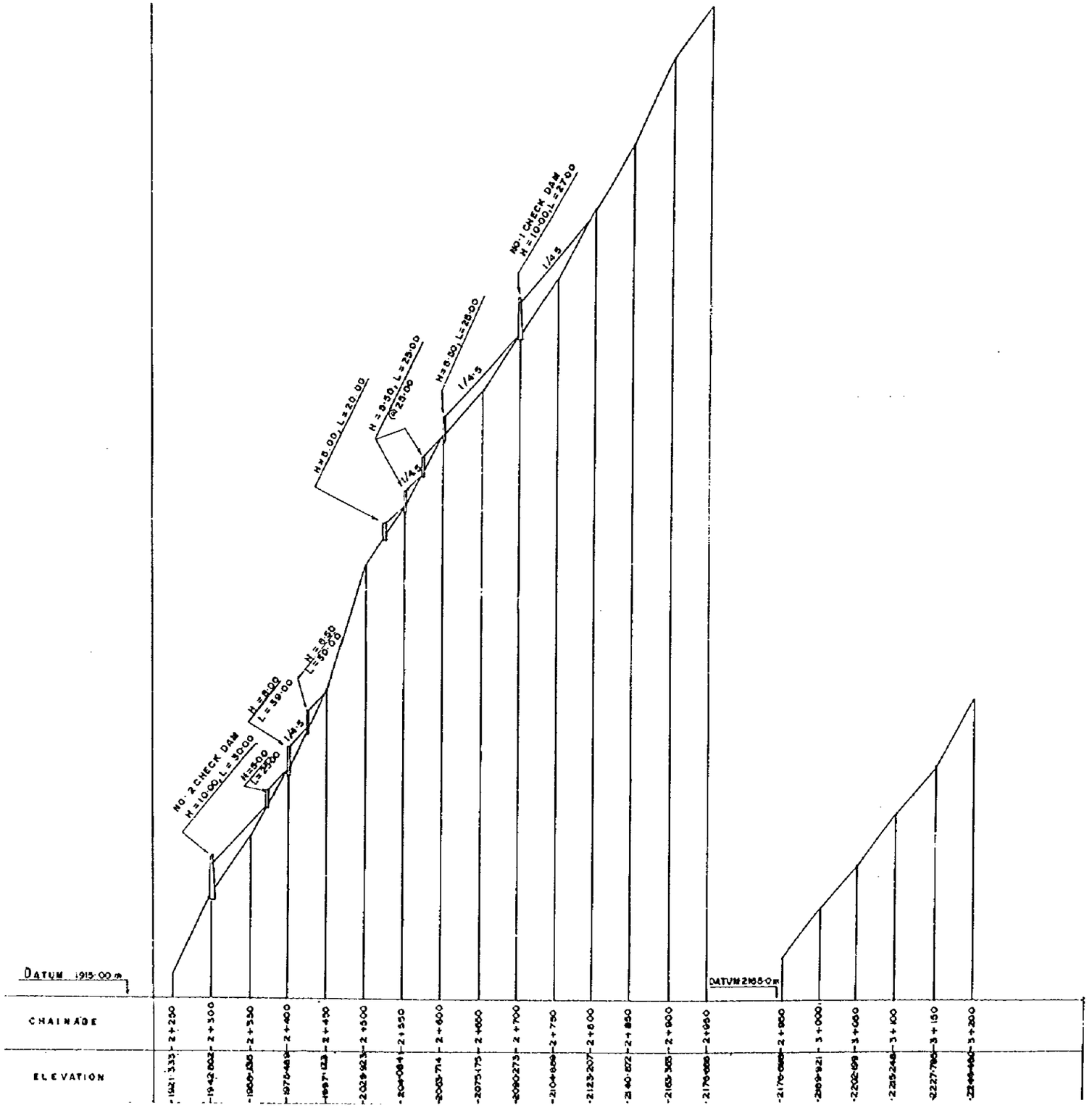

Fig. 5.4.4
Longitudinal Profile of Chisapani Khola (Upstream side)

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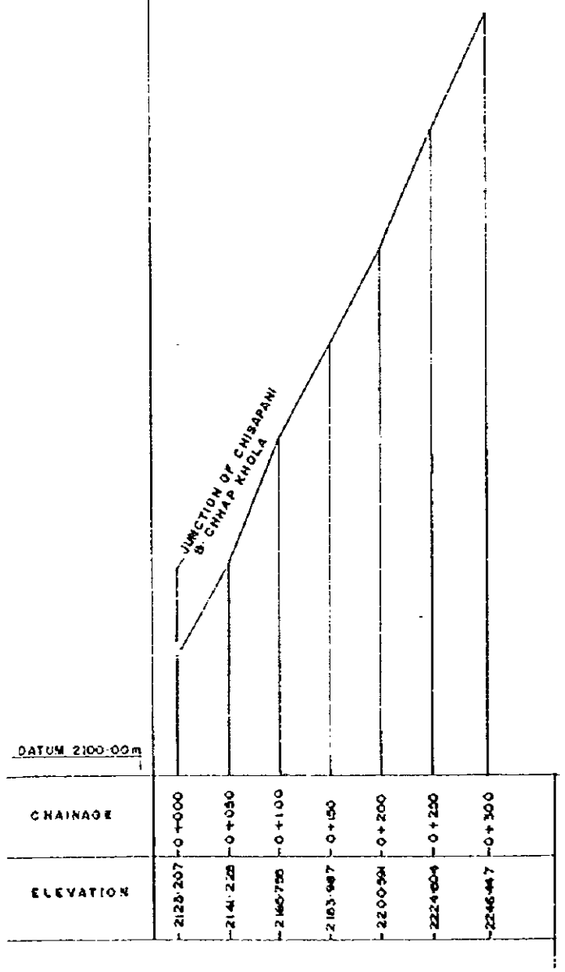
L - SECTION OF CHHAP KHOLA
(CHISAPANI)



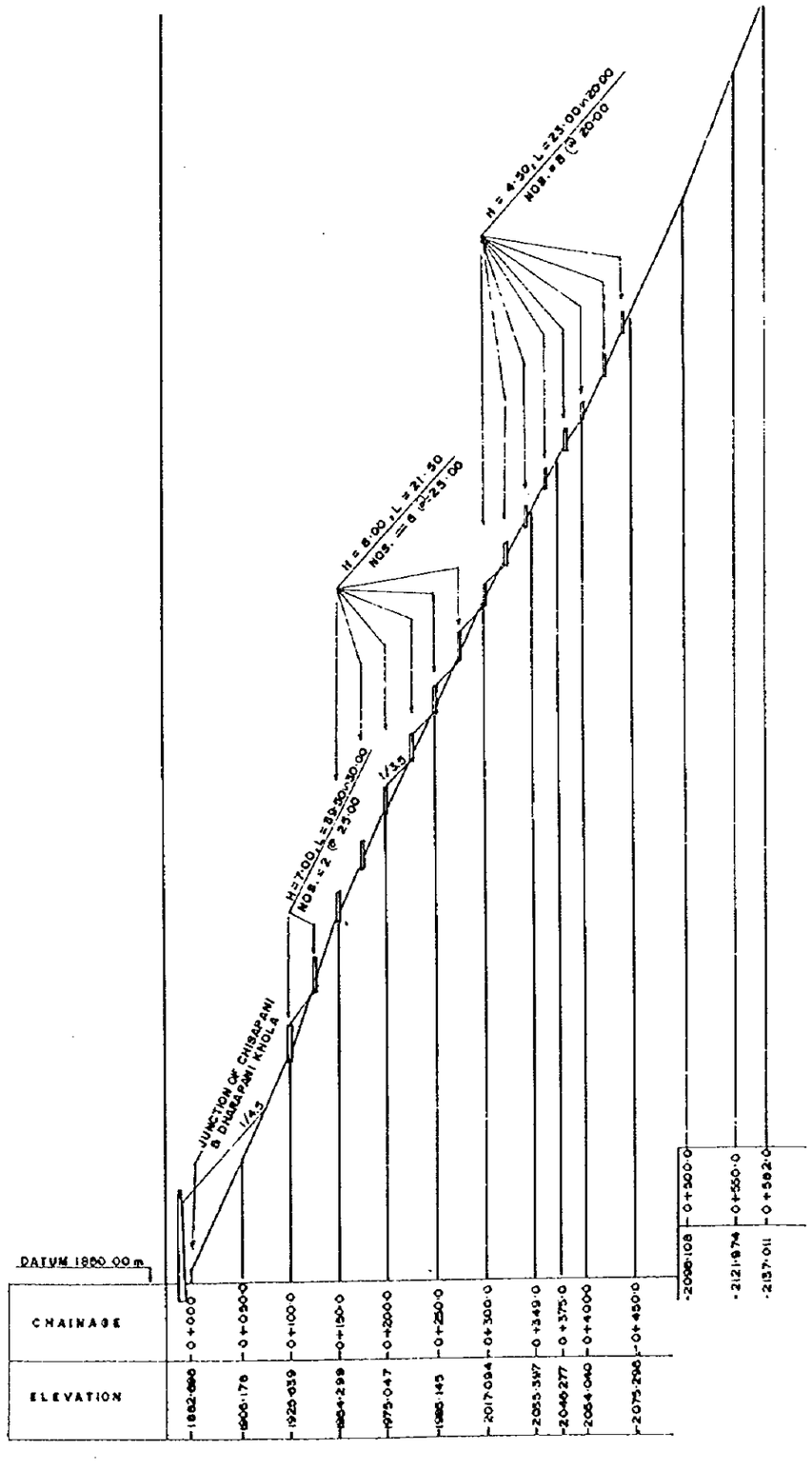


Fig. 5.4.5
Longitudinal Profile of Dharapani Khola

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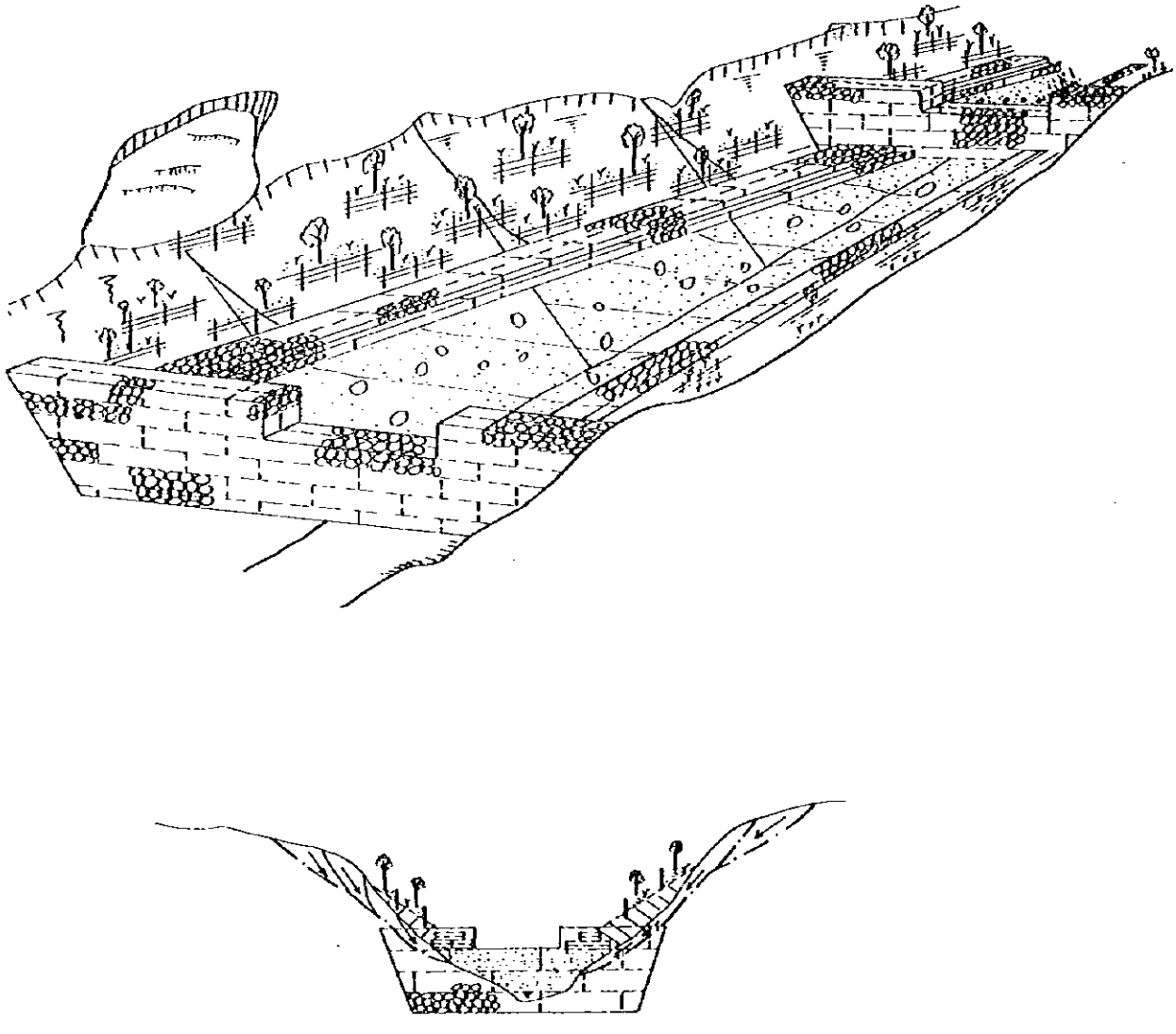

Fig. 5.4.6
Schematic Idea on Series of Gabion Check Dam and Bank Protection Works

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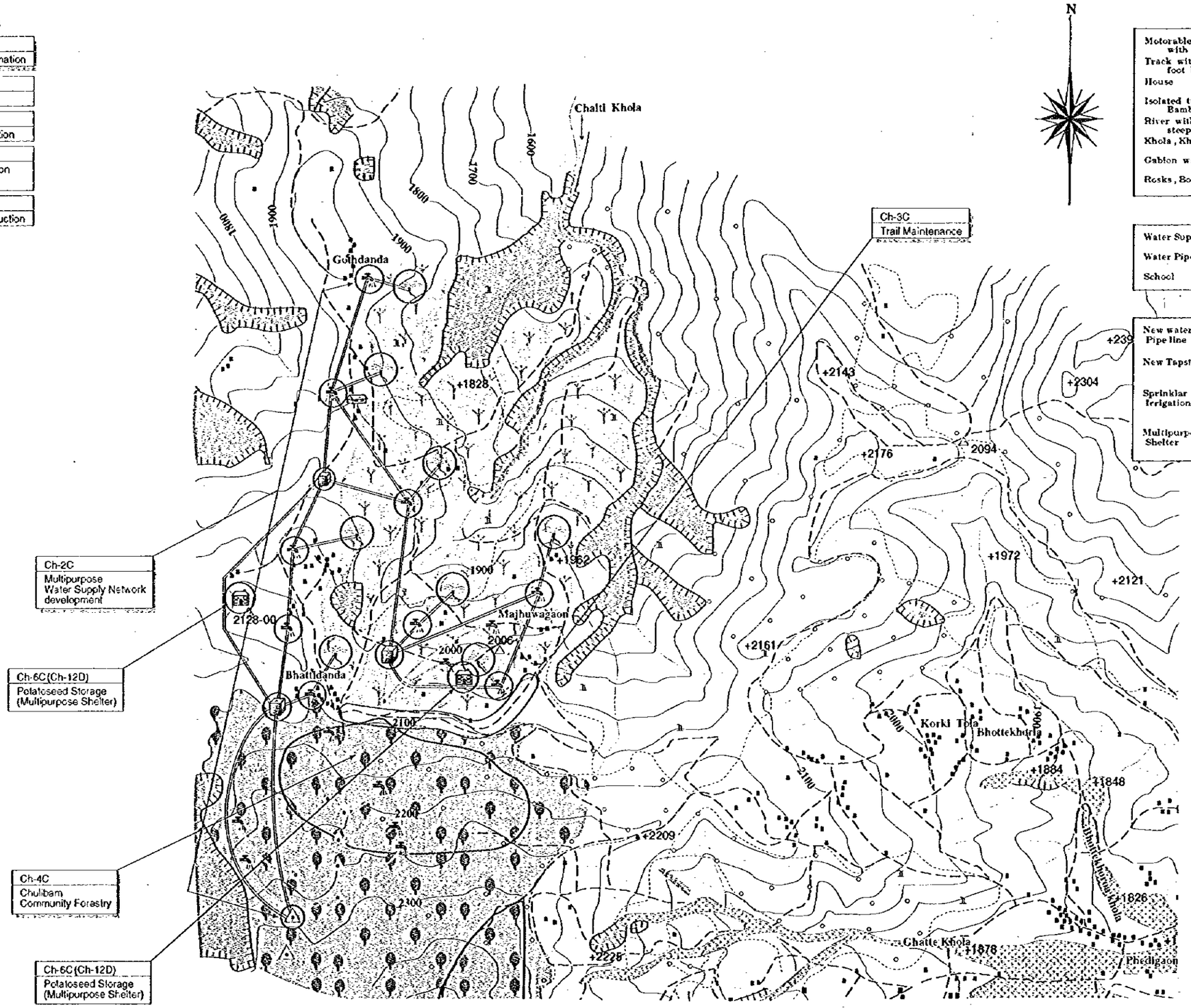
For whele Area

- Ch-1C — Users Committee Formation
- Ch-5C — Cash Crop Promotion
- Ch-7C — Medicinal Herd Plantation
- Ch-8C — Mulberry Tree Plantation and Sericulture
- Ch-9C — Mortable Road Construction



LEGEND-1

Motorable road with bridge		Forest area	
Track with foot bridge		Land slide	
House		Contour	
Isolated tree, Bamboo		Spot height	
River with steep banks		Bench mark	
Khola, Kholsi		Cliff	
Gabion wall		Water-mill	
Rosks, Boulders		Trigonometrical control point	

LEGEND-2 (Existing Conditions)

Water Supply Intake		Non-Irrigated land	
Water Pipe line		Existing Forest	
School		Tapstand	

LEGEND-3

New water Pipe line		Irrigation land	
New Tapstand		Community Foresty Area	
Sprinklar Irrigation		Distribution Tank	
Multipurpose Shelter		Delivery Tank	

Priority Plan

Overall Plan

Fig. 5. 4. 7
Overall Plan Community Development in Chisapani

SCALE 0 125 250 500m

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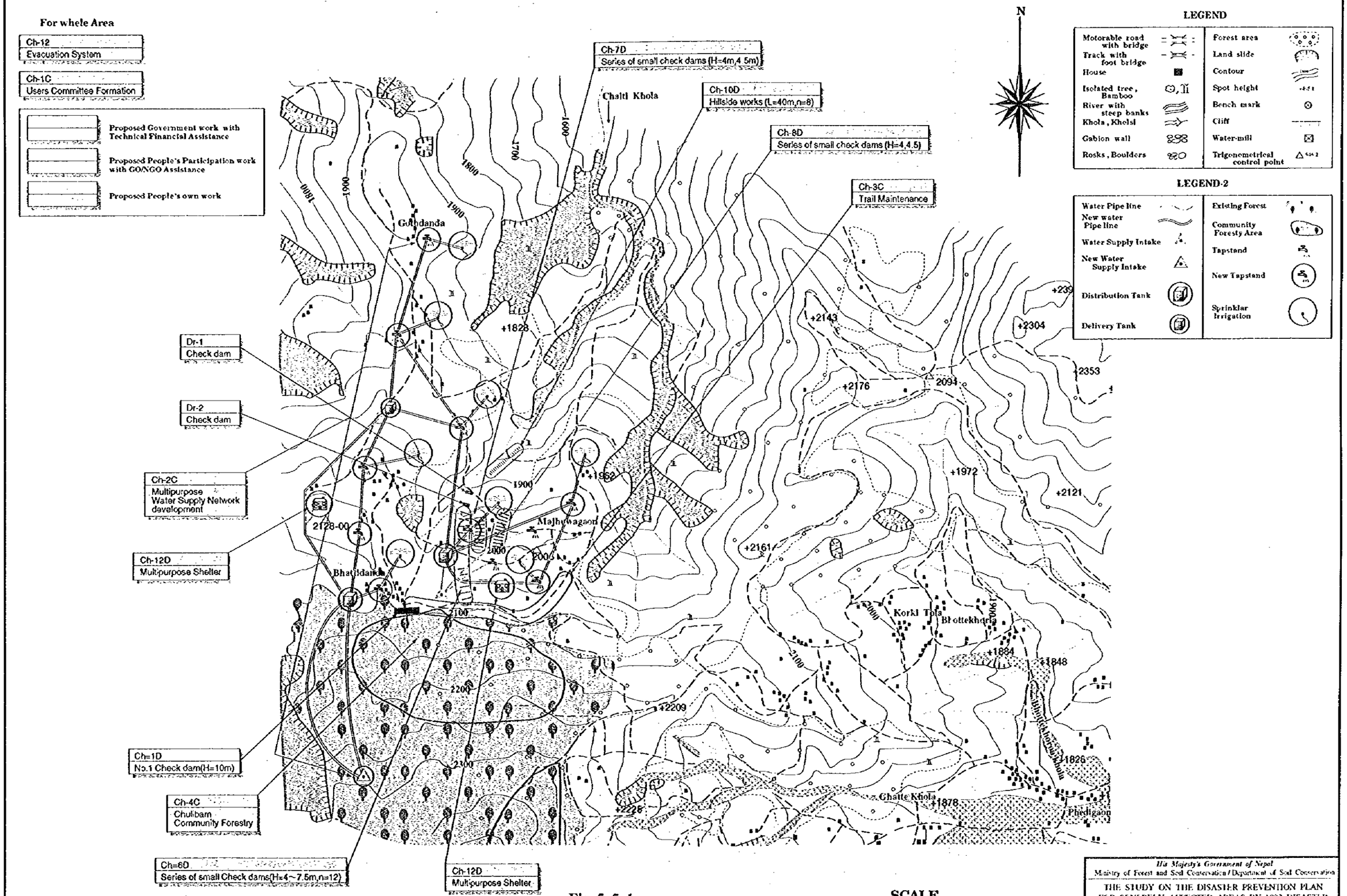
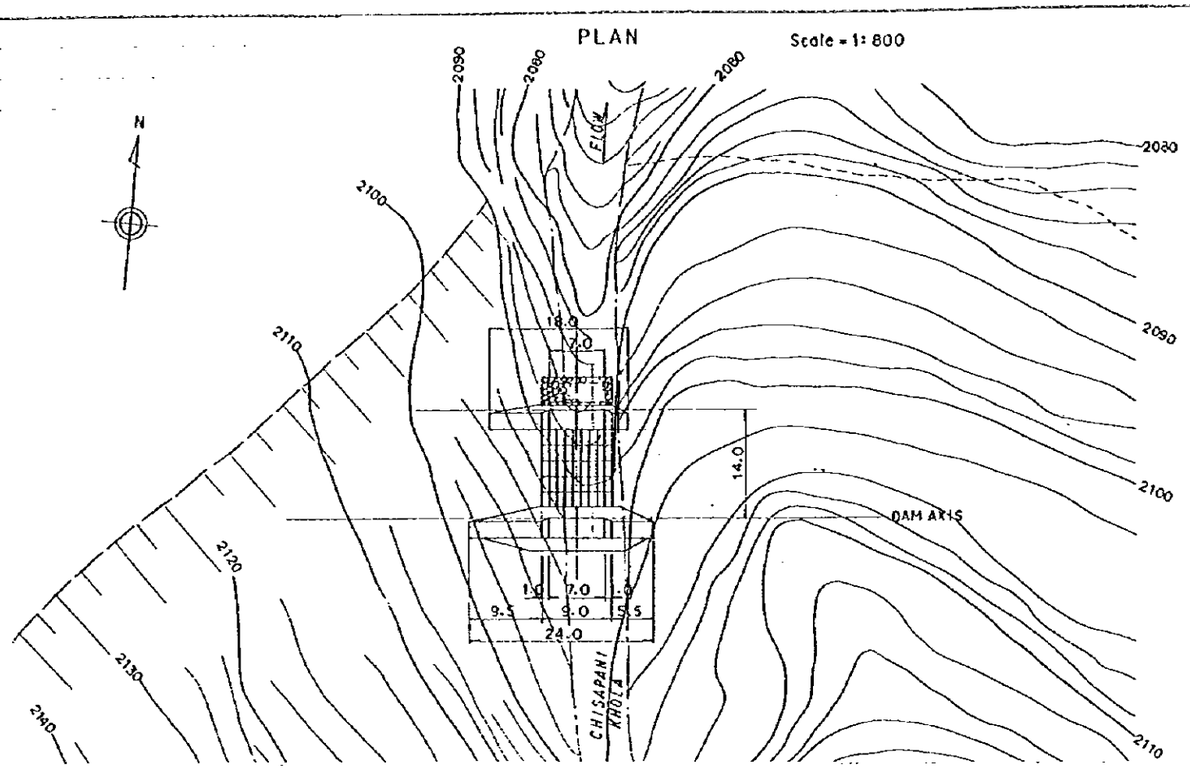


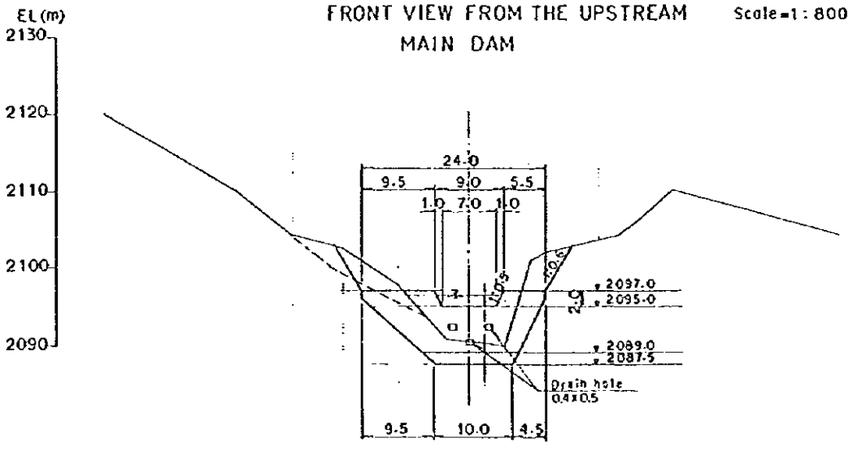
Fig. 5. 5. 1
Priority Plan for Chisapani

PLAN Scale = 1: 800

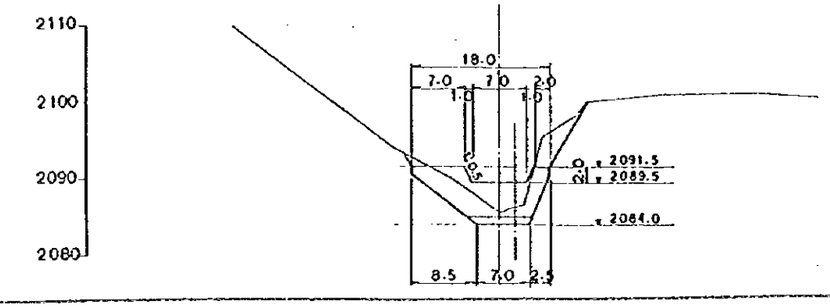


FRONT VIEW FROM THE UPSTREAM Scale = 1 : 800

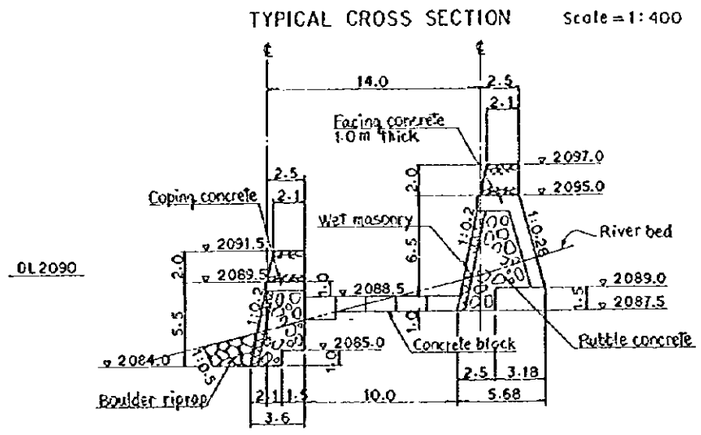
MAIN DAM



SUB DAM



TYPICAL CROSS SECTION Scale = 1: 400



Remarks:
This work is to be carried out with I CB basis.

Fig. 5.5.2
Check Dam Ch-1 in Chisapani CDPP

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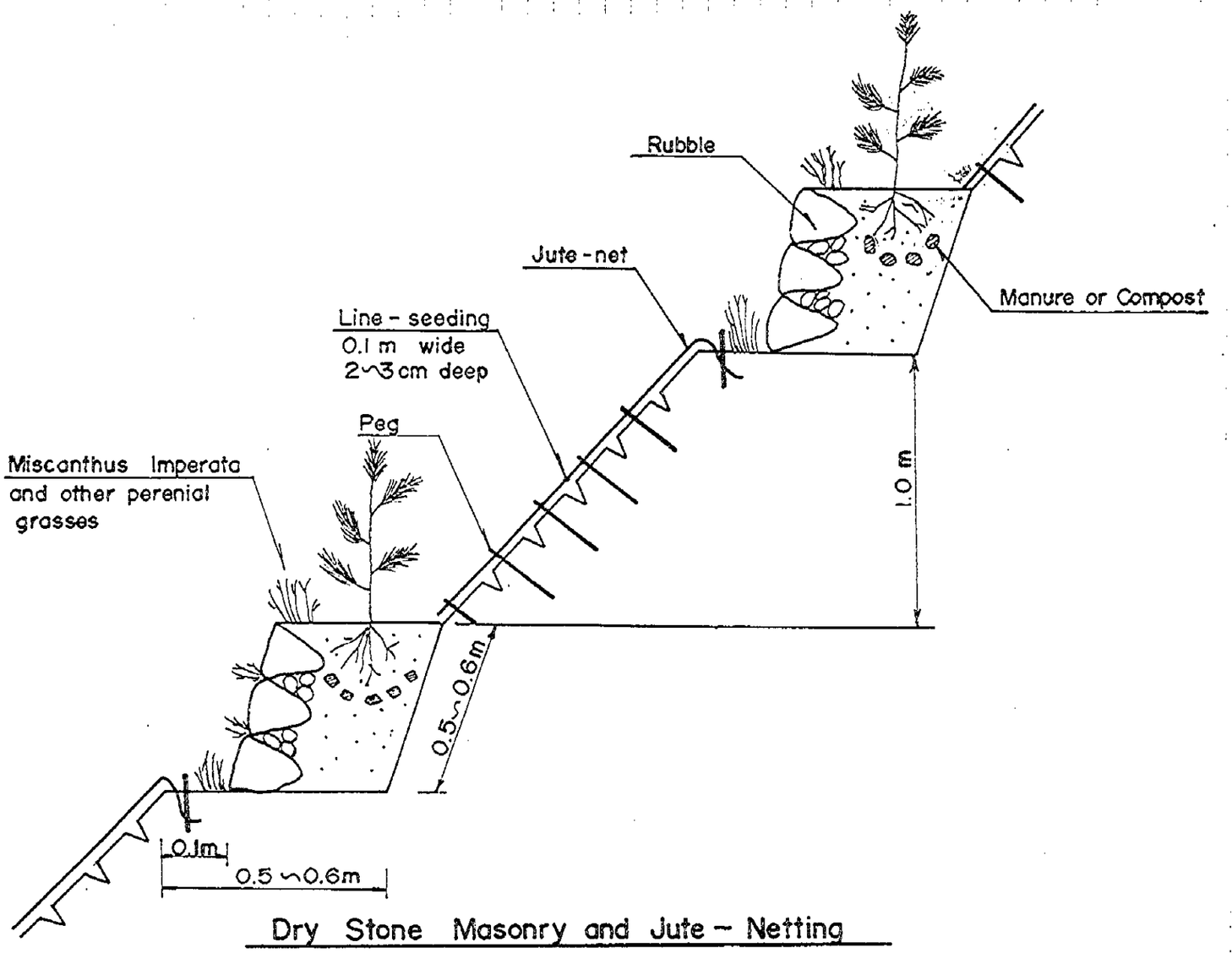
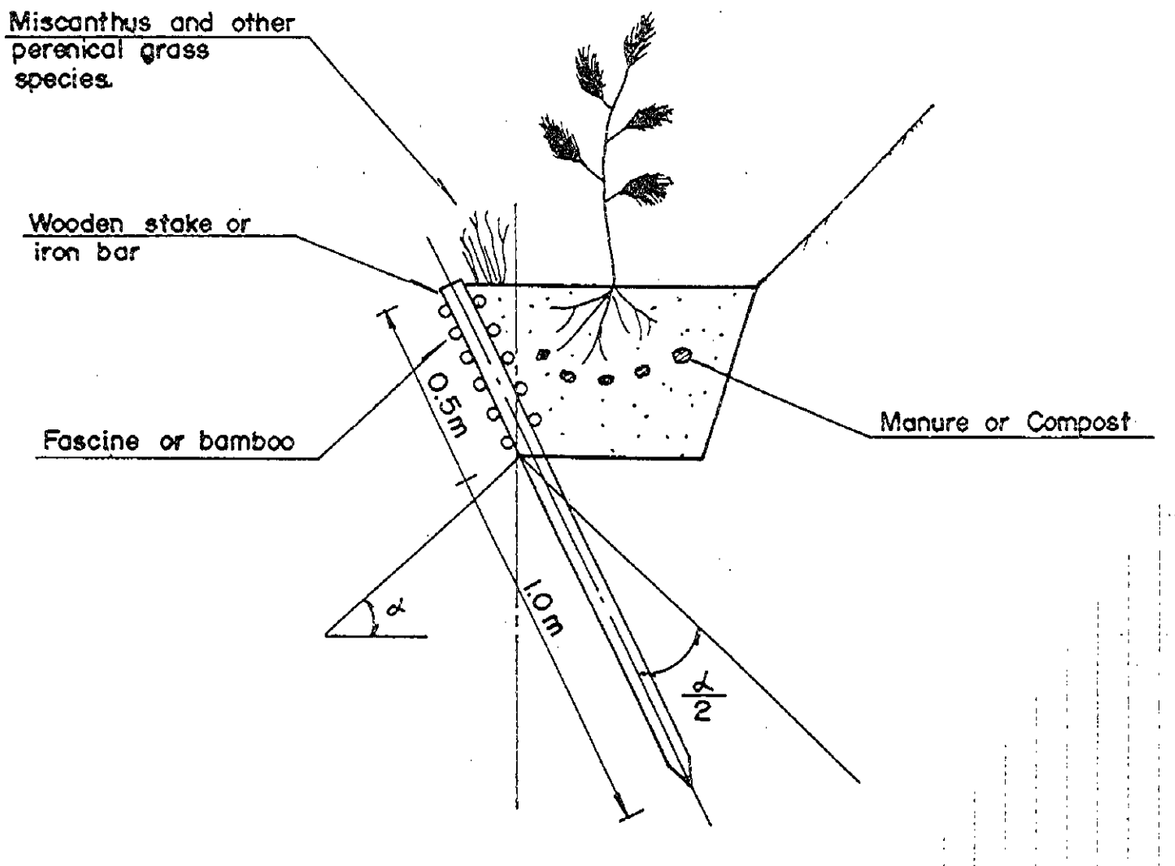


Dry Stone Masonry and Jute – Netting



Wattling

Fig. 5.5.3
Typical Design for Hillside Works

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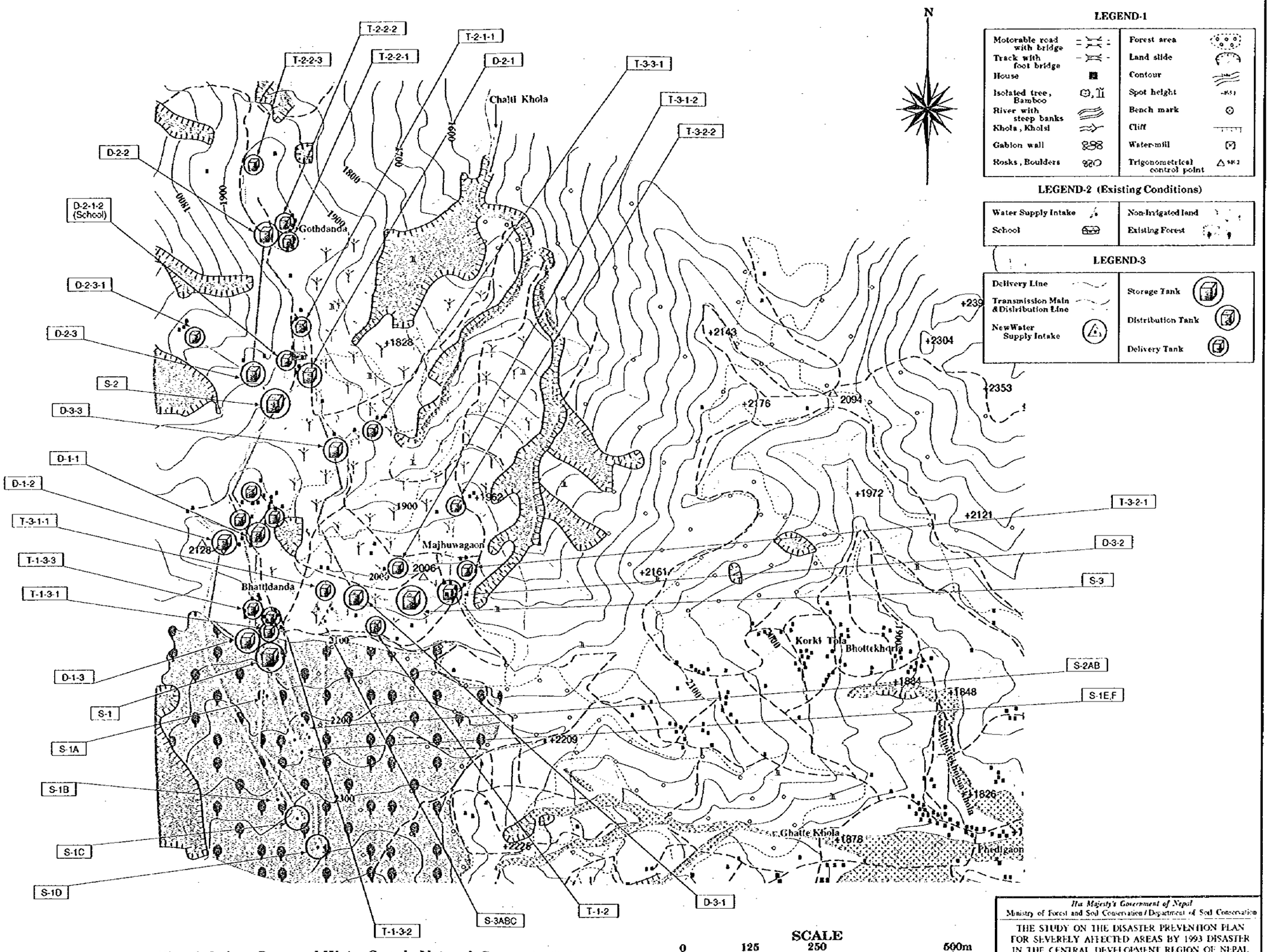

Fig. 5. 5. 4 Proposed Water Supply Network System in Chisapani

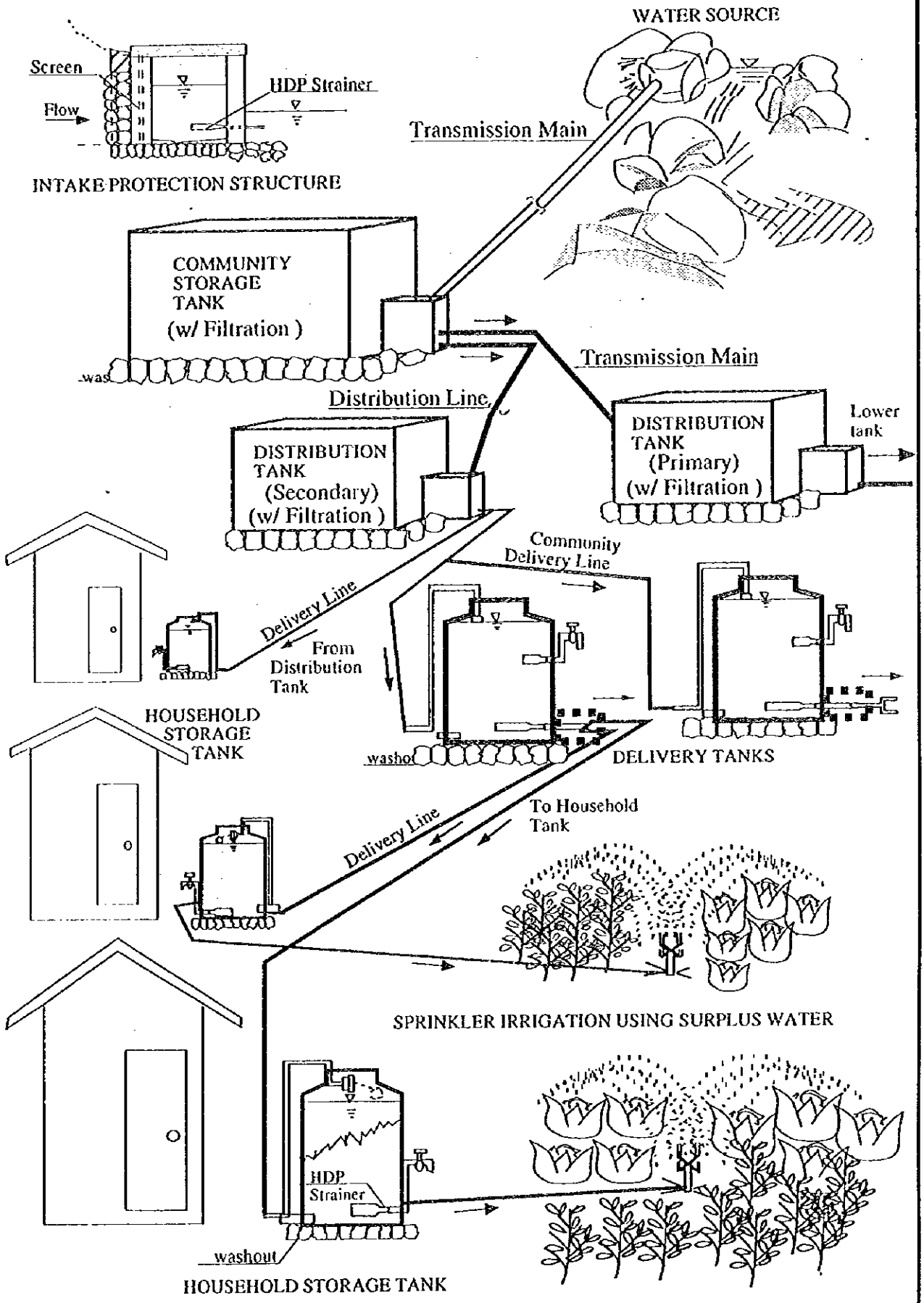

Fig. 5.5.5
Sketch Drawing for Rural Water Supply Network Development in Chisapani Area

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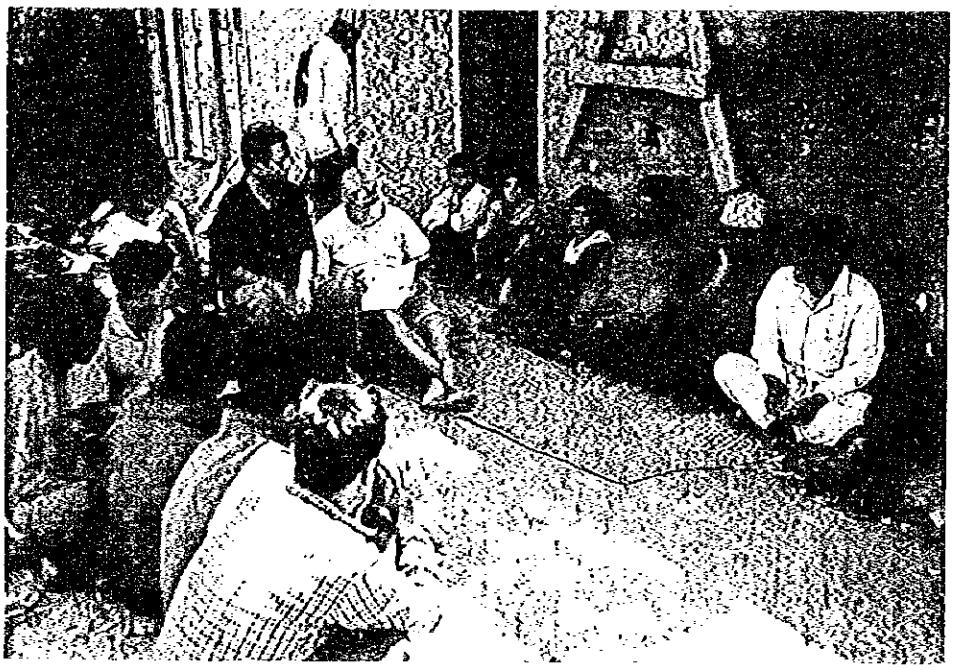

Photo 5.4.1 Focus Group Discussion of Males in Chisapani

Photo 5.4.2 Focus Group Discussion of Females in Chisapani