

## **Damage**

Twelve people were killed and 20 injured in the earthquake. Ten people were trapped and had to be rescued from RCC roofed houses. 90% of the houses were severely damaged and will have to be demolished, the remaining 10% are heavily damaged and will require extensive strengthening and repair. Most of the people were killed by the collapse of the rear wall of the building or by the fall of heavy Slate roofs. One cow and one buffalo were also killed in the earthquake.

## **Reconstruction**

Emergency shelters are built out of wooden planks retrieved from damaged and collapsed buildings with timber frames and wooden planks, CGI sheet and tarpaulin.

The village has been adopted by Swami Ram Foundation and they are erecting an emergency community shelter designed by CBRI: Kedar Kuti, in one of the agricultural fields near the road. People are apprehensive about living in it at the time of the survey, because the portal frame has not been grouted into the ground properly and the CGI sheeting provides no relief from the cold. They are also strongly opposed to the supply of cement or steel by the District Administration at this point of time as they have no place to store the cement.

## **Risk**

Even though only few buildings have totally collapsed, it is not possible to repair most of the houses and they pose a serious risk of collapse.

Around 30% of the agricultural terraces have collapsed. Most of the collapsed terraces are more than 1.5 m. high. This could cause considerable problems of food shortage in the coming season.

Two large quartzite boulders fell from the cliff, broke enroute and were stopped from damaging the houses by the trees and terraces near the village. At least 3 boulders are standing in an unstable condition around 1 km. above the Ginda village.

The land-slide risk is low in this area. Rock falls from the cliff are possible during the next wet season. It will be advisable to break up large boulders dangerously perched on the upslope area.

## Village Kishanpur, Bhatwari Tahsil, Uttarkashi District

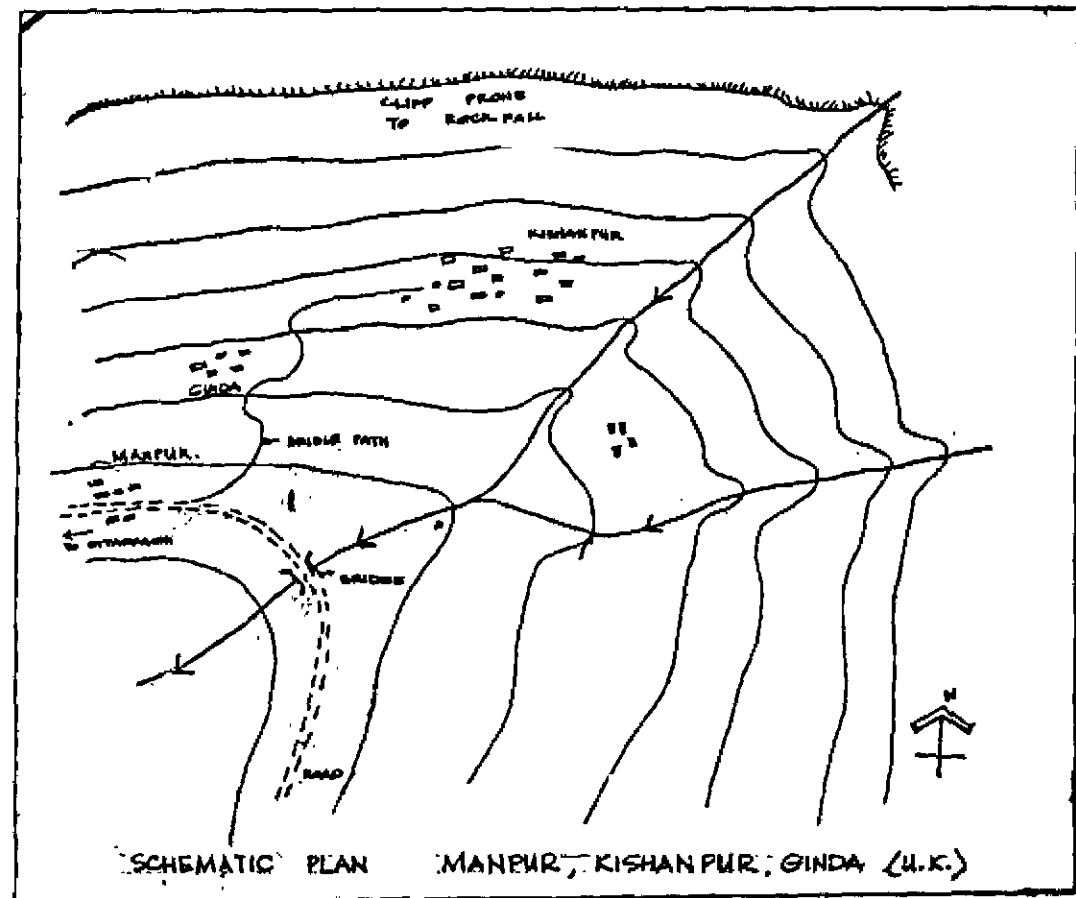
Kishanpur is a large village of 150 houses located at an altitude of 2,300 above msl. with a population of 225 households. It overlooks the main road, the Indravati river and Ginda village.

### Location

The village is located about 14 km. from Uttarkashi on Indravati valley on boulder-bed bearing slopes. Snowfall in the village touches 45 cm.

### Geology

The country rock is quartzite. Both colluvial and glacio-fluvial deposits were observed. The slopes are steep, considerable area is terraced and the terrace heights vary from 1 m. up to 4 m. The width ranges from 1.5 m up to 5 m. The soil thickness is very low and even in the terraced fields it rarely exceeds 30 cm.



*The village Kishanpur appears undamaged from the road. In actual fact 60% of the houses are severely damaged and virtually all the houses will have to be demolished before reconstruction can take place.*

### **Occupational Structure**

The primary occupation of the village is agriculture and animal husbandry. The village has a well built system of terraces and irrigation channels that have suffered severe damage. The local farmers estimate 2 to 3 years time to reconstruct these terrace and irrigation channels. The staple crops are paddy, wheat and potato. The village has 200 cows, 300 bullocks, 500 buffaloes, 300 goats and sheep. The people are concerned about the survival of these animals in the cold, especially the buffaloes.

A few men are working outside the village in the Army, Forest Department and the Government.

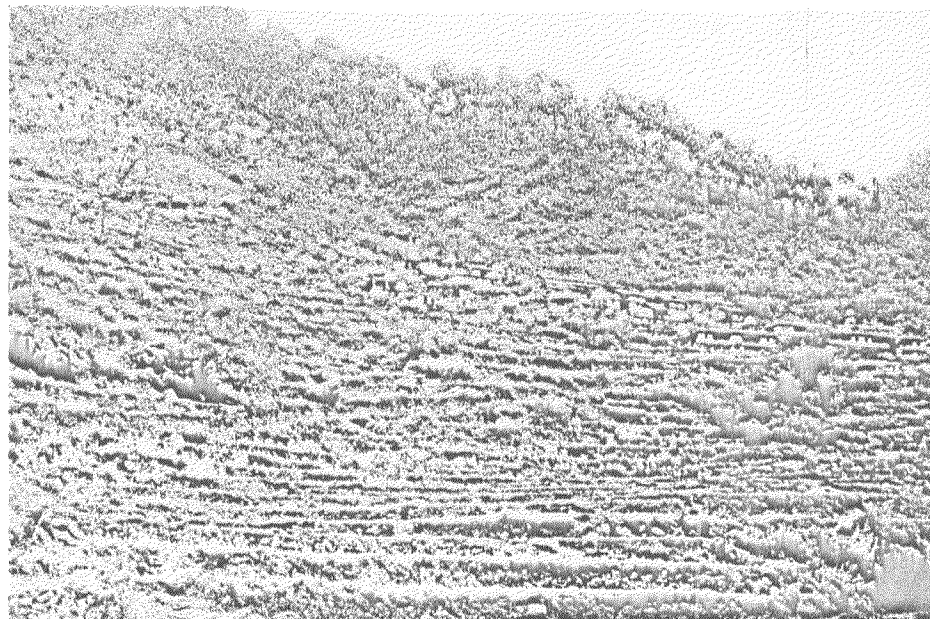
### **Infrastructure**

The village water supply is drawn from a spring about 1 km. walk from the village. The pipe system has been damaged by the earthquake, but a trickle of water was observed at one standpipe. The water was said to be contaminated. Electric supply was restored a week after the earthquake and some households have tapped the line for use in their emergency shelters.

The village has a primary school that is located near the road. The nearest dispensary is about 1 km. down the road.

### **Local building materials**

The local building materials used are phyllites and quartzites for walls. The block sizes are generally small. Slates for roofs were transported from more than 5 km.



A view of the severely damaged Kishanpur village, Bhatwari Tahsil, Uttarkashi District.

### Local construction workers

Masons and carpenters have to be hired from lower elevations and are paid upto Rs. 75 per day.

### Materials of Construction

All the houses in the village are built with walls in Stone in mud mortar. The predominant roofing material is Slate (80%), the rest are built with RCC. Both types of roofs have failed during the earthquake. The proportion of people injured or killed in Slate roofed houses is more than RCC, though the RCC roofed structures failed more catastrophically.

<i>Table 6.5 Village Kishanpur: Estimated Structure of Housing Stock (% to total houses)</i>			
<i>Material of Wall</i>	<i>Material of Roof</i>		
	<i>Slate on earth on timber planks</i>	<i>RCC</i>	<i>TOTAL</i>
Mud-pathri	80%	20%	100%
Source: TARU field appraisal			

The price of cement is Rs. 130 per bag delivered and sand is available at Rs. 58 per bag. Steel is available delivered at Rs. 1350 per quintal.

### Damage

Twenty-three people were killed and 100 injured (mainly minor injuries) in the earthquake. Twenty-five people were trapped and had to be rescued. Twenty-five head of cattle were killed in the earthquake.

30% of the houses were severely damaged and will have to be demolished, 60% were heavily damaged and will have to be partially demolished, the remaining 10% are moderately damaged and will require extensive strengthening and repair. Most of the people were killed by the collapse of the rear wall of the building or by the fall of the heavy Slate roof.

## **Reconstruction**

Emergency shelters are built out of wooden planks retrieved from damaged and collapsed buildings with timber frames and wooden planks, CGI sheet and tarpaulin.

## **Risk**

Even though only few buildings have totally collapsed, it is not possible to repair most of the houses and they pose a serious risk of collapse.

Around 30% of the agricultural terraces have collapsed. Most of the collapsed terraces are more than 1.5 m. high. This could cause considerable problems of food shortage in the coming season.

Two large quartzite boulders fell from the cliff, broke enroute and were stopped from damaging the houses by the trees and terraces near the village. At least 3 boulders are standing in unstable condition around 700 m. above Kishanpur village.

The land slide risk is low in this area. Rock falls from the cliff are possible during the next wet season. It will be advisable to break up large boulders\* dangerously perched on the upslope area.

## Village Thati, Pratap Nagar Tahsil, Tehri Garhwal District

Thati, is a medium sized village of 100 houses located at an altitude of 2,000 above msl. with a population of 150 households. It overlooks the strategic confluence of two rivers and the shrine of BudhaKedar. The bulk of the inhabitants of the village belong to scheduled and other backward castes.

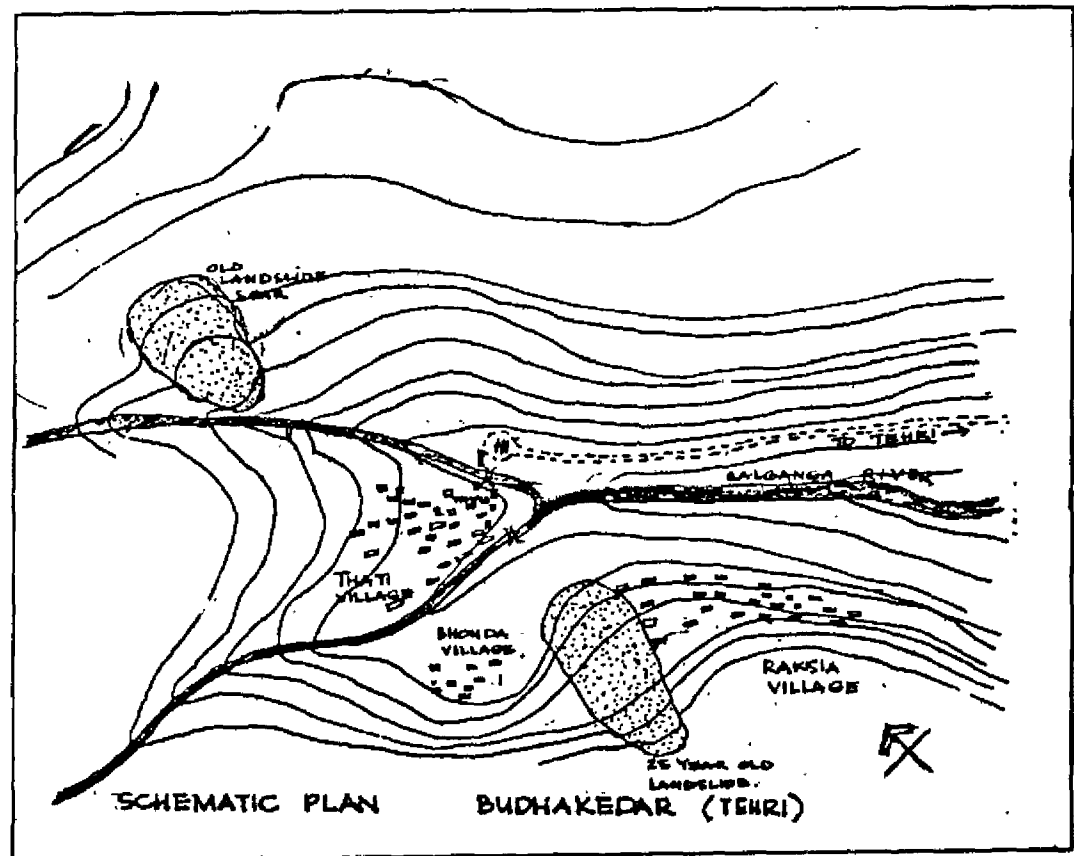
### Location

This village is situated at the road head (Ghansali-Budhakedar). The Balganga valley forms a bowl shaped basin opening downwards through a narrow U-shaped valley. There are many fossil and recent landslide scars on the valley slopes. The present shape of the valley is largely due to multiple landslides.

Thati village is situated on the alluvial terrace at the confluence of two tributaries. The Budhakedar temple is situated on an granitic outcrop jutting out of the alluvial sediments. Snowfall in the village touches 30 cm.

### Geology

The country rock is granitic, sheared and weathered and is prone to landslides. The soil depth is more than 30 cm. in most of the places along the slope.



## **Occupational Structure**

The primary occupation of the village is agriculture and animal husbandry is a subsidiary activity. The staple crops are paddy and wheat. The average land holdings are small: less than 1 hectare. The village has 200 cows, 50 bullocks, 50 buffaloes and 6 mules. Fruit like Oranges, Malas and Bananas are also grown.

## **Infrastructure**

The village water supply is drawn from a spring about 0.5 km. away. Electric supply was restored a week after the earthquake. The village has access to a primary school and middle school that is located near the road. The nearest dispensary is about 1 km. down the road.

## **Local building materials**

The local wall building material is granitic boulders collected from the river bed and colluvium. Roofing slates are mined from a quarry situated around 6 km upstream.

## **Local construction workers**

Masons and carpenters come from the neighboring village Ragsya.

## **Materials of Construction**

All the houses in the village are built with walls in Stone in mud mortar. The predominant roofing material is Slate (60%) (30%) and the remaining 10% (usually very poor households) in Timber and thatch.

<i>Table 6.6 Village Thathi: Estimated Structure of Housing Stock (% to total houses)</i>				
<i>Material of Wall</i>	<i>Material of Roof</i>			
	<i>Thatch on timber planks</i>	<i>Slate on earth on timber planks</i>	<i>RCC</i>	<i>TOTAL</i>
Mud-pathri	10%	60%	30%	100%
Source: TARU field appraisal				

The price of cement is Rs. 135 per bag delivered. Steel is available delivered at Rs. 1350 per quintal.

### **Damage**

Ten people suffered injuries in the earthquake and none were killed. No cattle were killed or injured.

15% of the houses were severely damaged and will have to be demolished, 40% were heavily damaged and will have to be partially demolished, the remaining 45% were moderately damaged and will require extensive strengthening and repair.

### **Reconstruction**

Emergency shelters are built out of wooden planks, (retrieved from damaged and collapsed buildings) timber frames, CGI sheets and tarpaulin.

### **Risk**

Large cracks are seen at many places along the slope above the adjacent village of Ragsya. A major crack is reported by the villagers around 800 m. uphill near the junction of colluvium with country rock. Damming of the left tributary near Thathi village is probable if this fossil landslide is activated and in that event, few low lying houses may be inundated. Thathi village is otherwise safe from immediate geological hazards.



## Village Ragsya, Pratapnagar Tahsil, Tehri Garhwal District

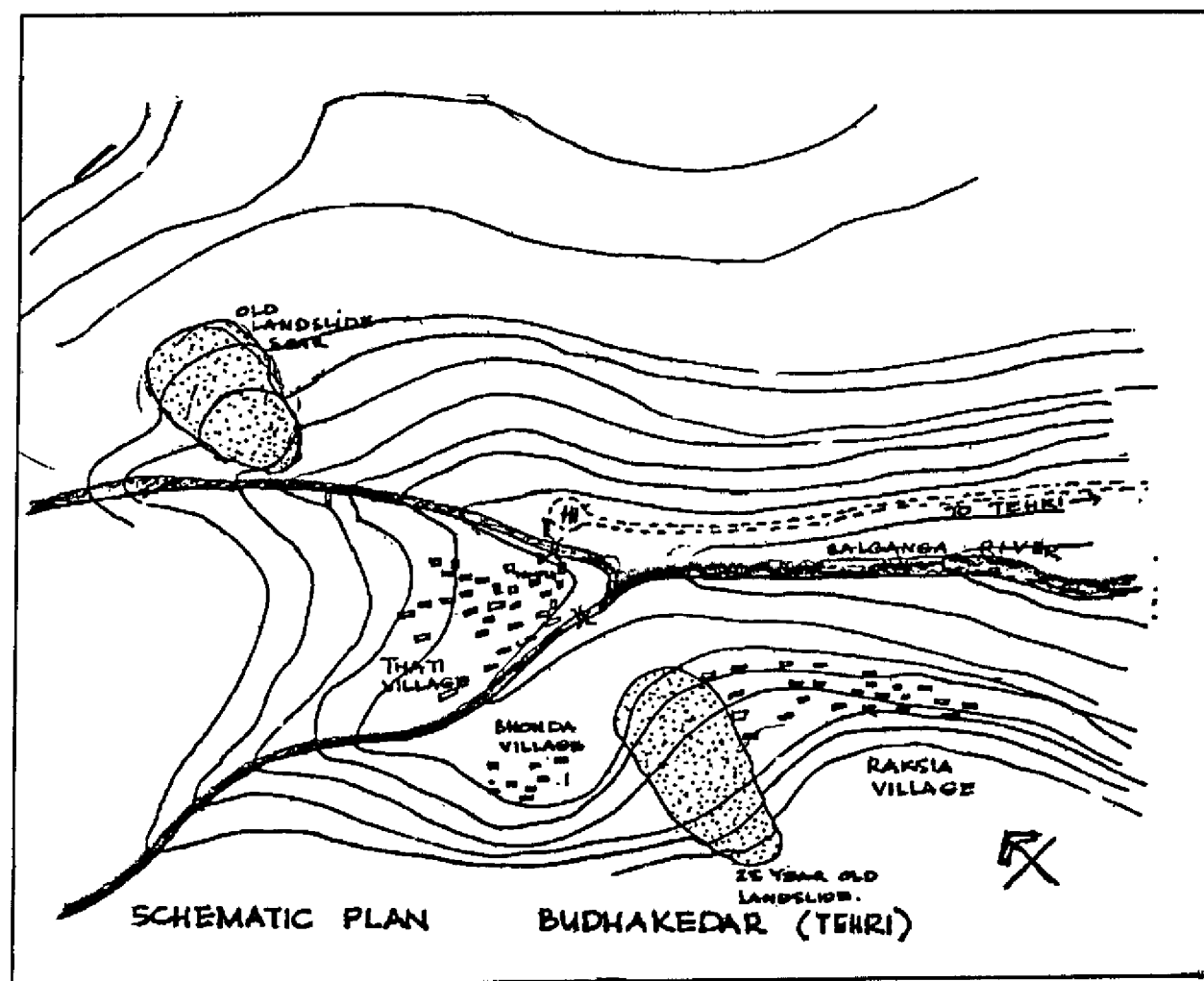
Ragsya is a large village of 200 houses located at an altitude of 2,200 above msl. with a population of 300 households. It overlooks the strategic confluence of two rivers and the shrine of BudhaKedar. The bulk of the inhabitants of the village belong to scheduled and other backward castes.

### Location

Ragsya village is situated on colluvial slopes. There are many fossil and recent landslide scars all around the valley slopes. One such landslide hit the village during late sixties destroying around 15 houses and their occupants. The present Bhonda village was built by the survivors on the other side of the landslide route. Snowfall in the village touches 30 cm.

### Geology

The country rock is granitic, sheared and weathered and is prone to landslides. The soil depth is more than 30 cm. in most of the places along the slope.



*A view of Ragsya village showing the small houses and the close linear clustering. The scale of damage here is much less than Uttarkashi District, however, the roofs of most buildings would have to be dismantled to undertake strengthening and repair.*



A view of houses in Ragsya village, Pratapnagar Tahsil, Tehri Garhwal District.

### **Occupational Structure**

The primary occupation of the village is agriculture and animal husbandry. The staple crops are paddy and wheat. The average land holdings are small: less than 1 hectare. The village has 200 cows, 300 bullocks, 200 buffaloes, 500 goats and sheep and 2 mules. Fruit like Oranges, Malas and Bananas are also grown.

### **Infrastructure**

The village water supply is drawn from a spring about 1 km. away from the village. The pipe system has been damaged by the earthquake, but a trickle of water was observed at one standpipe. The water was said to be contaminated. Electric supply was restored a week after the earthquake and some households have tapped the line for use in their emergency shelters.

The village has access to a primary school and middle school that is located near the road. The nearest dispensary is about 1 km. down the road.

### **Local building materials**

The local wall building material is granitic boulders collected from the river bed and colluvium. Roofing Slates are mined from a quarry situated around 6 km upstream.

### **Local construction workers**

Few masons and carpenters are there in this village, who also cater the needs of neighboring villages.

All the houses in the village are built with walls in Stone in mud mortar. The predominant roofing material is Slate (50%), 40% (usually very poor households) in timber and thatch, and the remaining 10% are in RCC.

<i>Table 6.7 Village Ragsya: Estimated Structure of Housing Stock (% to total houses)</i>				
<i>Material of Wall</i>	<i>Material of Roof</i>			
	<i>Thatch on timber planks</i>	<i>Slate on earth on timber planks</i>	<i>RCC</i>	<i>TOTAL</i>
Mud-pathri	40%	50%	10%	100%
Source: TARU field appraisal				

The price of cement is Rs. 135 per bag delivered on site. Steel is available at Rs. 1350 per quintal. Roofing Slate is available at Rs. 20 each for large slates and Rs. 10 for small ones.

### Damage

No people were killed in the earthquake, twenty suffered injuries. No cattle were killed or injured.

10% of the houses were severely damaged and will have to be demolished, 40% were heavily damaged and will have to be partially demolished, the remaining 50% were moderately damaged and will require extensive strengthening and repair.

### Reconstruction

Emergency shelters are built out of wooden planks (retrieved from damaged and collapsed buildings) on timber frames, CGI sheets and tarpaulin.

### Risk

Large cracks are seen at many places along the slope. A major crack is reported by the villagers around 800 m. uphill near the junction of colluvium with country rock. The risk of the near future landslide is extremely high. Immediate relocation of the Ragsya and Bhonda villages are necessary to avoid casualties.

## Village Gauri Kund, Ukhimath Tahsil, Chamoli District

Gauri Kund is a small village of 45 houses located at an altitude of 3,000 above msl. with a population of 56 households. The village is located on the Kedarnath pilgrim route, 5 km. north of Soneprayag.

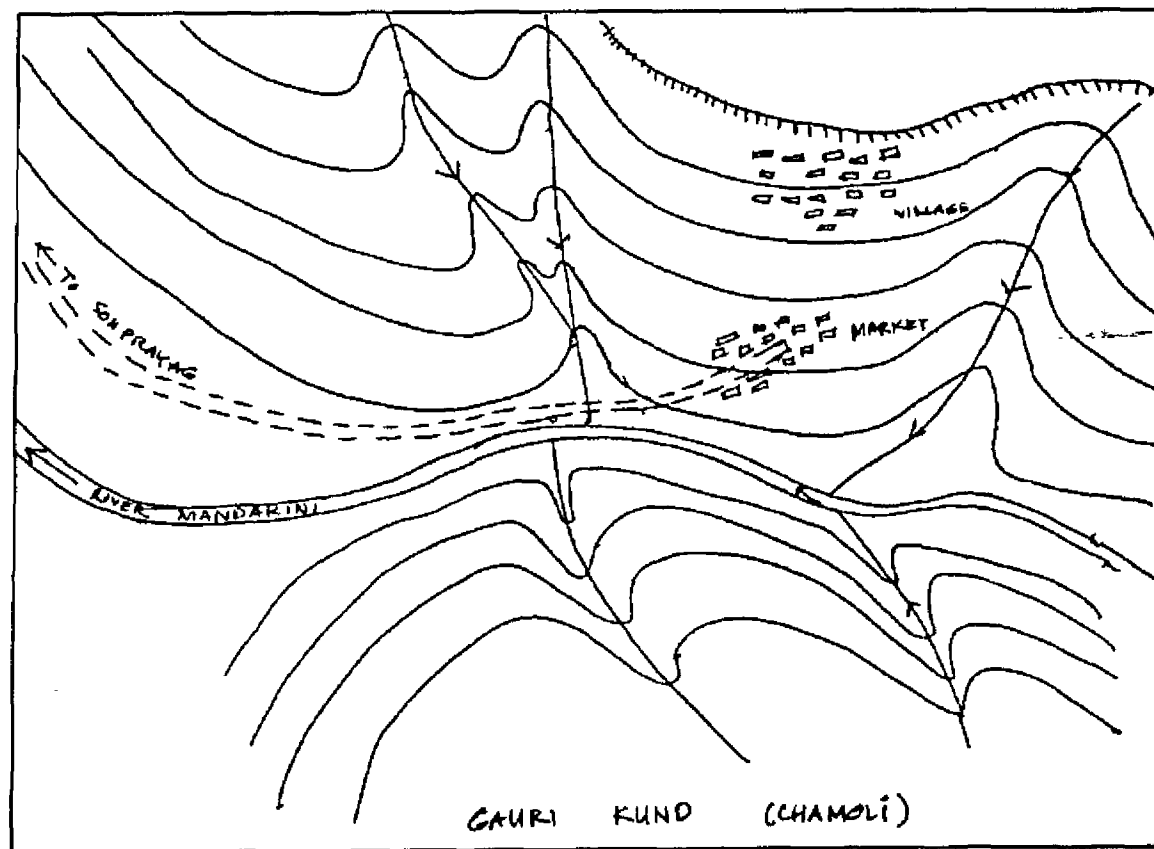
### Location

The village settlement is about 800 ft above the densely built pilgrim post. The predominant building material is stone, though it is being replaced by brick and cement in the more recent buildings.

Snowfall in the village touches 75 cm. The slopes are steep and the south facing slopes are used for agriculture. The terraces are 2 to 3 m. wide, 1 to 1.2 m. high and have not been affected by the earthquake.

### Geology

This village is situated in the Central Crystallines composed of granitic gneisses and schists.



## **Occupational Structure**

The primary occupation of the village is agriculture and animal husbandry is a secondary activity. During the summer, the primary occupation is catering to tourist traffic. The staple crops are *jowar*, potato and some paddy. Apples and walnuts are also grown. The average land holdings are small: less than 1 hectare. The village has 100 cows, 50 buffaloes, 100 goats and sheep, and 50 horses and mules.

## **Infrastructure**

The village has access to a primary school, a middle school and a dispensary that is located near the road. Water supply is through a pipeline drawn from the river passing through the Gauri Kund market. Electric supply was restored within five hours of the earthquake.

## **Local building materials**

The local wall building material are Stone boulders collected from the river-bed. Slate for roofing is transported from more than 3 km. away.

## **Local construction workers**

Masons and carpenters have to be hired from lower elevations and are paid upto Rs. 100 per day.

## **Materials of Construction**

The bulk of the houses in the village: (90%) are built in walls with stone in mud mortar the rest are in brick. The predominant roofing material is CGI sheet on 35% of the roofs, RCC 30%; Slate on timber planks (25%) and thatch on timber planks (10%) (usually very poor households).

Table 6.8 Village Gauri Kund: Estimated Structure of Housing Stock (% to total houses)					
Material of Wall	Material of Roof				
	Thatch on timber planks	Slate on earth on timber planks	CGI on timber planking	RCC	TOTAL
Mud-pathri	10%	25%	35%	30%	100%
Source: TARU field appraisal					

The price of cement is Rs. 150 per bag delivered on site. Aggregate and sand are available at Rs. 15 per bag. Steel is available at Rs. 1300 per quintal. Bricks have to be transported from Rishikesh and are available for Rs. 2 per brick.

### Damage

The extent of damage was limited with no people being killed, injured or trapped in buildings after the earthquake. Only one cow was killed.

5% of the houses were severely damaged and will have to be demolished, 15% were heavily damaged and will have to be partially demolished, the remaining 80% were moderately or slightly damaged and will require strengthening and repair. The damage has occurred largely due to buckling of walls, and vertical cracks in lowers.

Relief of Rs. 10,000 (in cash) has been given to 24 of the 56 households along with 10 CGI sheets and 17 cement bags. 10 kilos each of wheat and rice have been distributed to all households.

### Reconstruction

Majority of the households are staying in their own houses. Many of them have started repair and reconstruction work themselves. Emergency shelters are built out of wooden planks retrieved from damaged or collapsed houses, on timber frames, CGI sheets and tarpaulin.

### Risk

Water from the slopes drain through the village settlement and it will be important to divert the flow through contour channels above the settlement as there may be new excavation in the settlement area.

## Village Rampur, Ukhimath Tahsil, Chamoli District

Rampur is a medium size village of 150 houses located at an altitude of 2,200 above msl. with a population of 155 households. The average family size is seven. It is located 4 Km. before Soneprayag on the Kedarnath route.

### Location

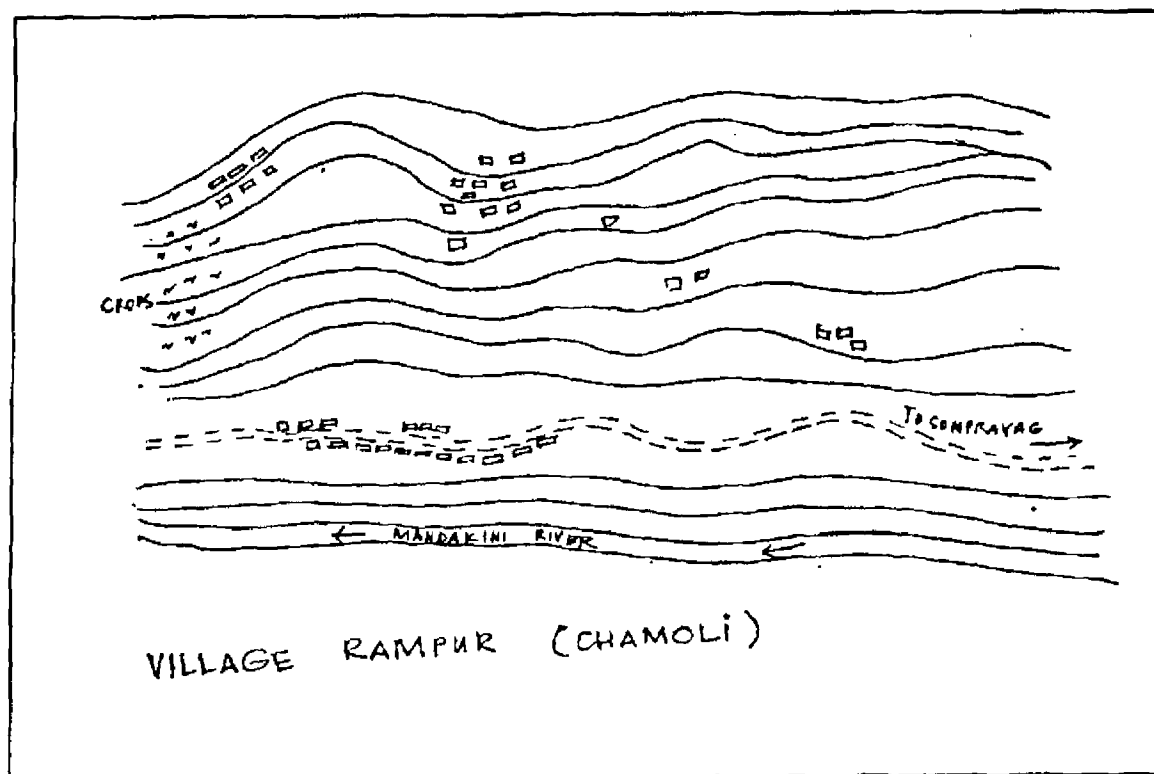
Rampur village is situated on colluvial slopes. Snowfall in the village touches 60 cm.

### Geology

The bedrock is granitic gneiss. There are few outcrops on the ridge top.

### Occupational Structure

The primary occupation of the village is agriculture and animal husbandry is a secondary activity. During the summer, the primary occupation is catering to tourists traffic. Seven men from the village are serving in the army. The staple crops are wheat, *jowar*, potato and paddy. Oranges, Malta, Apples and walnuts are also grown. The average land holdings are small: less than 1 hectare. The village has 150 cows, 50 bullocks, 200 buffaloes, 1000 goats and sheep, and 50 horses and mules.



## Infrastructure

The village has a primary school and access to a dispensary, located near the road. Water supply is through a pipeline drawn from the river below. Electric supply was restored within five hours of the earthquake.

## Local building materials

The predominant wall building material is Stone, largely granite-gneiss available nearby. Occasionally quartzites are brought into the area.

## Local construction workers

Masons and carpenters have to be hired from lower elevations and are paid upto Rs. 75 per day.

## Materials of Construction

All the houses in the village are built in walls with stone in mud mortar. The predominant roofing material is Slate on timber planks (60%); Thatch on timber planks (20%); CGI sheet (15%) of the roofs and RCC (5%). Many villagers are in the process of changing Slate roofs to Thatch. There is a high proportion of buildings in the market area, along the road, in which GI sheet roofs are used.

<i>Table 6.9 Village Rampur: Estimated Structure of Housing Stock (% to total houses)</i>					
<i>Material of Wall</i>	<i>Material of Roof</i>				
	<i>Thatch on timber planks</i>	<i>Slate on earth on timber planks</i>	<i>CGI on timber planking</i>	<i>RCC</i>	<i>TOTAL</i>
Mud-pathri	20%	60%	15%	5%	100%
Source: TARU field appraisal					

The price of cement is Rs. 150 per bag delivered on site. Aggregate and sand are available at Rs. 15 per bag. Steel is available for Rs. 1300 per quintal and bricks for Rs. 2 per brick.