2-2 Erosion Control

2-2-1 Plan Principles

(1) General

① Only those landslides, gully erosion sites, bank erosion sites, etc. which have conservation objects nearby to be protected will be the target of erosion control plan. Conservation objects will be mainly farmland, roads, trails and houses, and will be determined using topographic maps and land use/vegetation maps (scale 1/25,000) of Model Areas.

② Simple and low cost structural measures such as bamboo, log or stone (dry stone and gabion) check dams, bamboo wattlings, etc., the material for construction of which is available in the community and can be constructed using simple techniques, will be planned.

③ All structural measures will be accompanied with bioengineering measures such as planting of grasses, shrubs and trees and natural regeneration to improve the site environment and to produce plant material for use by local inhabitants.

④ The plan will provide incentives for local community to participate in soil conservation activities and in protection and maintenance activities through:

a. Planting of grasses that can be utilized as fodder for livestock and for roof making.

b. Planting of forest trees the branches and leaves of which could be used as fodder and fuelwood.

c. Planting of fruit trees the fruits from which could be utilized by local inhabitants.

d. Provision of a part of construction material for erosion control, such as gabions wires, which have to be supplied from outside the community.

e. Provision of planting material such as seeds, seedling and cuttings from the nearest project nursery.

Moreover, the following points should be observed at the implementation stage of the plan.

⑤ Priority in treating a site should be established based on the degree of activeness of erosion and level of erosion hazard (from erosion hazard maps) in that particular site. For example, if the scar of a landslide is bare, where rills and gullies have developed, contain no vegetation and is located in high hazard area it should be given priority to a landslide in the scar of which vegetation is established to some degree through natural regeneration and is located in low hazard area.

⑥ Benefits of treating eroded areas, options available for erosion control under prevailing conditions in the area, difficulties involved in controlling and preventing erosion, for example, difficulties in treating large landslides should be explained to the local community in simple terms. The community should be encouraged to take the initiative in carrying out erosion control works. User's groups, comprising those community members affected by erosion, should be formed and all erosion control activities, including protection and future maintenance, should be carried out by the groups.

⑦ All treated sites will be protected by user's groups against grazing, cutting and fire to preserve the structures and to encourage natural regeneration and the growth of planted plants.

(2) Landslide

① Generally, practicality of treating a landslide is based on identification of causes, depth of failure, environment of the site (including presence or absence of conservation objects and their value) and the availability of human and financial resources.

② Considering the immediate causes of small scale landslides, which are mainly a weak geology, concentration of surface run-off from upper fields, steep slope, etc., a mixture of structural measures to divert surface run-off and stabilize the landslides, and bio-engineering measures to control secondry erosion of the scar, improve the site environment and provide a source of income for inhabitants will be planned.

③ In view of the causes of the large landslides, which are mainly geological structures and groundwater, their prevention and rehabilitation will require major engineering undertakings such as construction of large structures, treatment of groundwater, etc. the implementation of which will require

special skills and large investments. (See Volume III Appendixes for an example of treatment cost of a large landslide near Kathmandu). Therefore, simple mitigation and monitoring measures, applicable at the community level will be planned to prevent further enlargement and expansion of these landslides. Mechanical or structural countermeasures will be adopted from what is mentioned in Fig. 2-3.

④ Taking into consideration the financial and human resources conditions of the local inhabitants affected by landslides, condition of conservation objects and inaccessibility of affected sites, from among the structural countermeasures of Fig. 2-3., those items the application of which is judged to be practical in Study Area are:

a. control works such as prevention of infiltration and channel work for surface water drainage.

b. Prevention works such as construction of retaining structures made of loose stones or stone-filled gabion check dams.

⑤ When preparing countermeasures the following points have to be taken into consideration.

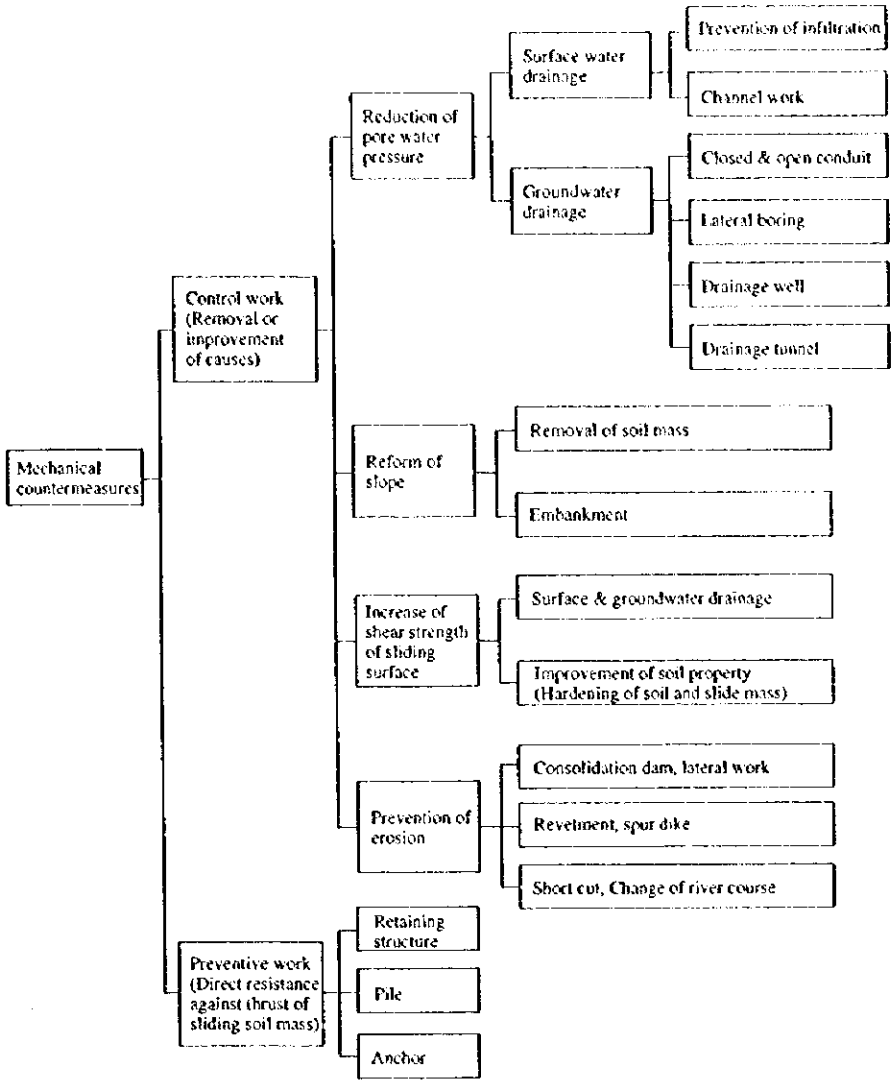
a. The channel cross-section should have sufficient size to drain heavy rainfall and must be based on the calculation of design discharge.

b. The channel will be stone-paved or grassed and lateral works will be installed at 20-30m intervals at steep sections to prevent erosion of bed and sides.

c. The channels should be lead to a natural and stable stream nearby to avoid erosion.

d. Excavation of foundation at the toe of a landslide for retaining wall construction will be restricted to the minimum because this increases the danger of activating the slide.

e. The gabion type and block dimensions will be the same as those currently used by DOSC and CDFWCP in the area.



Source: FAO Conservation Guide 13/4, Landslide prevention measures

Fig. 2-3 Types of Mechanical or Structural Countermeasures for Landslide Control and Prevention

(3) Gully Erosion

① In principle, for effective control of gully erosion in areas which have heavy rains, such as Study Area, the following 3 methods will be applied.

a. Improvement of gully watershed to reduce and to regulate the surface run-off.

b. Diversion of surface water above the gully area to direct surface run-off away from gully head and discharge it safely into natural and stable streams.

c. Stabilization by a combination of structural and bio-engineering measures.

② Criteria applied for selection of control measures for various portions of a gully in Model Areas will be those established by the FAO (Conservation Guide 13/2, 1986) for continous gullies of up to 20 ha watershed area, up to 1,000m channel length and less than 35 degrees channel gradient.

a. Diversion ditches will be established above the gully heads. The ditch cross-section will be decided after survey of discharge and topographic condition at the implementation stage but should be designed to have sufficient capacity to drain maximum run-off. To prevent scouring of the bed and sides, the channel will be stone-paved or grassed.

b. The upper portions of the main gully channel and branch gullies will be controlled by constructing bamboo or log check dams (depending on the availability of material) and loose stone check dam. Bamboo or log check dams are temporary structures and are estimated to have a life-span of 3-4 years under the climatic conditions of Study Area, are less expensive and easy to built and maintain by local user's group. They are intended to stop channel and lateral erosion of gullies by reducing the original gradient of the gully channel, diminish the velocity of water flow and the erosive power of run-off. Also these structures hold soil and moisture in the bottom of the gully and therefore tree seedlings as well as shrubs and grass cuttings can grow in gullies without being washed away by flowing water. This will help the establishment of a permanent vegetation cover in a short period of time.

c. The lower parts will be treated with loose stone or boulder check dams.

d. At a stable point in the lowest section of the main gully channel, a gabion or cement masonary check dam will be constructed. The sizes of gabion mesh and blocks of stone-filled gabions will be the same as those currently used by CDFWCP. Spacing between the check dams and therefore their number will be determined according to the compensation gradient of the gully channel and effective height (minus foundation depth) of the check dam.

e. All structural measures will be accompanied with bio-engineering measures such as planting of grasses, shrubs and trees which will begin after structural works are completed. Choice of fodder trees will be left with the user groups.

(4) Bank Erosion

① Currently in Study Area structural measures such as revetments and spurs, built using stone-filled gabions, are the main countermeasures applied for bank erosion control. In this study, riparian vegetation belt as a bio-engineering measure will be introduced along the affected streams for bank protection. The riparian belt will be effective in adjusting and improving the river environment as well as binding the soil by means of root system. Moreover, the riparian vegetation will assist local life by providing fodder, firewood, etc. Also the presence of the belt along streambanks will reduce the velocity of overflowing flood, thereby reducing the damage to crops.

② A 4m wide strip of land on both sides of the banks (2m along each bank) will be planted with forest, fodder, fuel, and where possible, fruit trees. The forest trees will be Dalbergia Sissoo for low elevation (under 1,000m) areas and Alnus nepalensis for high elevation (over 1,000m) areas.

③ As an incentive, all seedlings will be provided and the choice of fodder, fuelwood and fruit trees will be given to farmers on whose land the riparian belt is going to be established. Actually a riparian belt should be more wider, for example, 50m or 100m to be effective, but considering the scarcity of land in the area it's highly unlikely that local farmers will agree to the establishment of a belt wider than a few meters. Thus a belt 2 meters wide in one side will be a beginning step and in the future it can be expanded with the agreement of local inhabitants.

④ Bio-engineering measures such as the creation of riparian belts alone may not be enough for bank erosion control because the plants may not be firmly established before the time a strong flood occurs. Therefore, for an effective bank erosion control and prevention structures will be constructed but in combination with bio-engineering measures such as riparian belts.

2-2-2 Erosion Control Programme

(1) Landslide Treatment Programme

① Small landslides

a. Whole Programme

Small landslide sites targeted for treatment are as shown in Table 2-10.

Table 2-10 Small Landslide Sites Targeted for Treatment by Model Area

(Unit: landslide)

Model Area	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	Total
Landslide sites targeted for treatment	59 (235)	16 (35)	31 (88)	45 (79)	50 (90)	260 (527)

Figures in ( ) show total number of landslides.

b. Model Programmes

Some typical small landslide sites were investigated in the field and concrete programmes as mentioned below were formulated for their treatment. These programmes will be the models and similar treatments are proposed for the small landslides as shown in Table 2-10 by taking into consideration the specific site condition of each landslide.

(a) Armala VDC Ward No.6 landslide

i. A 200m long channel will be constructed at the upper part of the crown to divert the surface run-off, flowing on the slided site from the rain-fed paddies located on the upper slope, to outside the landslide area.

ii. To stabilize the landslide, a gabion retaining wall some 32m long and not less than 2 blocks high will be constructed at the landslide toe.

iii. Between the retaining wall and landslide crown, wattlings, each some 32m long and made of bamboo or tree branches of not less than 8cm diameter, will be constructed at 5 meters interval. Some 16 wattling lines will be needed.

iv. In between the wattlings, grasses or shrubs will be planted along the contour. Interval of the grass lines will be 1 meter and the cuttings will be planted 10-20cm apart. Some 0.24 ha will be planted with grasses and shrubs.

(b) Mauja VDC Ward No.1 landslide

i. This landslide is located in the lower slopes of JOCV Site Office. A 50 meters long channel will be constructed at the upper part of the crown to divert the surface run-off from the overgrazed grassland located in the upper slopes.

ii. A 10 meters long gabion retaining wall not less than 2 blocks high will be constructed at the toe of the slide.

iii. In between the retaining wall and the landslide crown, wattlings some 10m long will be built at an interval of 5 meters. Some 4 wattling lines will be established. In between the wattlings, grass or shrub will be planted along the contour in some 0.02 ha area.

(c) Puranchaur VDC Ward No.3 landslide

i. The main cause of this landslide is stone excavation. The first step, therefore, for the control of the landslide will be to stop stone excavation.

ii. A gabion retaining wall some 28m long and not less than 3 blocks high will be constructed at the slide toe.

iii. Since the scar face is very steep (>40°) and rocky, wattling and grass planting will not be carried out. However, this and other similar type of landslides will be protected against stone excavation and disturbances that may hinder natural regeneration of plants.

iv. A number of tension cracks exist in the upper parts of the landslide crown. These will be filled with clay soil or covered with vinyl to prevent surface run-off infiltration.

(d) Arba Vijaya VDC Ward No.5 landslide

i. The debris from this landslide are deposited on the surface of the road which is extended from Pokhara to Bijaipur Khola,

creating a hummock on the road surface. The main cause of this landslide is the concentrated surface run-off from the overgrazed grassland, a trail and a new road located in the upper slope. Drainage facilities will be provided for the road and the trail to divert the surface run-off away from the landslide scar (see infrastructure improvement for road and trail drainage improvement).

ii. A retaining wall some 10m long and not less than 3 blocks high will be constructed in the toe section of the slide.

iii. In between the retaining wall and the landslide crown, wattlings will be established at an interval of 5m. A total of 7 lines will be required.

iv. In between the wattlings grasses and shrubs will be planted in some 0.03 ha area.

(e) Pumdi Bhumdi VDC Ward No.1 landslide

i. The main cause of this landslide is concentrated surface run-off from the sloping terraces located in the upper slope. Some 100m long channel will be constructed at the upper part of the landslide crown to divert the surface run-off.

ii. A gabion retaining wall some 18m long and not less than 2 blocks high will be constructed at the landslide toe.

iii. 7 lines of wattlings each 18m long will be constructed and some 0.06 ha of the affected area will be planted with grasses and shrubs in between the retaining wall and the landslide crown.

(f) Chapakot VDC Ward No.5 and 6 landslide

i. The main cause of this landslide is irrigation water from the upper slope farmland. A 100m long channel will be constructed at the upper part of the landslide crown to divert the water.

ii. A retaining wall of gabion some 15m long will be constructed at the toe of the slide. 5 lines of wattlings each 15m long will be constructed and some 0.04 ha grass and shrub planting will be carried out in between the retaining wall and the landslide crown.

(g) Thapathana VDC Ward No.1 landslide

i. To divert the surface run-off from the upper slope farmlands, some 100m long channel will be constructed at the upper part of the landslide crown.

ii. A loose stone check dam, acting as retaining wall, was constructed by Parbat DSCO at the landslide toe. Some 12 wattling lines each 32m long and 0.20 ha grass and shrub planting will be carried out in between the check dam and the landslide crown.

(h) Karkineta VDC Ward No.5 landslide

i. Seepages in several points were observed at the scar of this landslide and therefore groundwater is suspected of being the main cause of this failure.

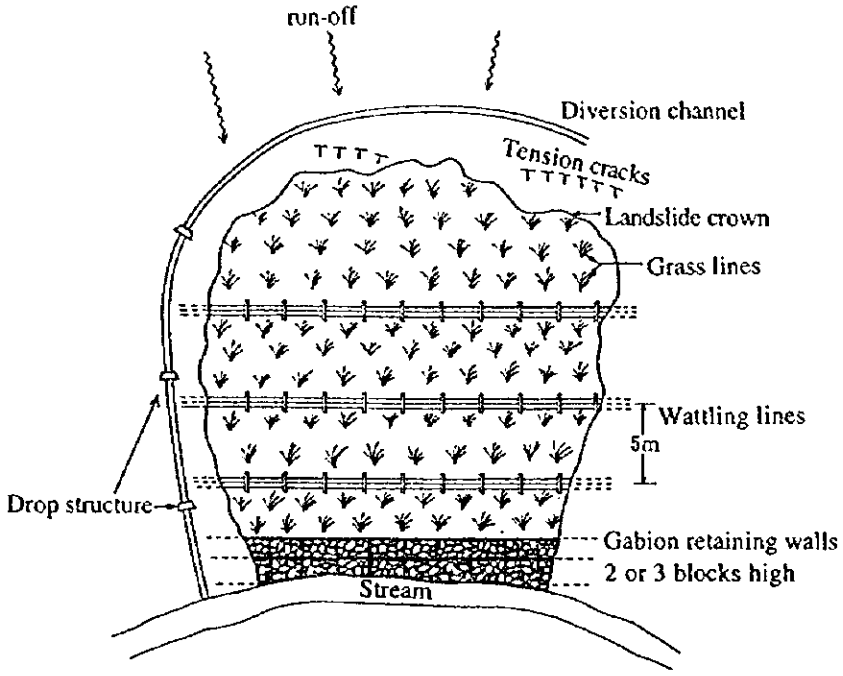
ii. Tension cracks were observed in several locations between the landslide crown and the ridge during the first field survey conducted in February and March of 1996. However, during the subsequent re-examination of this landslide in December of the same year, more tension cracks and wider ones were observed than those seen during the first field survey. This points to the possible reactivation and enlargement of this landslide.

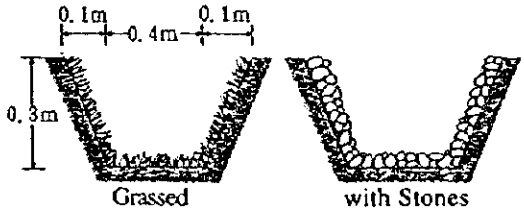
iii. A practical mitigation measure for this landslide will be the filling of the tension cracks with clay soil or covering with vinyl to prevent surface water infiltration.

Contents of model programmes for treatment of some small landslides are shown in Table 2-11 and an example of treatment of a small landslide is shown in Fig. 2-4.

Table 2-11 Small Landslide Treatment Measures (Model Programmes)

Location		Structural measures			Bio-engineering measures			
Model Area	VDC, Ward No.	Diversion channel (m)	Retaining wall (m)	Filling and covering of tension cracks	Wattling (m)	Grass and shrub planting (ha)	Natural regeneration (ha)	Remarks
Kaski North	Armala, 6	200	32	-	512	0.24	-	
	Mauja, 1	50	10	-	40	0.02	-	
	Purunchaur, 3	-	28	needed	-	-	0.1	
	Arba vijaya, 5	-	10	-	70	0.03	-	
	Sub-total	250	80	-	622	0.29	0.1	
Kaski West	Pumdi bhumdi, 1	100	18	-	126	0.06	-	
	Chapakot, 5 and 6	100	15	-	70	0.04	-	
	Sub-total	200	33	-	196	0.10	-	
Parbat North	Thapa Thana, 1	100	-	-	384	0.20	-	
	Karkineta, 5	-	-	needed	-	-	0.2	
	Sub-total	100	-	-	384	0.20	0.2	
Total		550	113	-	1202	0.59	0.3	





Cross-section of diversion channel

Fig. 2-4 Treatment of a Small Landslide with Bioengineering Work and Simple Structural Work

② Large landslides

a. Whole Programme

Large landslide sites targeted for treatment are as shown in Table 2-12.

Table 2-12 Large Landslide Sites Targeted for Treatment by Model Area

(Unit: landslide)

Model Area	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	Total
Landslide sites targeted for treatment	6 (58)	0 (14)	3 (25)	10 (38)	10 (23)	29 (158)

Figures in ( ) show total number of landslides.

b. Model Programmes

Model programmes for some large landslides that were investigated in the field are as mentioned below. These programmes will be the models and similar treatments are proposed for the large landslides as shown in Table 2-12 by taking into consideration the specific site condition of each landslide.

(a) Mauja VDC Ward No.8 landslide

i. This is the largest landslide in Kaski North Model Area. It's an old landslide but was reactivated some 2 years ago.

ii. According to the geological survey findings, it's a complex type of failure: a plane rockslide (controlled by the dip of the joints) at the crown and changes into the debris slide at the toe.

iii. Water overflowing from a pond and water from farm lands, both located near the landslide crown, flows on the surface of the scar during the monsoon season. This created deep gullies on the scar.

iv. Mitigation measures proposed for this landslide will consist mainly of fencing and diversion of surface run-off. Fencing will protect the area against grazing and cutting and therefore promote natural regeneration. Also because the landslide is a potential high hazard zone, fencing will reduce the danger to

human life and to livestock by physically preventing entry into the affected area.

v. Some 300 long fence will be erected at around the landslide, especially around the crown and flanks.

vi. A trail is running across the head of the landslide and this will be re-routed, if possible.

vii. The pond will be improved by increasing the height of its walls in all sides at least by 50cm. The excess surface run-off from the pond and its surrounding areas will be diverted through a 50m long channel to the nearby stable stream.

viii. Some 150 long channel will be constructed at the upper part of the landslide crown to divert surface run-off from farm lands.

ix. Tension cracks developed at the head of the slide will be filled by clay soil or covered with vinyl to prevent surface water infiltration.

x. If the landslide is protected properly and the surface and gully erosion in the scar is controlled, Alnus nepalensis which is growing on old landslide sites in surrounding areas will also establish itself on this landslide through natural regeneration.

(b) Arnala VDC Ward No.1 landslide

i. This is a debris type landslide occurred some 2 years ago in Jumleti community where entire slope from the ridge is gradually moving down along the gully in the east. Many tension cracks, some having a width of approximately 0.5m, were seen between the landslide crown and the ridge.

ii. To protect the affected area, some 200m long fence will be established at the upper part of landslide crown.

iii. To divert surface run-off from the overgrazed grassland and farm land, located in the upper slope, some 150m long diversion channel will be constructed at the upper part of the landslide crown.

iv. The tension cracks will be filled with clay soil or covered with vinyl to prevent infiltration.

(c) Kristi Nachnechour VDC Ward No.3 landslide

i. This is an old debris slide which was re-activated in 1996, presumably by bank undercutting at the toe of the slide by Phurse Khola.

ii. The upper slope of the landslide is a mixture of bush land and forest land and there are no houses or other facilities on the slide or in its immediate vicinity. However, if the whole unstable mass slides down, it could block Phurse Khola and may affect a hydroelectric facility located some distance downstream.

iii. Prevention and control of this landslide will require large concrete retaining walls and embankment, etc. along Phurse Khola at the toe of the slide. Therefore, from the point of view of the scale of countermeasures required and type of conservation objects to be protected, this landslide has to be dealt with by the authorities in charge of river management and hydel facilities.

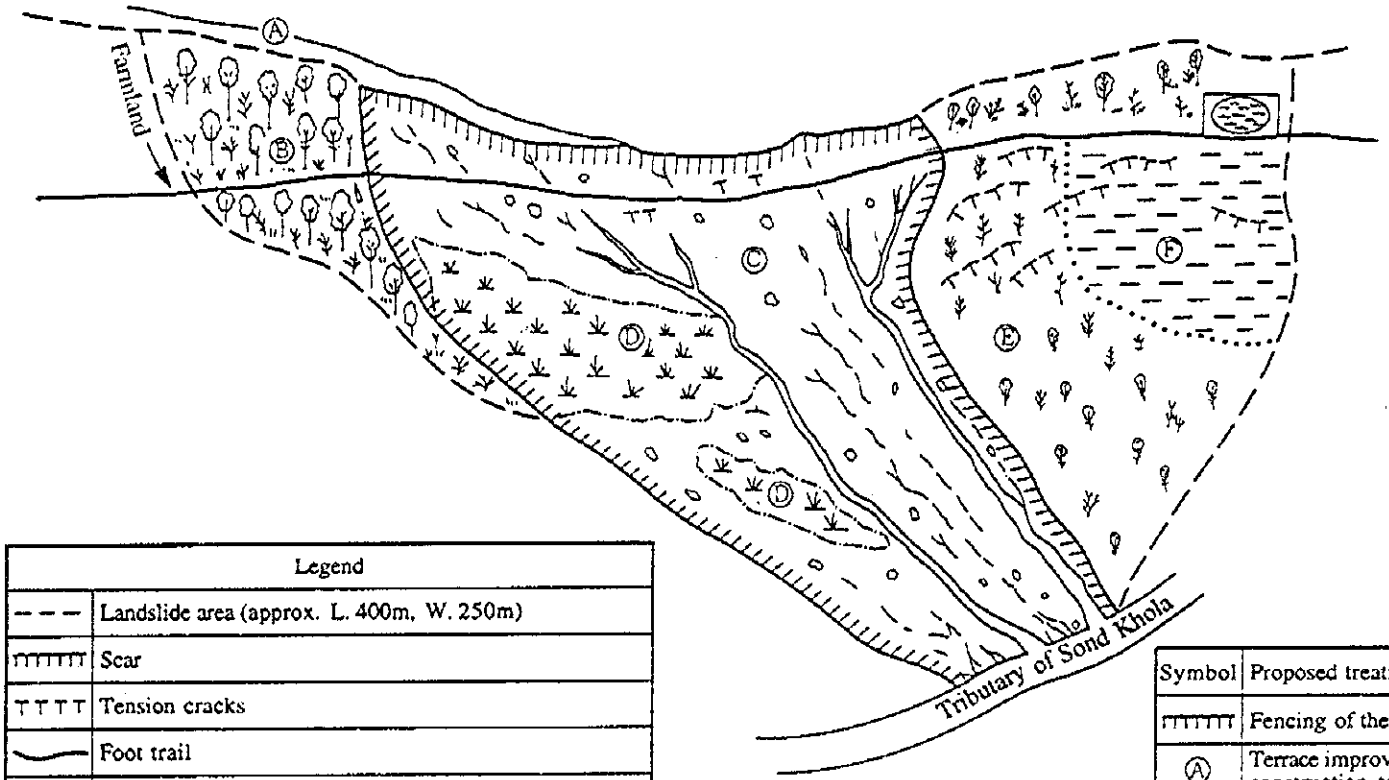
(d) Hosrangdi VDC (Argaudi) Ward No. 6 landslide

i. This is a complex type of landslide. Its western block is a rockslide and its eastern block is a debris slide. The possible causes of the landslide could be undercutting at the toe by Argaudi Khola, infiltration of surface water and deeply weathered rocks.

ii. Many tension cracks at the crown of the slide and in the whole of Argaudi community as well as subsidence of up to 2.5m of farmlands were observed during field inspections.

iii. So far, past mitigative efforts by local inhabitants, such as drainage channels, which were damaged because of the movement of the sliding mass, did not succeed in preventing the enlargement of the slide. Under the circumstances, a practical option will be to monitor the landslide, provide information to the local inhabitants about its movements and assist them in finding safe places to move.

Model Programmes for treatment of some large landslides are shown in Table 2-13 and an example of treatment of a large landslide is shown in Fig. 2-5.



Legend	
- - -	Landslide area (approx. L. 400m, W. 250m)
⌐⌐⌐⌐⌐⌐	Scar
T T T T	Tension cracks
~~	Foot trail
~~	Active gully
⬭	Pond
Ⓐ	Bari land
Ⓑ	Old part of landslide (Alnus trees 8-10m H.)
Ⓒ	Slided area (bare and active)
Ⓓ	Slided area (some vegetation due to natural regeneration)
Ⓔ	Steep bushland containing tension cracks
Ⓕ	Abandoned bari land

Symbol	Proposed treatment measures
⌐⌐⌐⌐⌐⌐	Fencing of the scar.
Ⓐ	Terrace improvement and diversion channel construction to control run-off.
Ⓑ	Protection against cutting, grazing and fire and utilization of tree branches as fuelwood.
Ⓒ	Protection to encourage natural regeneration of plants.
Ⓓ	Bioengineering work (grass and tree planting) and protection.
Ⓔ	Filling of tension cracks and protection.
Ⓕ	Filling of tension cracks and protection.
⬭	Improvement to prevent overflow.
———	Foot trail re-routing or improvement.

Fig. 2-5 Mauja VDC Ward No.8 Large Landslide

Table 2-13 Large Landslide Treatment Measures (Model Programmes)

Location		Structural Measures			Bio-engineering Measure	Monitoring		Remarks
Model Area	VDC, Ward No.	Fencing (m)	Diversion channel (m)	Filling and covering of tension cracks	Natural regeneration (ha)	Extenso-meter (unit)	Manual rain gauge (unit)	
Kaski North	Mauja, 8	300	200	needed	7.0	1	1	
	Armala, 1	200	150	needed	0.4	1	1	
	Sub-total	500	350	-	7.4	2	2	
Kaski West	Kristi Nachnechour	-	-	needed	5.0	-	-	
	Sub-total	-	-	-	5.0	-	-	
Parbat South	Hosrangdi, 6	-	-	needed	6.0	1	1	
	Sub-total	-	-	-	6.0	1	1	
Total		500	350	-	18.4	3	3	

③ Monitoring

a. Monitoring a landslide will provide the data that can be used for planning countermeasures for its control. Also the information obtained from monitoring can help local inhabitants affected by the landslide to decide on actions such as temporary or permanent evacuation, etc.

b. An extensometer and a rain gauge were installed by CDFWCP for monitoring purposes in Khalte landslide in Parbat North Model Area through cooperation with DPTC. The DPTC has developed a simple type of extensometer made of wooden posts which is a simple instrument that can be operated by local inhabitants to monitor the conditions of tension cracks and movement of landslide blocks.

c. Manual rain gauges operated by local inhabitants are necessary for monitoring rainfall. Rainfall data will provide local inhabitants affected by a landslide with information on the amount of concentrated rainfall in 24 hours, which is said to be a triggering factor of landslides. Manual rain gauges and simple monitoring devices will be installed at Mauja, Armala and Hosrangdi landslides.

④ Use of landslide affected sites

a. Considering the existing natural as well as socioeconomic conditions of Study Area, the complete prevention and rehabilitation of landslides, especially large landslides, will be extremely difficult as discussed earlier. Therefore, an effective way of dealing with landslides in the area will be their management through a combination of the application of possible preventive and rehabilitative measures and utilization of the areas affected by landslides for production purposes.

b. Usually when a landslide occurs in an area, the affected site is abandoned and the land is not used for any purpose. This is a natural action considering the dangers and disasters associated with landslides. However, when several years pass it become clear to some extent which part of the landslide is still active and which part is relatively stable.

c. It's at this stage that people could be encouraged to plant grasses, shrubs and trees in the relatively stable parts and utilize the plants under a management plan as fodder and fuelwood. With this type of management the local community will look at landslides not only as sources of disasters but as areas which also have some production potential. This approach, by providing some benefits from landslides, could inspire people to actively participate in mitigation of landslides.

d. In this study rehabilitation of small landslides is planned as mentioned previously using simple civil engineering measures and bioengineering measures including grass and shrub planting which could be utilized by user's groups engaged in rehabilitation work. In the case of large landslides, detailed investigations at implementation stage will be needed to determine the relatively stable sites for planting. Existence of tension cracks, subsiding and bented trees are the major signs of instability in a landslide, while the presence of natural regeneration of plants and the absence of cracks are the signs of relative stability.

(2) Gully Control Programme

① Whole Programme

Gullies targeted for control are as mentioned in Table 2-14.

Table 2-14 Gullies Targeted for Control by Model Area

(Unit: gully)

Model Area	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	Total
Gullies targeted for treatment	8	4	6	1	5	24

② Model Programmes

Some typical gullies were investigated in the field and concrete programmes as mentioned below were formulated for their control. These programmes will be the models and similar treatments are proposed for gullies as mentioned in Table 2-14 by taking into consideration the specific site condition of each gully.

a. Purunchaur VDC Ward No.1 gully

(a) The watershed of this gully is some 2 ha and the main land use there is khet land (paddies). Surface run-off from the paddies is the principle cause of the formation of this gully.

(b) A diversion ditch approximately 80m long will be constructed at the gully head to divert water from the paddies and discharge it safely into Ghatte Khola.

(c) Inside the gully an 8m log gabion check dam is constructed at the mouth of the gully which will have an effective height of 3-4m. Other check dams constructed up to the gully head will be bamboo or log check dams. The construction of some 7, each having an approximate length of 8m, is proposed at the interval of 5 meters. The effective height of these check dams will be 1.5-2.0m and the diameter of bamboos or logs to be used will not be less than 10cm.

(d) After the construction of diversion ditch and check dams are completed, tree seedlings (planting distance 1m × 1m) and grass and shrub cuttings (planting distance 0.5m × 0.5m) will be planted inside the gully in between the check dams and in surrounding areas (some 2 meters from the gully edge). Inside the gully, tree seedlings

will be planted along the gully edge to prevent gully wall collapse. Considering the average length and width of the gully, approximately 0.023 ha will be planted with grass and shrub and 0.020 ha with tree seedlings. Some 950 grass and shrub cuttings and 300 tree seedlings will be required.

b. Puranchaur VDC Ward No.3 gully

(a) The watershed of this gully is some 4 ha and mainly consists of shrub land which will be protected against grazing and cutting. Some 200m long section of a trail located at the gully head will be improved to divert run-off water from the upper slopes.

(b) Inside the main gully channel, 2 stone-filled gabion check dams, having effective heights of 3-5 meters and each having a length of some 8m, will be constructed. One such a dam will be constructed at the gully mouth and another one near Kaure water tank. In between the gabion dams at an interval of 5m some 40 bamboo or log check dams that will have effective heights of some 1.0-1.5m and each having a length of some 8m will be constructed.

(c) Inside the gully in between the dams in some 0.2 ha area grass and shrub cuttings and in some 1 ha area of degraded grassland in surrounding areas forest and fodder trees will be planted. The planting distances for forest trees inside the gully along its edge and in the degraded grassland will be 1m × 1m and 6m × 6m respectively. In the degraded grassland in between forest trees fodder trees at a distance of 2.5m × 2.5m will be planted. Some 700 forest and 1,600 fodder trees will be required.

c. Arba Vijaya VDC Ward No.2 gullies

(a) Since these are actually 2 gullies located next to each other, causes of their formation are the same and require similar control measures, they will be treated as one unit. The watershed of these gullies is some 10 ha and the land use there is overgrazed grassland containing a few trees (upper slope) and paddy lands (lower slope). The surface run-off which flows from the grassland to the paddy land, plus water from the paddy lands, caused these gullies. Approximately 5 ha overgrazed grassland part of the watershed will

be planted with fodder trees at a planting distance of 2.5m × 2.5m. Some 8,000 fodder tree seedlings will be required.

(b) Some 500m long diversion ditch will be constructed at the foot of the slope between the grassland and the paddy land to divert run-off water to Kahu Khola.

(c) 2 stone-filled gabion check dams, each having a length of 15m and effective heights of some 3.0-4.0 meters will be constructed at the mouths of the gullies. Since the gullies mouths are along the Kahu Khola bank, where a severe bank erosion is occurring, the dams will also help control the bank erosion. Inside the gullies from the mouths towards the gully heads at an interval of 5m some 57 bamboo or log check dams of 1.0-1.5m height and each having a length of some 15m will be constructed. In between the dams inside the gully in some 0.4 ha area grass and shrub cuttings and trees (1m × 1m) along the gully edge will be planted. Some 16,000 grass and shrub cuttings and some 570 seedlings (0.06 ha) will be required.

The gully erosion control measures (Model Programmes) are summarized in Table 2-15. A model of gully control and cross-sections of bamboo check dam and stone check dam for gully control is shown in Figs 2-6 ~ 2-10.

Table 2-15 Gully Erosion Control Measures (Model Programmes)

Gully location	Planned Measures									Remarks
VDC, Ward, Model Area	Tree planting		Grass and shrub planting		Diversion channel	Bamboo or log check dam		Gabion check dam		
	Area (ha)	Quantity (seedling)	Area (ha)	Quantity (Cutting)	(m)	Quantity	Length (m)	Quantity	Length (m)	
Puranchaur VDC Ward No.1, Kaski North Model Area	0.020	300	0.023	950	80.0	7.0	56.0	1.0	8.0	
Purunchaur VDC Ward No.3, Kaski North Model Area	1.00	2,300	0.20	8,000	-	40.0	320.0	2.0	16.0	
Arba Vijaya VDC Ward No.2, Kaski North Model Area (2 gullies)	5.00	9,000	0.40	16,000	500.0	57.0	855.0	2.0	30.0	
Total	6.02	11,600	0.62	24,950	580.0	104.0	1,231.0	5.0	54.0	

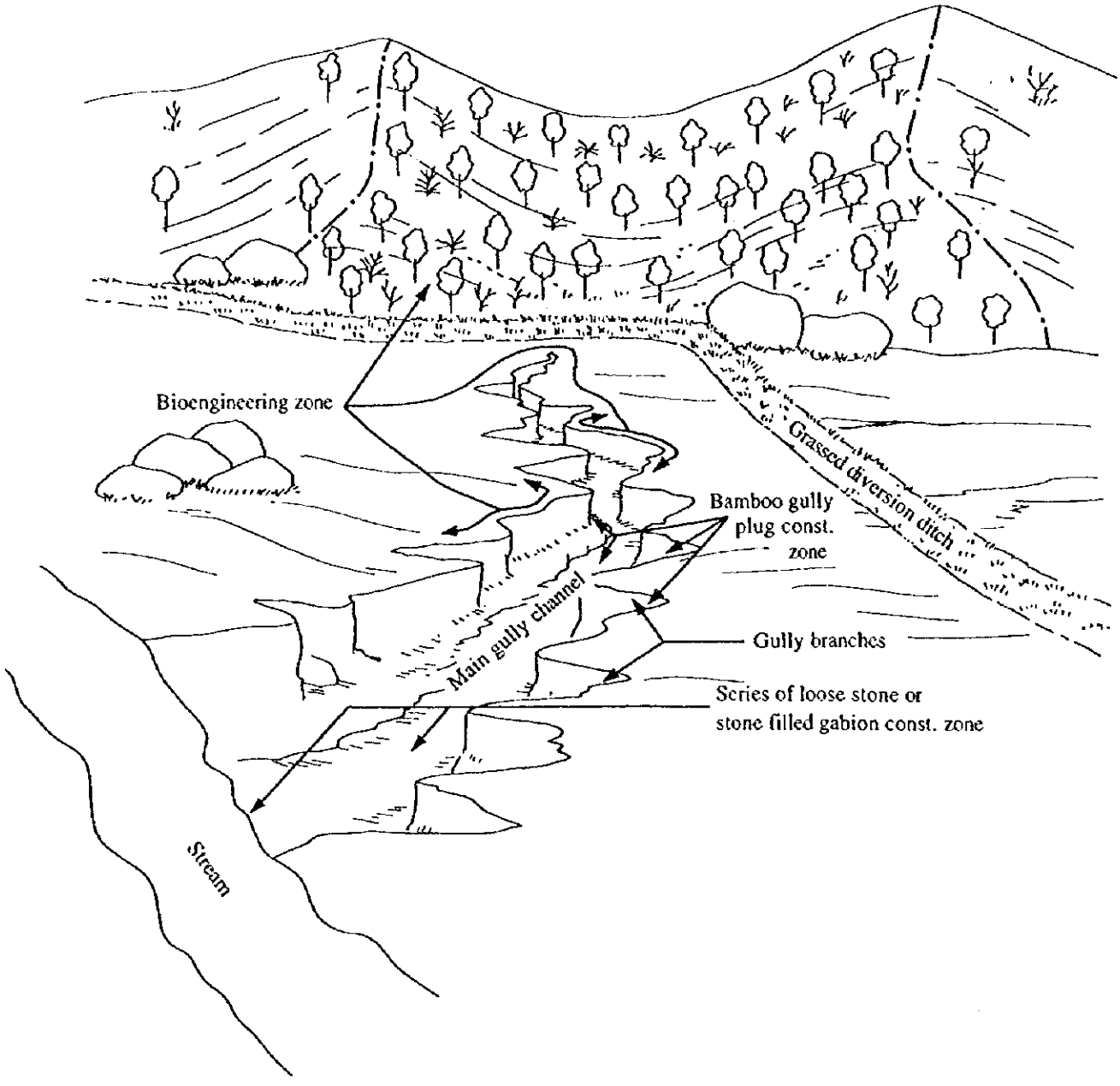


Fig. 2-6 Gully Control with Bioengineering Work and Simple Structural Work

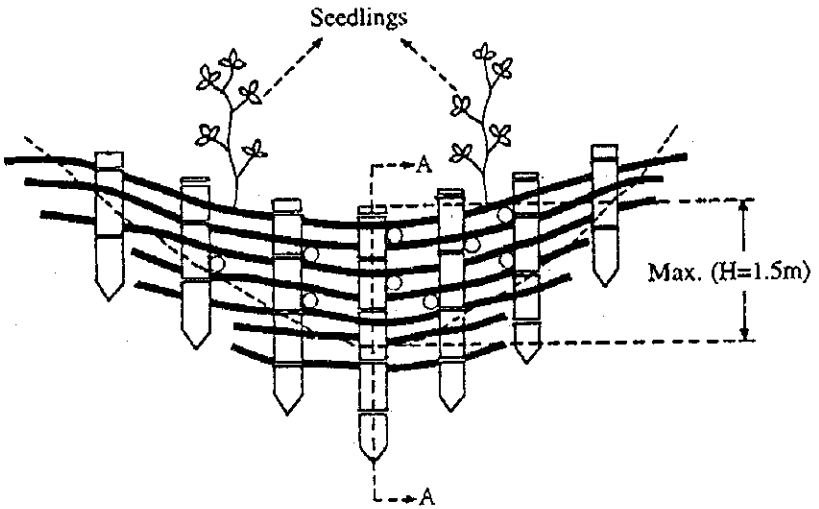


Fig. 2-7 Front View of Bamboo Gully Plug

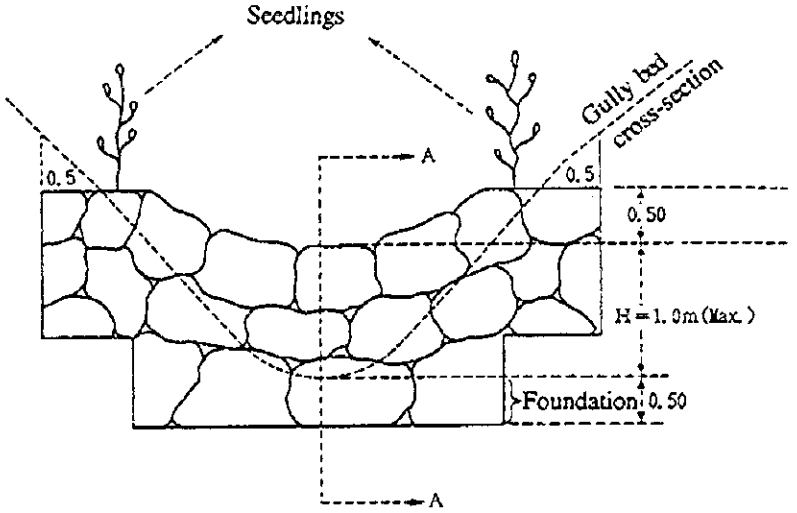


Fig. 2-9 Front View of Stone Check Dam

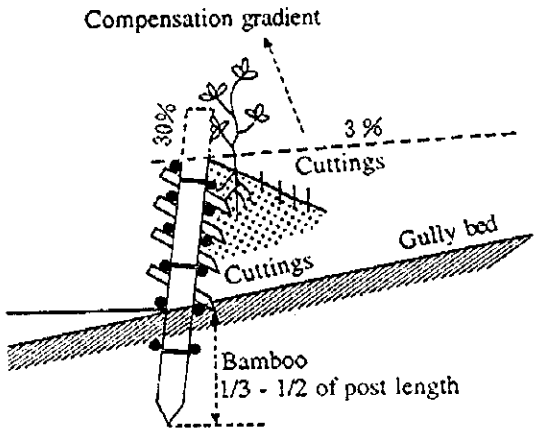


Fig. 2-8 Cross-Section of Bamboo Gully Plug

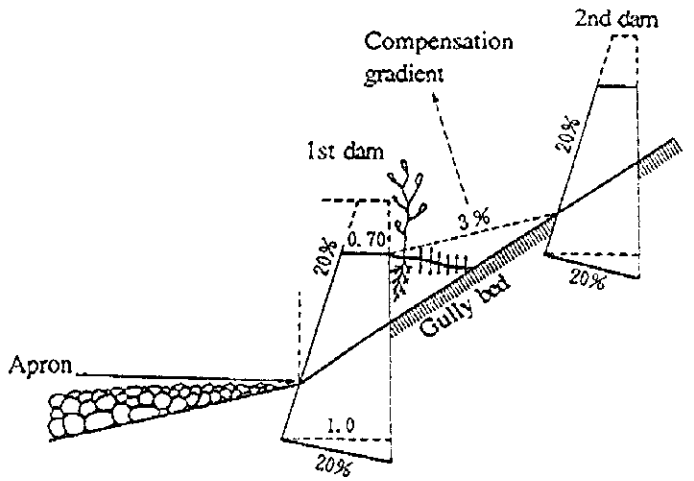


Fig. 2-10 Cross-Section of Stone Check Dam

(3) Bank Erosion Control Programme

Bank erosion control programme by Model Area is an shown in Table 2-16. The programme by type of countermeasure and stream is presented in Table 2-17.

Table 2-16 Bank Erosion Target of Control by Model Area

(Unit: km)

Model Area	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	Total
River length target of bank erosion control	5.6	4.4	3.7	2.0	2.3	18.0

① Structural measures

a. Along small streams (tributaries) where peak flows are not strong and the streambank is not very high, ripraps (without gabion boxes) and bhakari will be established. Riprapping work will be conducted where large size stones of diameter 30cm or more are available. One benefit of riprapping is that shrubby riparian plants can grow in the gaps between the loose stones, thereby increasing the strength and effectiveness of the structure and the amount of biomass for use by local inhabitants.

b. Bhakari is a traditional stone-filled and round-shaped structure built by local inhabitants using bamboo sticks for bank erosion control and are seen in the downstream of Virdi Khola and Khalte Khola in Kaski East Model Area. It's a temporary structure that can last for 2-3 years. Specifications of a bhakari will be as follows.

Diameter	:	1.5m ~ 3.0m
Foundation depth	:	not less than 0.5m
Height from ground surface	:	1.0m ~ 1.5m
Diameter of bamboo stick	:	not less than 10cm

Riprapping and construction of bhakari is simple, will reduce the overall cost of construction by using locally available material and the local inhabitants participation can also be higher as the method requires more man power.

c. In principle, along streams and rivers where strong peak flows are expected and where small size stones for filling the gabions are available revetments made of stone-filled gabions will be applied. Gabion type and size will be the same as those currently used by CDFWCP for bank erosion control.

d. Both ripraps and gabion structures will be firmly embedded into the ground by providing foundations not less than 0.5m deep.

② Bio-engineering measure

a. Behind structures such as bhakari, riprapping and revetments made of stone filled gabions, a 2 meters wide strip of land will be planted with forest trees with a planting distance of 2m × 6m (833 trees/ha). In between the forest tree lines fodder, fuelwood, etc. trees will be planted at a distance of 3m × 3m (1,111 trees/ha). Where a strip of land 2 meters wide is unavailable, for example, where a trial or road is running along the affected streambank, only one line of forest trees will be planted behind the structures. In between the structures and the banks, in one line, cuttings of any grass that can grow in the site and is beneficial to local inhabitants will be planted.

b. In between the newly established riparian belt and the foot of hillslope, where the flood plain is located mostly consisting of either rain-fed or irrigated paddies, the farmers should be empowered to plant a mix of such fodder plants as Dhaincha Susbania sp. etc. along terrace bunds. The plants will help reduce the velocity of overflowing flood, thus minimizing damage to the standing crops, can be used as fodder and having nitrogen fixing characteristic will increase land fertility.

c. To obtain the cooperation of farmers in conducting the planting on their private lands, the activity needs to be discussed with the farmers and its benefits explained to them through extension work.

From the total lengths of streams and their tributaries affected by bank erosion, as mentioned in Table 3-15, Volume I Surveys, the portions having conservation objects nearby are assumed to be some 20%. These portions, as given in Table 2-17, will be the target of bank erosion

control plan. An example of bank erosion control measure is shown in Fig. 2-11.

Table 2-17 Planned Bank Erosion Control Measures

Location		Structural measure		Bio-engineering measure	Remarks
Model Area	Stream	Riprapping Work and Bhakari (km)	Revetment of gabion (km)	Tree and grass planting (ha)	
Kaski North	Bijaipur Khola	0.5	2.2	1.08	
	Kali Khola	0.4	1.4	0.72	
	Bhoti Khola	-	0.6	0.24	
	Bhatte Khola	-	0.5	0.20	
	Sub-Total	0.9	4.7	2.24	
Kaski East	Khalte Khola	0.2	1.2	0.56	
	Virdi Khola	0.2	1.0	0.48	
	Anpu-Phushre Khola	0.4	1.4	0.72	
	Sub-Total	0.8	3.6	1.76	
Kaski West	Magsoli Khola	0.3	0.8	0.44	
	Phurse Khola	0.4	1.4	0.72	
	Harpan Khola	-	0.8	0.32	
	Sub-Total	0.7	3.0	1.48	
Parbat North	Malyahdi Khola	1.1	-	0.44	
	Lamaya Khola	0.9	-	0.36	
	Sub-Total	2.0	-	0.80	
Parbat South	Seti Khola	1.8	-	0.72	
	Mardi Khola	0.5	-	0.20	
	Sub-Total	2.3	-	0.92	
Total		6.7	11.3	7.20	

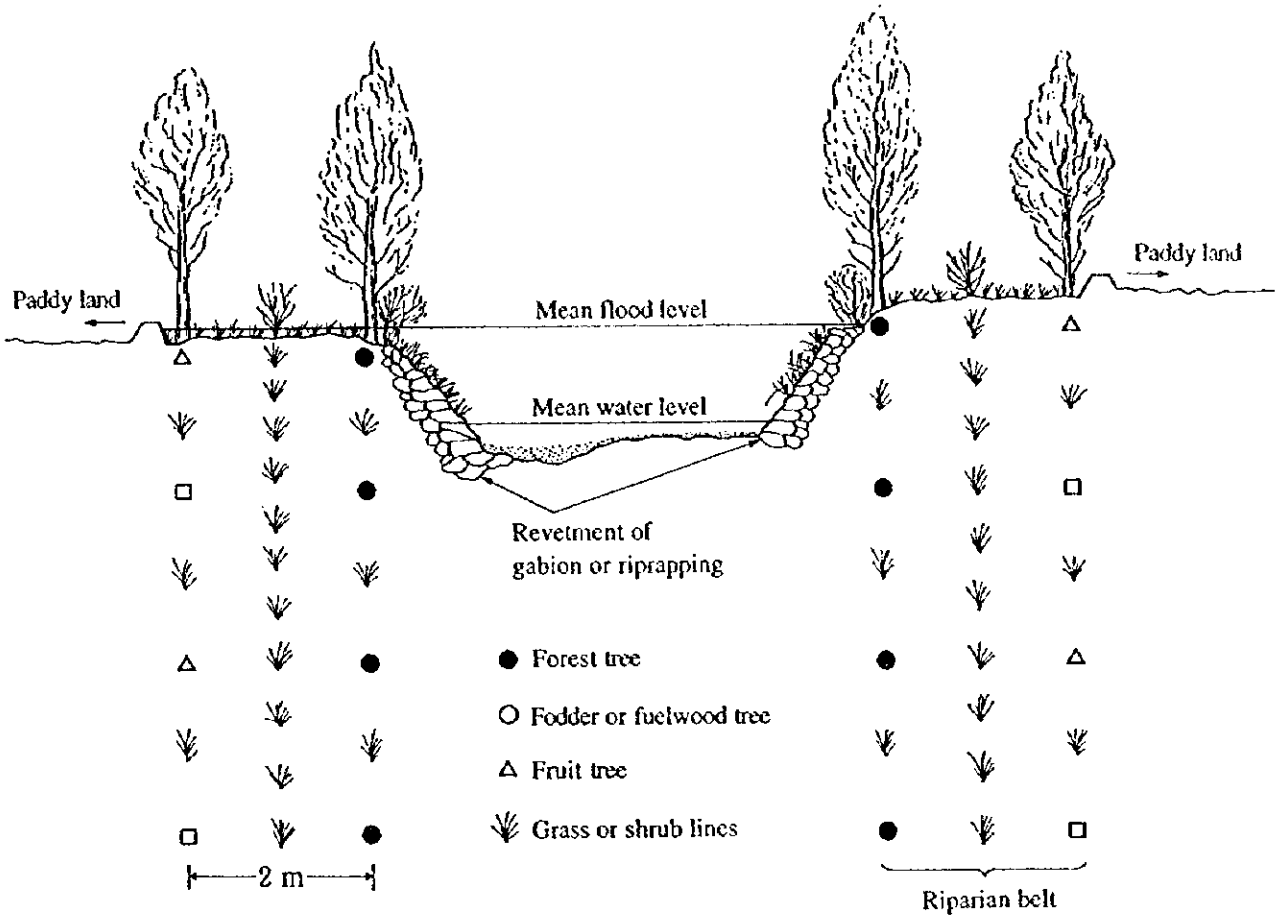


Fig. 2-11 Revetment and Riparian Belt Design for Bank Protection

(4) Erosion Control Plan Maps

Erosion control plan maps of landslide treatment, gully erosion control and bank erosion control are as shown in Fig. 2-12 (A ~ E).

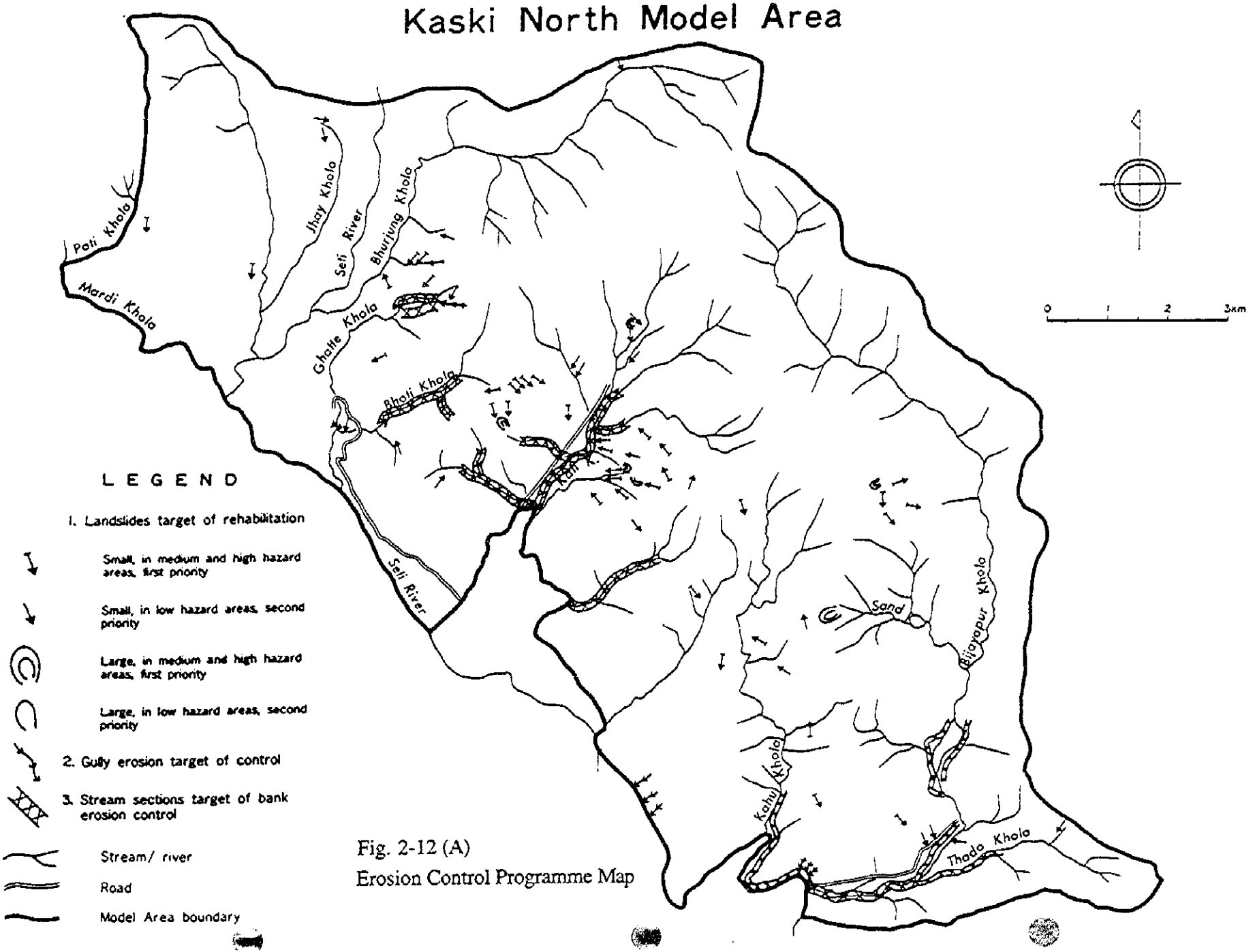


Fig. 2-12 (A)
Erosion Control Programme Map

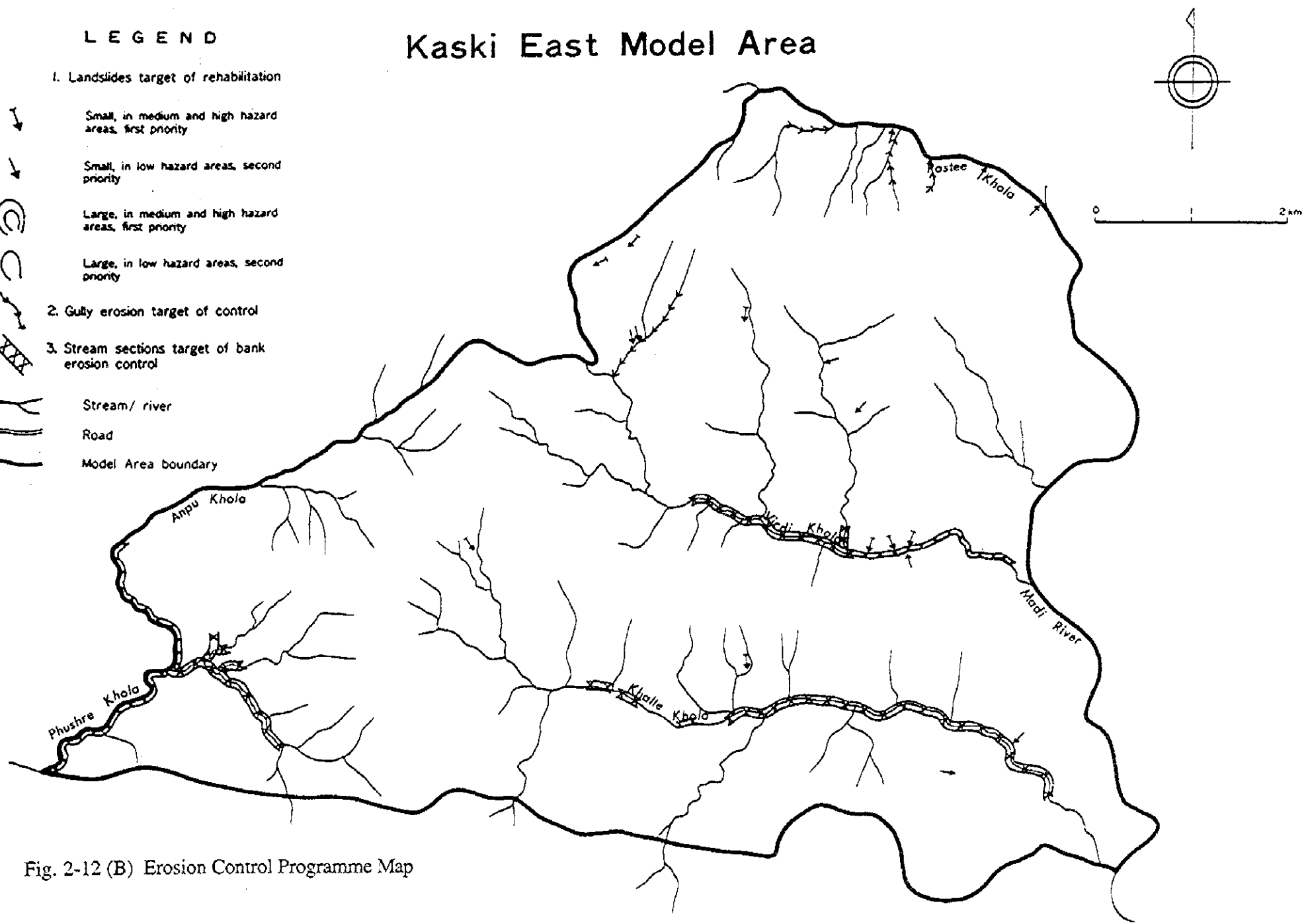


Fig. 2-12 (B) Erosion Control Programme Map

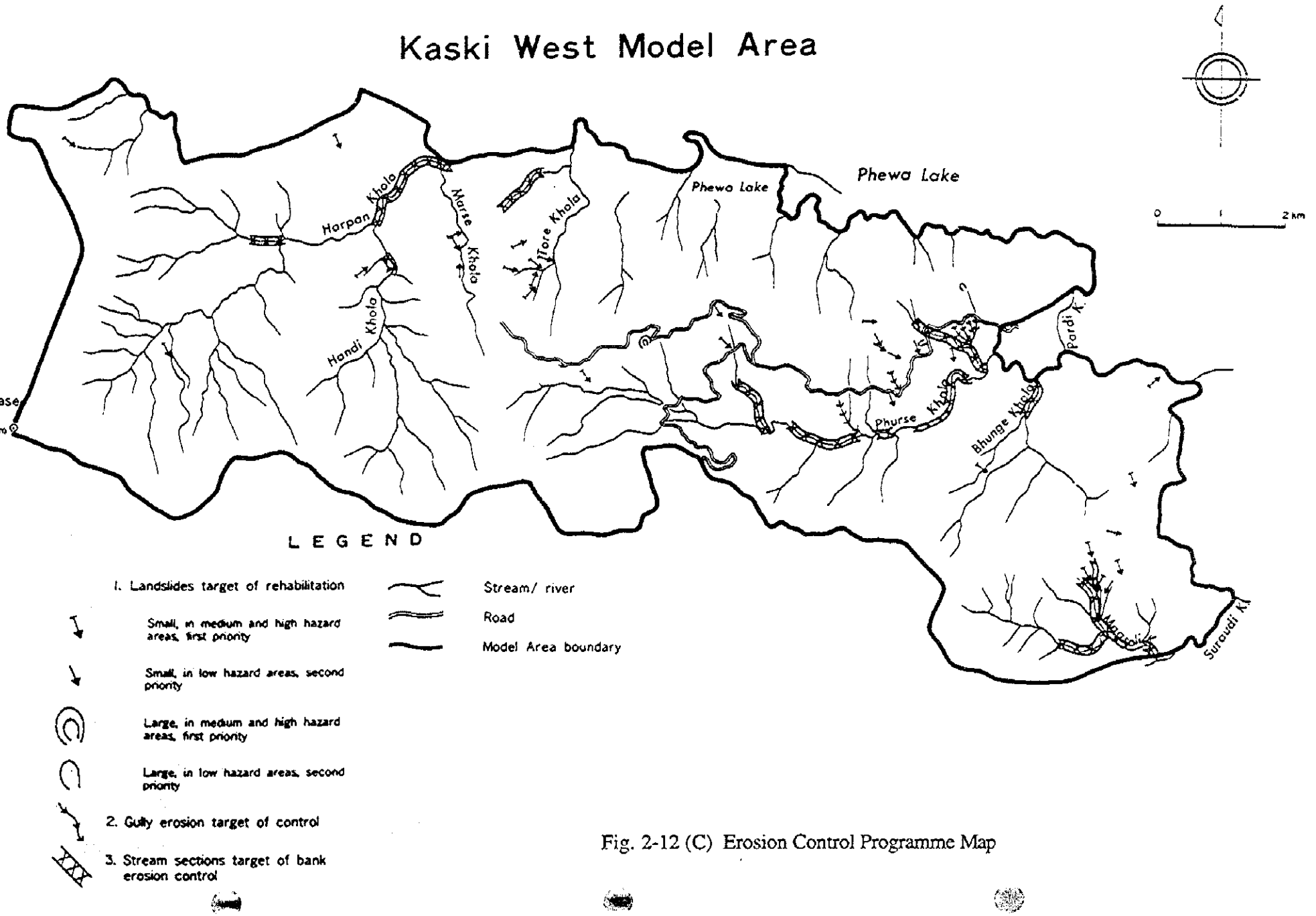


Fig. 2-12 (C) Erosion Control Programme Map

Parbat North Model Area

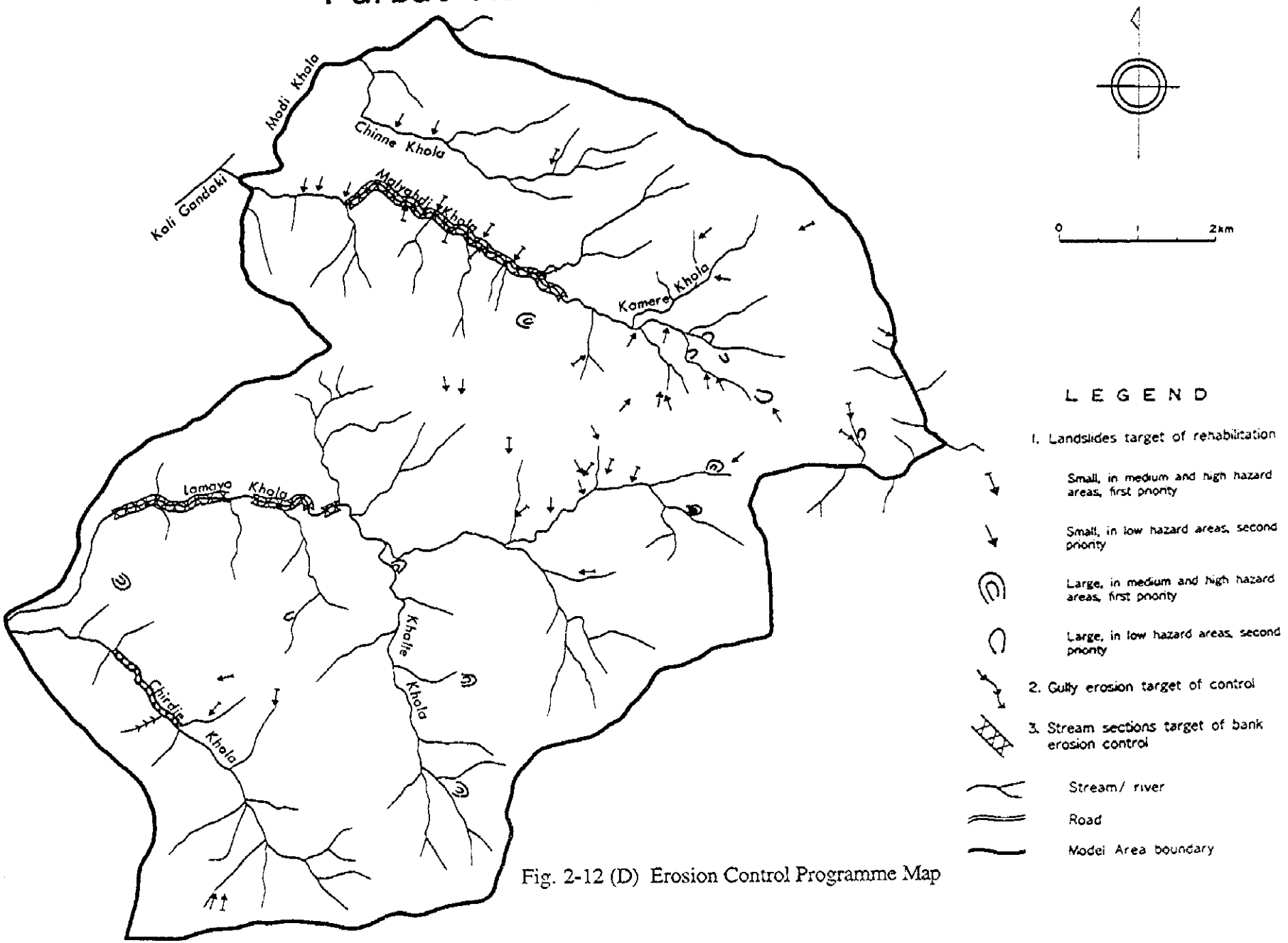
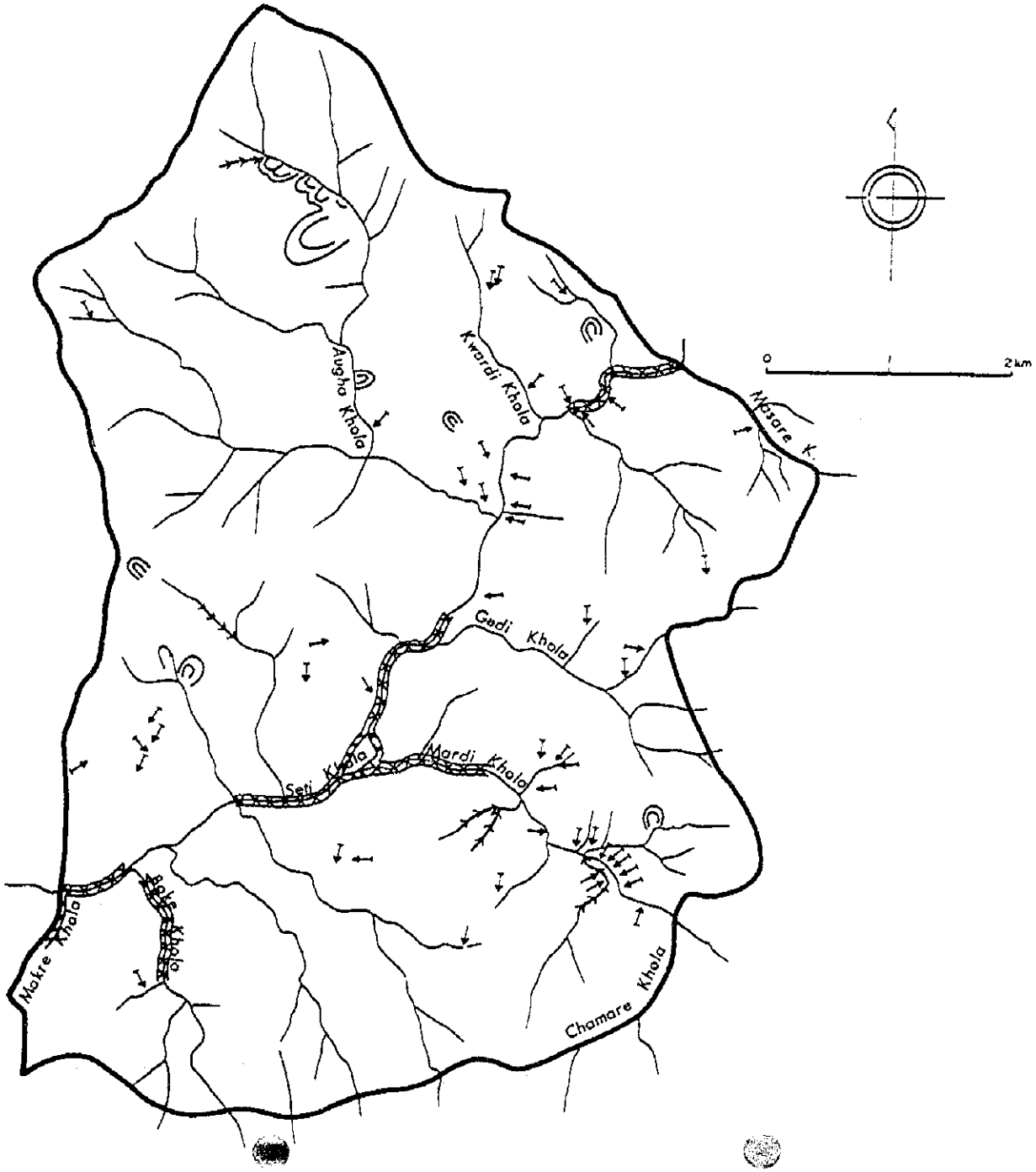


Fig. 2-12 (D) Erosion Control Programme Map

Parbat South Model Area



LEGEND

1. Landslides target of rehabilitation
   - Small, in medium and high hazard areas, first priority
   - Small, in low hazard areas, second priority
   - Large, in medium and high hazard areas, first priority
   - Large, in low hazard areas, second priority
2. Gully erosion target of control
3. Stream sections target of bank erosion control

- Stream/ river
- Road
- Model Area boundary

Fig. 2-12 (E) Erosion Control Programme Map

2-3 Improvement of Living Environment

2-3-1 Plan Principles

The most important issue from the viewpoint of ensuring the success and sustainability of programmes designed to achieve watershed management is an accurate understanding of and voluntary and active participation of people in implementation of the programmes. For this purpose, first the living environment of the people will be improved according to their needs, and based on it, watershed conservation will be conducted.

For the Plan, the following improvement measures will be prepared for issues which are of strong concern or for which there is a strong need among local people.

(1) The construction or improvement of roads and footpaths will be examined from the viewpoint of soil conservation. A proposal will be made in regard to the possibility of constructing new roads.

(2) The construction of suspension bridges is important to improve the access of local people. Coordination between communities will, however, be essential.

(3) As the supply of drinking water (installation of water tanks and pipes) involves the question of local water rights, proper surveys and coordination will be necessary.

(4) In the case of the repairing of ponds, proposals will be made from the viewpoints of run-off conservation and their use as drinking places for livestock as discussed in the section dealing with the prevention of surface erosion and the use of ponds.

(5) In regard to community rice polishing and flour milling facilities, careful examination of the question of the distribution of operation profits will be necessary.

(6) Planning of the construction or rehabilitation of irrigation facilities will be conducted in the form of conservation measures around irrigation channels.

(7) The use of improved furnaces and biogas will not only contribute to the conservation of forest resources but will also lead to a reduction of the firewood collection time and the cooking time of women.

2-3-2 Living Environment Improvement Programme

(1) Infrastructure Improvement Programme

① Trail improvement programme

Improvements in terms of stone paving as well as provision of drainage facilities are necessary to control surface run-off, and therefore, erosion of the trails and their surrounding areas, which will facilitate a smooth use of the trails by local inhabitants. As the potential of occurrence of slope failure and erosion is high in the sites designated as high hazard areas in Erosion Hazard Maps, trails running in these areas as well as trails having gradients of 15 degrees or more (measured on topographic maps of the Scale 1/25,000) will be the subjects of improvement in this plan.

Cross-drains 15-20cm wide and 10-12cm deep will be constructed every 30-50m. Stone paved side drains 30-40cm wide and 20-25cm deep with drop structures in every 30-50m will be constructed, specially where a trail crosses heads of streams. The trails will be paved with stones. Table 2-18 shows trail lengths by Model Area targeted for improvement.

Table 2-18 Trail Lengths by Model Area Targeted for Improvement

(Trail length unit: km)

Trail improvement measures	Model Area					Total
	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	
Stone paving and provision of drainage facilities	91.4 (31.1)	50.0 (30.6)	68.0 (30.2)	63.0 (36.3)	44.6 (36.3)	317.0

Note: a. Figures in ( ) are the percentages of the total length of trail in a Model Area.
b. Drainage improvement is palnned for all trails which are target of improvement. Since stone paving is already carried out in some trails having steep gradients, this activity will be applied in some 40% of the trails which are targets of improvement.

② Road Improvement Programme

Improvement of feeder roads is necessary for the smooth implementation of this plan and for the promotion of local economy.

a. The following measures will be applied in feeder roads located in valley floors or relatively flat areas such as Pokhara to Lamachour VDC road, Pokhara to Armala VDC road, road in Kahun VDC and Jimira Yoil to Amalchour road in Arba Vijaya VDC in Kaski North Model Area.

(a) The existing drainage ditches will be improved by clearing them of deposited material to prevent plugging and to facilitate the flow of run-off water.

(b) Where drainage ditches do not exist, ditches 0.5m wide and 0.3m deep will be built on both sides of the roads.

(c) The roads will be paved with 10cm to 15cm deep layer of gravel and maintenance will be carried out regularly.

b. The measures as mentioned below will be applied in roads running on steep hillsides such as the newly built road in Amalchour, Arba Vijaya VDC, Kaski North Model Area and the road in Kristi Nachnechour VDC between Phurse Khola and Kristi and the road extended from Sidhartha highway in Pumdibhumdi VDC in Kaski West Model Area.

(a) These roads will be improved according to the specifications of mountain roads (4-5m wide and 20-30 km/hour vehicle speed) as mentioned below.

(b) In case of a lack or insufficiency of gravel paving traffic will cause ruts to form, channelling run-off water longitudinally down the road. In mountain roads water flowing in ruts could easily obtain high velocities, causing erosion of the road surfaces. To prevent this to happen, road surfaces will be paved with gravel 10-15cm thick.

(c) Lateral drainage will be conducted by crowning or by in-or out-sloping (3-5%) of road surfaces. longitudinal drainage will be conducted by constructing side ditches and cross-drains. Side

ditches will be 0.5m wide, 0.3m deep and stone paved with drop structures every 20-50m.

(d) Cross-drains 0.3m wide and 0.3m deep will be constructed. Either logs or stones will be used or open culverts will be built. Culverts will be slanted at 30° downslope to help prevent plugging. The gradient in order for cross-drains to be self-cleaning will be 4% or more. Spacing of cross drains depend on road grade, surfacing material, rain intensity and slope. Here a spacing of 10-50m is proposed, depending on actual field situation.

(e) Road surface grade will be 8% and the maximum will be 12-14%. Curve radius will be more than 12m to facilitate a smooth flow of the traffic.

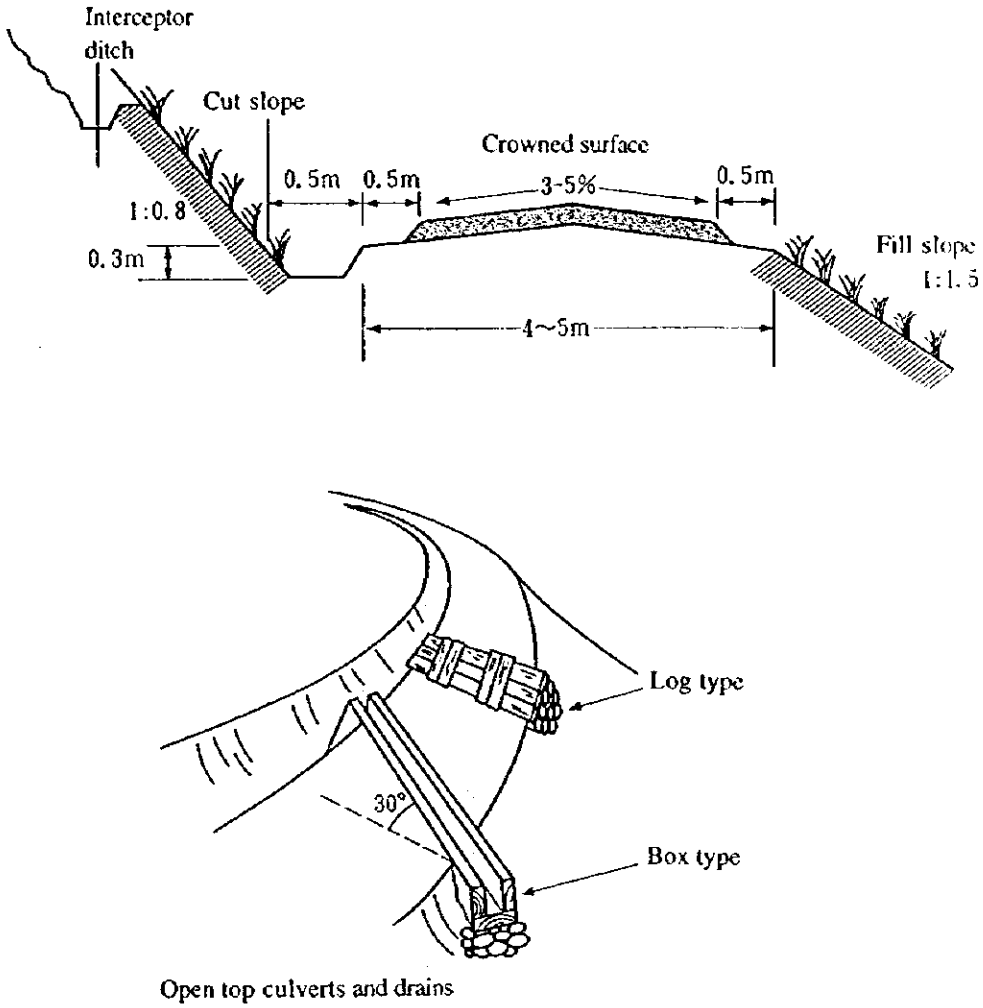
(f) Fill and cut slopes will be stabilized before the on-set of the monsoon season through planting of multipurpose grasses and other bio-engineering means, and where necessary retaining walls made of stone filled gabions will be constructed at slope toes. "Vegetation Structures for Stabilizing Highway Slopes: A Manual for Nepal" developed by HMG Department of Roads proposes detailed and concrete bio-engineering measures suitable under the social and natural environments of Nepal. This manual will be consulted for choosing proper vegetative measures and plant species for road slope stabilization in Model Areas.

Table 2-19 shows road lengths by Model Area targeted for improvement and Fig. 2-13 shows a typical mountain road corss-section and run-off draining facilities.

Table 2-19 Road Improvement Programme

(Unit: km)

Road	Improvement measure	Model Area					Total
		Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	
Feeder road	Drainage and road surface improvement	13.3	-	-	-	-	13.3
	Construction of drainage facilities, road surface improvement, cut and fill slope stabilization, etc.	4.0	-	14.0	-	-	18.0
Total		17.3	-	14.0	-	-	31.3



Open top culverts and drains

Fig. 2-13 A Typical Mountain Road Cross-section and Run-off Draining Facilities

c. Possible new roads

Due to the existence of severe natural conditions such as steep slopes, fragile geology and high rainfall the Study Area is prone to slope failure, debris flow and flooding, which make construction of new roads a highly expensive venture in view of the costs of countermeasures required to deal with the mass movements and road maintenance.

On the other hand, the socio-economic baseline survey results clearly indicate the strong hope of the public for improvement of the existing roads used for transportion of goods and for construction of new roads. Also as a general principle, social and economic developments in an area is closely connected with the existance of roads which can function in all seasons. The construction of new roads, therefore, should be undertaken after careful and detailed surveys and evaluation of a road's impact on the social as well as natural environments.

In this plan only the routes along which the construction of new roads is judged to be possible from the view point of topographic condition and proximity to existing roads, from which the new roads could be branched off, were examined on topographic maps of the Scale 1/25,000 and are as mentioned below. All the routes examined are currently trails. The specifications for mountain roads (4-5m wide), as mentioned earlier in road improvement, are also proposed for the possible new roads.

(a) Kaski North Model Area

i. Road extended from the existing Pokhara to Lamachaur VDC road at Chitepani in Puranchaur VDC to Kusum community in the same VDC. The road will connect Chitepani, Danda, Jallakot and Kusum communities. The approximate length of the new road will be 4.0km. Bridges will be needed on Bhoti Khola and Ghatte Khola.

ii. Road extended from the existing Pokhara to Lamachaur VDC road at Chitepani in Puranchaur VDC to Upplo Kaure in the same VDC. Most of the road will run along the ridge and will connect Chitepani to Kaure and Upplo Kaure communities and will be approximately 3.0km long.

iii. The existing Pokhara to Armala VDC road extended to Khurkot in the same VDC. The approximate length of the new road will be 1.0km and a bridge will be needed on the upstream tributary of Kali Khola.

iv. Road extended from the existing road at Patan Besi (outside Model Area) to Chapdanda in Arba Vijaya VDC, connecting Sanyasidada, Dobata and chapdanda communities. The approximate length of the road will be 4.0km and a bridge will be needed on Kahu Khola.

(b) Kaski West Model Area

i. Road extended from the existing Tilahar to Muresowara road at Pumdibhumdi VDC office site to Dandathok community in the same VDC. The new road will connect VDC office site with Thulaswara and Dandathok communities and will be some 2.5km long.

ii. Road extended from Sidhartha Highway near Khodi to Dhungepani in Pumdibhumdi VDC. The approximate length of the new road will be 1.5km.

(c) Kaski East Model Area

i. Road extended from the existing road near Pokhare Dee community (outside Model Area) to Deurali VDC office site, connecting Pokhare Dee, Phidi, Raiker and Deurali communities. The approximate road length will be 4.0km and a bridge will be needed on Anpu Khola.

(d) Parbat North Model Area

i. Currently a road from which new roads could be branched off do not exist in the Model Area or in its immediate vicinity. However, it's said that a new road will be constructed in the eastern part of Karkineta VDC, or in nearby areas. If construction of this road is materialized, a new road could be branched off from it and extended to Hatiya in Karkineta VDC.

ii. From Hatiya a new road could run west along the ridge up to Purkot in Shankar Pokhari VDC, connecting Karkineta VDC,

Thuli Pokhari VDC and Shankar Pokhari VDC. Another road from Hatiya could run north-west along moderately steep hillslopes to Puwa in Thuli Pokhari VDC, connecting Karkineta VDC, Khoula Lankuri VDC and Thuli Pokhari VDC. No major bridge construction will be required as the new roads will cross small streams only. The approximate length of the new road will be 18km.

③ Improvement programme of water source areas of permanent springs

To ensure a continued and sustainable supply of water from permanent springs in Model Areas, measures should be taken to improve the forest conditions in the water source areas of the springs and to protect the source areas against fire, grazing and cutting.

As was observed in the field, grazing by cattle in the water source areas of permanent springs is common. This causes compaction of the surface soil in the grazed areas which results in reduced infiltration and increased run-off, thus leading to erosion. Grazing also hinders natural regeneration in water source areas by physically destroying seeds and young sprouts. Moreover, spring water at the source could be contaminated with droppings of grazing animals and local inhabitants who consume such water in downstream areas may contract waterborne diseases.

The following measures are proposed for the protection and improvement of water source area of permanent springs in Model Areas.

a. Where a spring is located in non-forest areas such as paddy land, sloping terraced land, grassland, etc., from the spring source an area 50m in radius (approx. 0.8ha) will be fenced and planted with a mix of forest, fodder and fuelwood trees. This area will be protected against fire, grazing, grass cutting and tree cutting. After the trees grow and the crown is closed, utilization of branches as fuelwood and fodder will be allowed.

b. Where a spring is located in a forest having a crown density of 10-40%, or in a shrub land, from the spring source an area 100m in radius (approx. 3 ha) will be fenced and protected against fire, grazing, selective as well as clear cuttings. After a period of 5-8 years—

depending on the forest and site conditions this period could be shortened or prolonged—when the canopy cover of over 40% is achieved, utilization of tree branches as fuelwood and fodder will be allowed.

c. Where a spring is located in a forest having a crown cover of 40-70% or >70%, an area of the same size as in b. will be protected against fire, grazing and selective and clear cuttings.

User's groups will be formed and protection, planting and all forestry operations as mentioned in a., b. and c. above will be conducted under community forestry. The activities will be carried out for at least a period of 10 years, after which they will be reviewed and with the cooperation of local inhabitants protection area sizes could be increased. As an incentive for local inhabitants to cooperate in water source area protection, pipes could be extended to their communities to provide drinking water or irrigation water for small size farmlands. The plan a. to c., as mentioned above, is shown in Table 2-20.

Table 2-20 Land Area Target of Protection and Improvement at the Water Sources of Some Permanent Springs in the Model Areas

(Unit: ha)

Activity	Model Area					Total
	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	
a	4.8	2.4	0.8	9.6	6.4	24.0
b	15.0	-	3.0	6.0	6.0	30.0
c	18.0	42.0	39.0	12.0	12.0	123.0
Total	37.8	44.4	42.8	27.6	24.4	177.0

Trail improvement, road improvement and water source improvement are as shown in Fig. 2-14 (A ~ E), Infrastructure Improvement Maps.

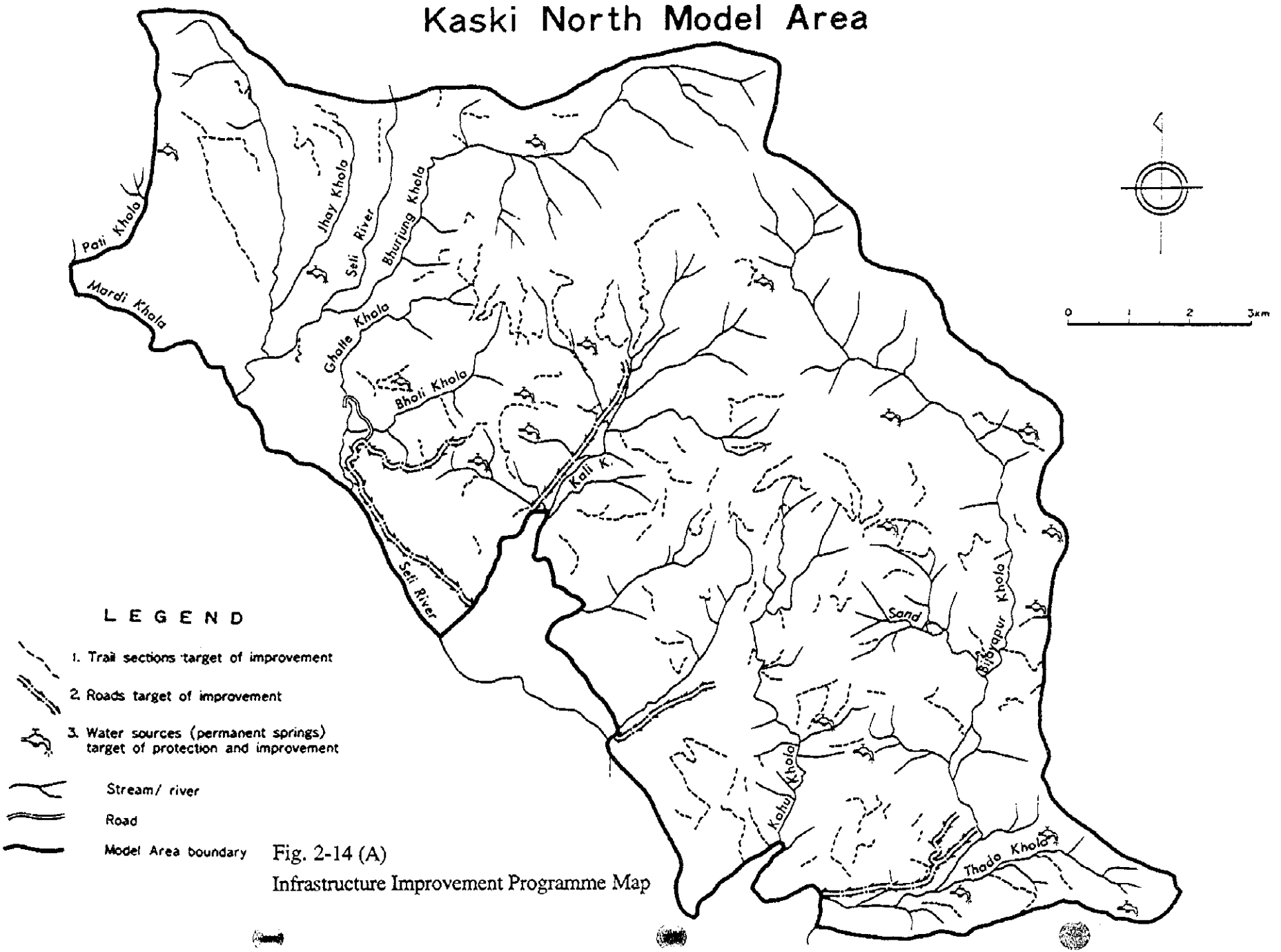


Fig. 2-14 (A)
Infrastructure Improvement Programme Map

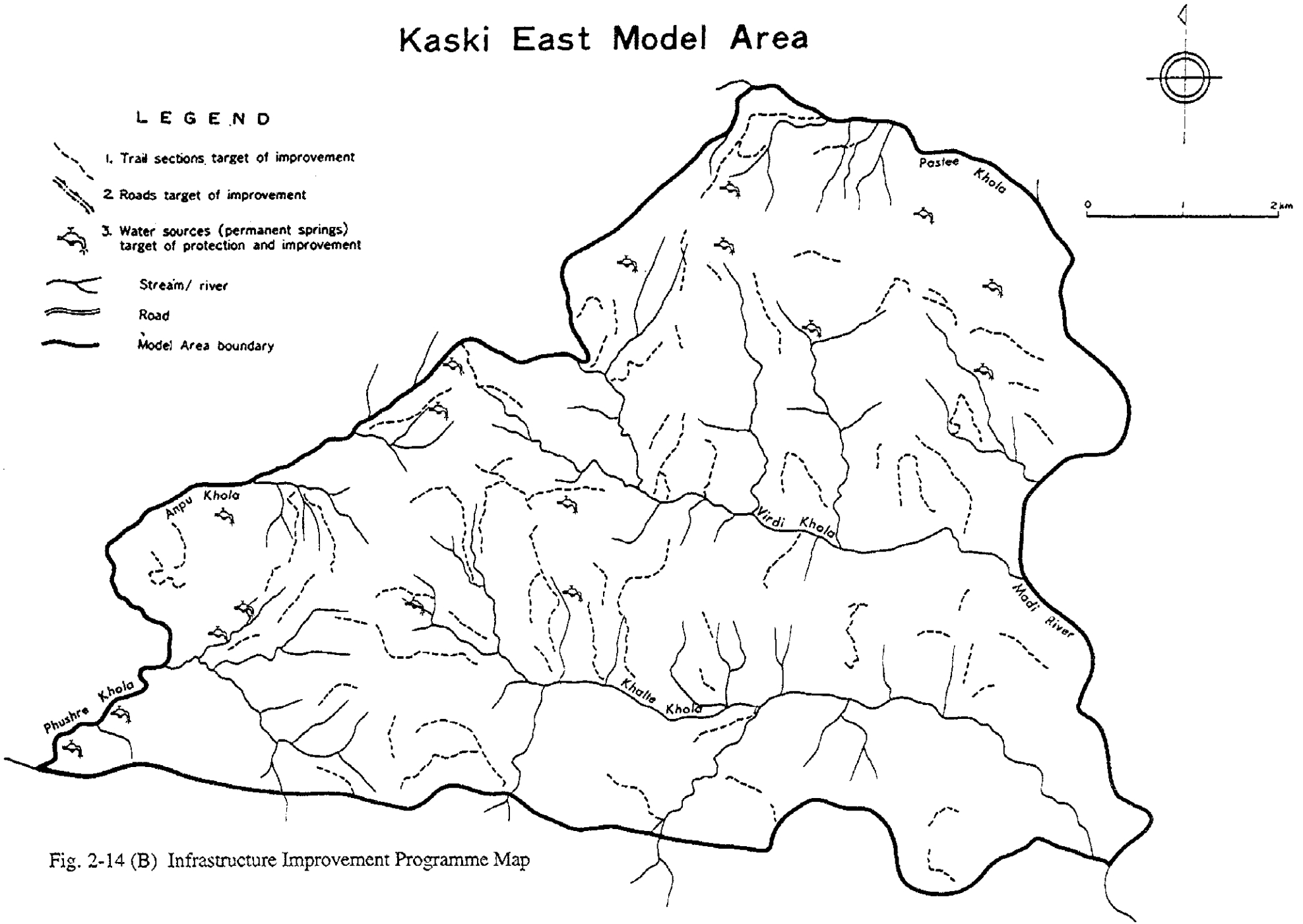


Fig. 2-14 (B) Infrastructure Improvement Programme Map

Kaski West Model Area

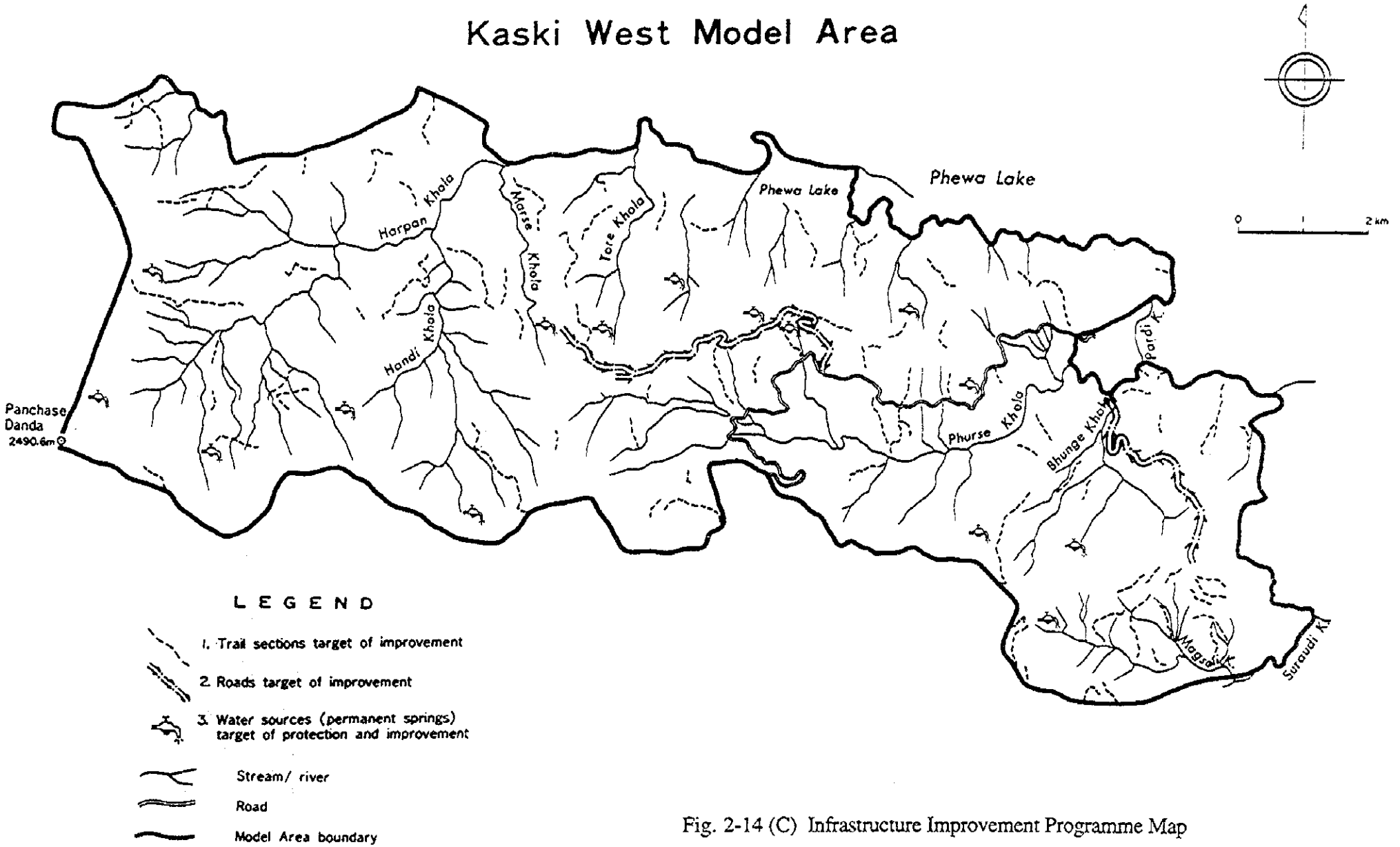


Fig. 2-14 (C) Infrastructure Improvement Programme Map

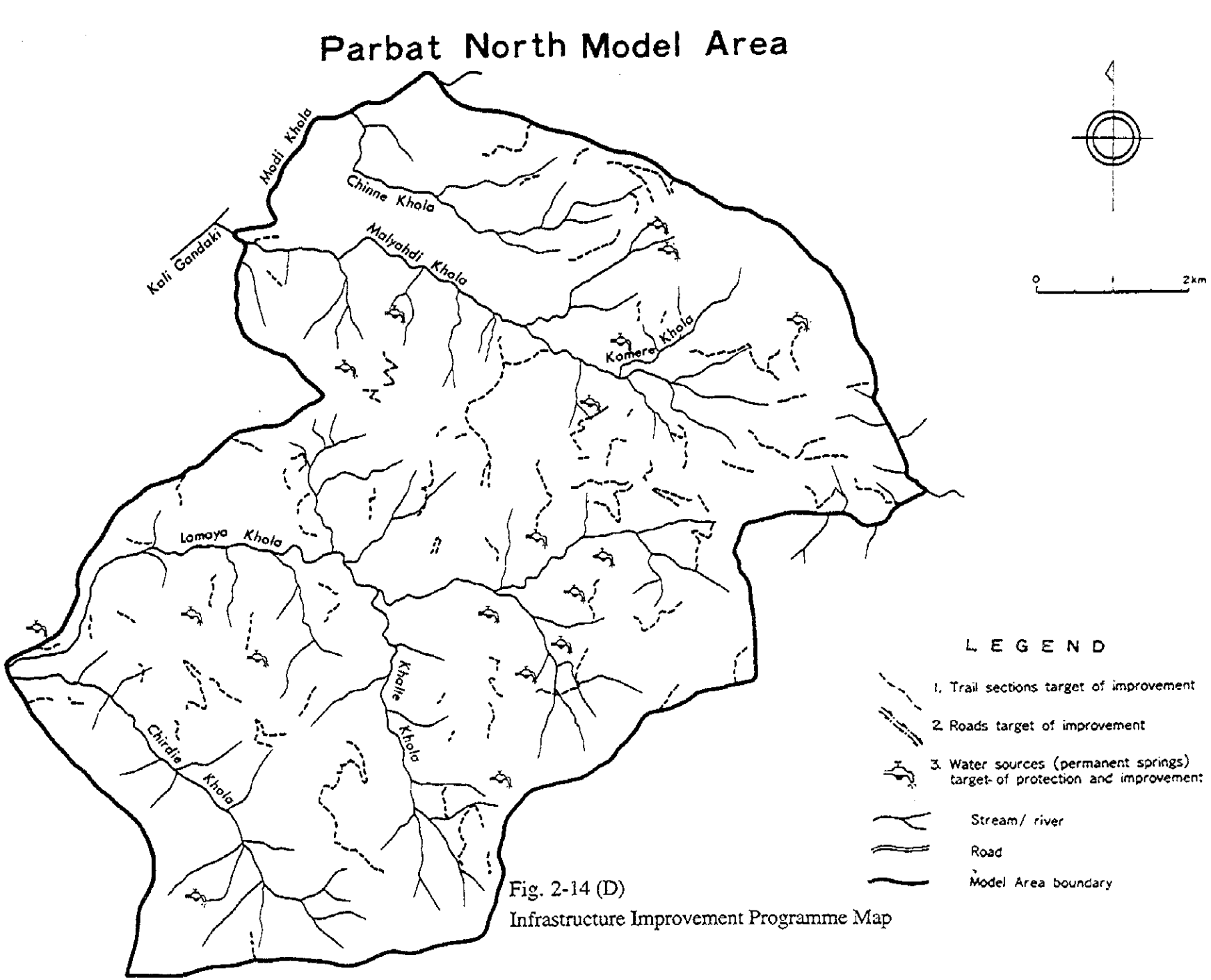
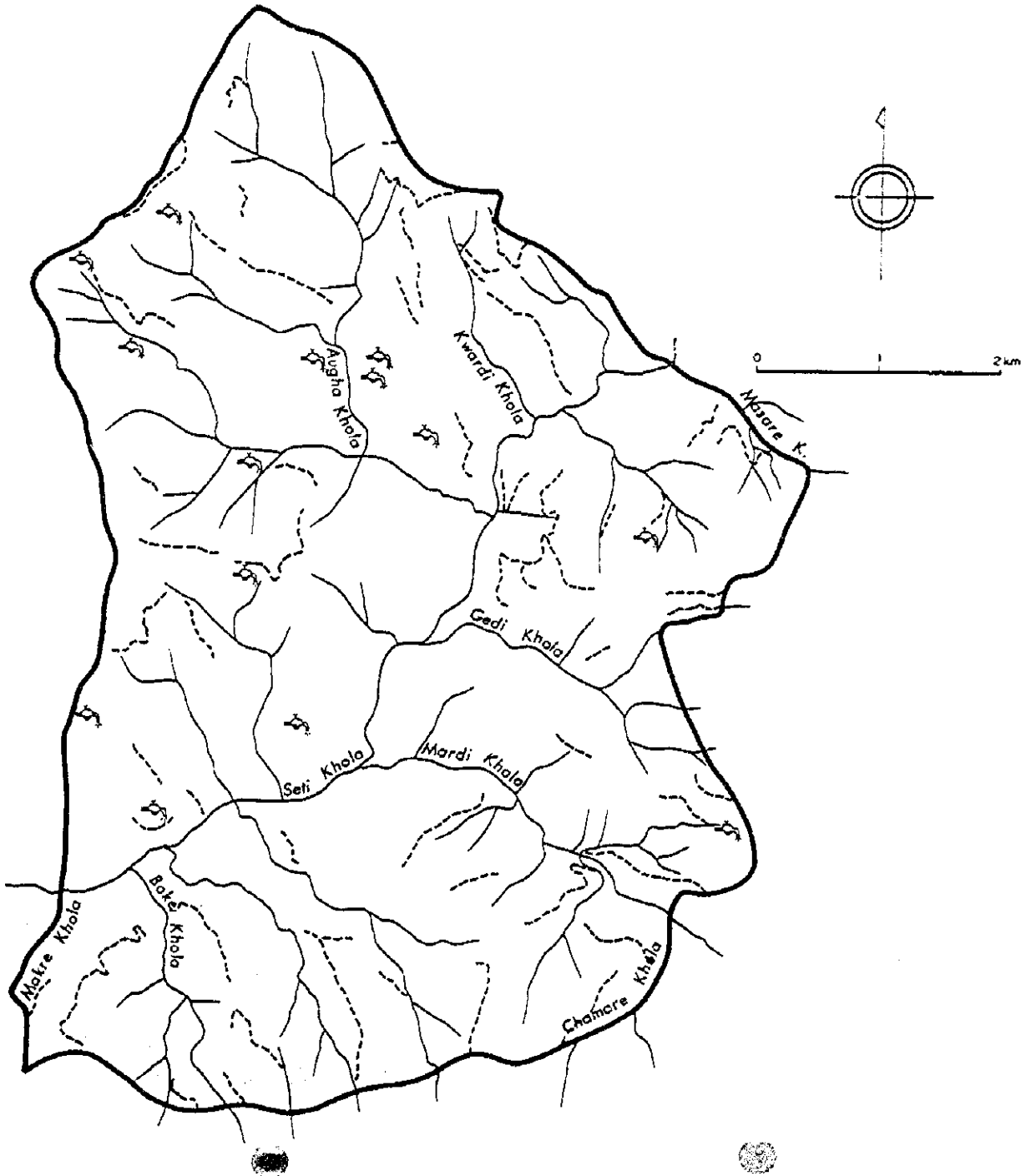


Fig. 2-14 (D)
Infrastructure Improvement Programme Map

Parbat South Model Area



LEGEND

1. Trail sections target of improvement
2. Roads target of improvement
3. Water sources (permanent springs) target of protection and improvement
- Stream/ river
- Road
- Model Area boundary

Fig. 2-14 (E)
Infrastructure Improvement Programme Map

(2) Construction of Suspension Bridges

As the lack of access hinders the transportation of fertiliser and farming products, suspension bridge construction will have important meaning for local life. However, there is a possibility that the construction of new suspension bridges will cause a clash of interests between communities and a socioeconomic gap between areas enjoying such bridges and other areas. There are, therefore, many problems to be solved prior to the implementation of such a project.

From the viewpoint of the construction cost, small bridges can be constructed by local people themselves while the construction of large bridges requires the form of a district or even national project. Accordingly, a careful approach is required to the construction of suspension bridges with the coordination of local people and the relevant VDC and district authorities and examination of the problems between communities, the cost and other relevant issues.

(3) Supply of Drinking Water

Some 60% (65% in the rainy season) of the population in the Model Areas receive drinking water through piped supply and local people show strong interest in the supply of drinking water. A piped water supply is convenient in that people can obtain water near home, resulting in a reduction of the women's water fetching workload. As such, all communities indicate a strong need for this type of water supply.

Meanwhile, because of the question of water use upstream, there has been a case of a project to lay clean water supply pipes being halted, indicating the necessity to obtain a proper understanding of all local people affected by such a programme. In addition to assistance for the programme, coordination with the VDC, DDC and Department of Water Supply will be required.

When the laying of clean water supply pipes in response to the needs of local people is planned, it is necessary to determine the priority among similar programmes based on a precise understanding of the local conditions, including the state of water use, etc. In addition, the following conditions should be set for local people and user groups.

① Compulsory conservation of the headwater area
② Compulsory maintenance of pipes and water tanks by users
③ Establishment of user groups to establish rules for ① and ② above

Target sites for water supply installation will not be pre-determined under the Plan and the work will commence in those places with a serious water shortage in areas where there is strong interest in watershed conservation on the part of local people.

(4) Repair and New Construction of Conservation Ponds

Many conservation ponds in the Model Areas play the dual functions of conservation to prevent soil loss and the provision of drinking places for livestock. The design conditions and drainage requirements for the repair or construction of the ponds from the viewpoint of conservation have already been described.

Conservation ponds play a significant role in controlling harmful insects for livestock, particularly water buffalo, while they are used as drinking places for other livestock. Although the target is to establish one reservoir in each ward, the final decision will be made in accordance with the needs of local people and the level of stock raising.

(5) Joint Rice Polishing and Flour Milling Facilities

User groups will be established to operate and maintain these facilities. Coordination with the district agricultural offices will be required for the establishment of flour milling facilities.

(6) Construction and Rehabilitation of Irrigation Facilities

Water is currently supplied to level terraces (khet land) via irrigation channels, the construction and maintenance of which is conducted by the Department of Irrigation. The existing irrigation facilities are fairly well maintained, showing a positive attitude towards khet land by farmers.

The relevant programmes under the Plan must be prepared after careful examination of the site conditions and the question of water rights, etc. regarding the subject sites. Proper coordination with the agricultural office and irrigation office will be essential. In regard to the DOSC, conservation around channels will be the main issue. Planting near new irrigation facilities and conservation measures near intake points should be conducted on the initiative of user groups. Local people, who will be responsible for the implementation of the programme,

should be made constantly aware of the importance of watershed management upstream.

(7) Improved Furnaces and Biogas

It is hoped that improved furnaces will be widely used in the future and their active use in the Model Areas should be encouraged. In regard to biogas, its use at high altitudes is not particularly efficient and, therefore, its use in the Model Areas should be carefully examined.

(8) Public Health

① Health Centres

Poor health leads to the stagnation of local people's participation as it can reduce not only the efficiency of the workforce conducting watershed conservation improvement work but also the level of local income. There is a total of 35 health centres in the Model Areas. These include health posts and sub-health posts attached to hospitals and simple treatment and the extension of family planning are conducted at these posts. The present health centre buildings should be repaired through the establishment of user groups with a view to improving the living environment. Compulsory planting around these buildings will also help to improve the awareness of local people of the importance of watershed and forest conservation.

② Toilets

The rate of toilet use is 50% in the Kaski District and 10% in the Parbat District. The construction of toilet facilities will improve the sanitation conditions for local people and remove the causes of various diseases, resulting in an improved sanitation level for the whole community. While it is normally preferable to locate toilets near houses, the drainage conditions in the surrounding area and possible adverse impacts downstream should be taken into consideration when deciding the sites. In the future, the needs of local people and environmental impacts should be carefully considered when constructing new toilets. The understanding of local people that the construction of toilets has important implications vis-a-vis not only public hygiene but also the water quality in the entire watershed is essential.

(9) Education

Among the economically active local population, 42% do not have any formal education, of which 60% are women. The percentages of non-educated persons among the occupational casts are higher than other casts and many of them are women. As the level of education is closely related to the level of understanding and the level of cooperation for watershed conservation programmes, appropriate improvement measures should be examined. The following measures are envisaged under the Plan.

① Literacy education for women will be thoroughly implemented to improve the status of women (requiring a positive understanding on the part of men).

② The local level of education will be improved through the proper maintenance of school buildings and the distribution of teaching materials.

③ User groups will be established for school building maintenance and planting activity around schools and forest conservation schemes.

④ Environmental education will be provided to facilitate understanding of the importance of watershed management among local people.

2-4 Income Generation

2-4-1 Plan Principles

The insufficient income of local people has the following impacts, leading to degradation of the watershed environment.

① The lack of money to purchase fertiliser leads to insufficient replenishment of soil nutrients, failing to prevent the decline of farmland fertility.

② It is difficult to purchase improved furnaces and/or alternative fuel which are measures to combat the excessive use of forest resources, one cause of forest degradation.

③ The lack of money to purchase food leads to insufficient control of the water discharge associated with the inappropriate use of land, including the unreasonable use of farmland, in turn resulting in landslides.

The aims of the programme are improvement of the living environment for women and occupational castes, development throughout the areas and at the same time empowerment of local people in terms of their involvement in soil conservation programmes. Also, through implementation of the programmes people's income will improve and in the future it will become possible for them to set up a fund to assist the continuous implementation of programmes.

2-4-2 Income Generation Programme

(1) Farming Products/Livestock

① Farming Products

The cultivation of cash crops is the quickest and most effective method of improving the income of local people and obtaining the understanding of local people. At present, the following crops are cultivated to generate income.

Kaski District	Parbat District
ginger, potatoes, cauliflowers, cabbages, pulses, apples, peaches, plums, tangerines, tea, coffee, vegetable seeds, Lapsi	ginger, rocta *(Edgeworthia chrysantha)*, coffee, napier grass, tangerines

Other optional cash income sources include cardamon, red pepper, medicinal herbs, apiculture, mushrooms, bamboo and bee-keeping. The cooperation of the agricultural office will be required in regard to crop cultivation, bee-keeping and apiculture methods with a view to facilitating the understanding of local people of these methods. While Pokhara is the most likely market for these products, the distribution channels for other crops have already been established among farmers in surrounding areas, preventing the smooth introduction of cash crops in some cases. This situation makes it essential to conduct a full market survey and a survey on the intentions of local people.

In regard to improving the awareness of local people of the importance of watershed conservation through income generation, it is important to improve the understanding of local people of the following connections.

a. Cultivation of potatoes → supply of compost → livestock fodder → conservation of forest resources

b. Bee-keeping → preservation of honey resources → growth of flower-bearing plants and trees → conservation of forest resources

c. Cultivation of rocta in forests → forest conservation

② Livestock

The most common animals raised locally are goats, rabbits and geese. Although the raising of goats is said to have adverse implications vis-a-vis conservation, appropriate breeding control can prevent forest degradation. Moreover, the problem of feeding goats can be presented to local people to improve their awareness of the importance of forest conservation. It will be necessary to obtain data on fodder required for goat raising.

(2) Small-Scale Processing Industries

The most common small-scale processing industry is rice polishing (one place in each VDC). There are also a small number of premises engaged in chicken raising, bamboo crafts and woodworking. The low level of processing work can be partly attributed to the small demand in the Model Areas.

As bamboo is observed everywhere, there should be a sufficient supply of bamboo for bamboo work. If bamboo work is to be conducted for self-consumption, the training of technicians, etc. will be required for the proper selection of materials and the improvement of processing techniques.

Local woodworking includes handicrafts, furniture making and sawing. For the expansion of sales outlets in this field, it will be necessary to improve access to and to develop the markets in Pokhara (particularly souvenir shops). Further requirements are the establishment of producer groups of bamboo work and handicrafts, i.e. user groups of forest resources, to provide marketing information and to organize technical training courses. In this regard, it will be essential to remind producers (users) of the importance of forests as a supply source of raw materials and also to prepare programmes, including a programme which makes planting after the felling of trees to obtain raw materials compulsory.

(3) Creation of Employment Opportunities

While full-time farmers dominate the population in both districts, the Kaski District has a higher proportion of wage earners and labourers than the Parbat

District, reflecting the influence of Pokhara on employment. This trend is underlined by the ratio of men among farmers, indicating a high level of employment in Pokhara.

Under these circumstances, it appears extremely difficult to create new employment opportunities in the Kaski and Parbat Districts. The active development of the small-scale processing industries described in (2) above will possibly lead to an expansion of community forests, producing new jobs for watchmen. Further employment opportunities will include those for engineers specialising in landslide prevention work and for the transportation of cash crops. Such creation of local employment will hopefully improve the situation of a population outflow to seek jobs outside home areas.

The day-to-day exchange of information with related organizations will be necessary for the creation of employment opportunities, treating this issue as not only one which affects local people but one which also relates to forests and environmental conservation through local development.

(4) Utilisation of Forest Resources

One of the targets of the Plan is forest conservation and it should be remembered that appropriate forest management has more economic value benefitting local people. It is, therefore, necessary to improve people's awareness of the importance of forests in addition to encouraging their participation in community forest schemes.

2-5 Extension and Training

2-5-1 Plan Principles

Extension activities are intended to provide incentives for local people to take the initiative in watershed and forest conservation and should not be simply the top-down conveyance of the importance of environmental conservation. The mutual exchange of information between extension agents and beneficiaries must be ingredients of the project design and plan implementation processes. In fact, extension activities and programme implementation cannot be separated in the field. The extension and training programme for local people, NGOs and field agents is described next.

2-5-2 Extension and Training Programme

(1) Local People

As indicated in the report for the JICA extension project, an important requirement for extension activities aimed at local people is the establishment of direct contact in the field to provide information and to transfer technology, etc. Visits to actual project sites facilitate the technical understanding of local people and, therefore, bus tours and visits to demonstration plots should be actively conducted. Given the low literacy level, visual displays should be used as much as possible. The emphasis of the programme should be placed on the socially weak, women and the poor who are in fact the most closely related to the use of forests. Other key points for extension activities are listed below.

① As local people have a strong interest in cash income and road improvement, these needs should be incorporated in reforestation and soil conservation programmes.

② Extension activities should avoid the busy farming season and any period with a high concentration of other necessary work as much as possible.

③ The benefits for local people participating in programmes should be clearly established together with the benefits for other communities.

④ Key persons should be selected from among local people and these persons should be used to encourage the active participation of farmers in various programmes.

⑤ Literacy education and environmental education in schools should be actively promoted to enable local people to understand the objectives and significance of programmes.

⑥ The participation method in watershed management should be clearly shown to create the opportunity for free participation.

⑦ Any extension activity should always incorporate an element of reminding local people of the necessity to try to be independent based on self-help efforts instead of relying on external assistance.

The process of people's participation has already been described in 1-5-4. (See the community forest manual prepared by the Department of Forestry for the process of participation in community forestry.) As the socioeconomic baseline

survey results showed, the rate of participation in local groups was 15.5% for men and 13.4% for women which is fairly low (the participation rate for community forestry in Model Areas is around 16%). As the Plan considers the establishment of user groups corresponding to the various programmes to be very important, increase of the participation rate step-by-step in accordance with the progress of activities should be aimed at.

(2) NGOs

The present manpower of the DOSC, which is responsible for watershed conservation and soil conservation activities, will find it difficult to ensure the smooth implementation and maintenance of programmes in the Model Areas.

The involvement of NGOs in national projects and foreign aid projects has been very active and NGOs have rich experience of projects with strong implications for local inhabitants, including watershed management and local development projects. Also NGO activities are highly evaluated by all existing projects. When the mobilisation of NGOs, which have members with various backgrounds, is intended, know-how on watershed conservation, local development and the organization of people is necessary. To ensure the building up of such know-how, NGO staff members should be encouraged to participate in technical training courses and seminars and to learn socioeconomic analysis techniques as in the case of DOSC staff members.

(3) Field Agents (DSCO Staff)

The following problems have been identified in regard to extension activities relating to watershed management and soil conservation in the Model Areas.

① In regard to the number of agents, it appears difficult to increase the present manpower level of soil conservation offices given the national policies of administrative rationalisation and decentralisation. It will, therefore, be necessary to improve the technical abilities of agents even if their number remains small.

② It is true to say that the present means of extension are insufficient as there is an inadequate number of vehicles and motorbikes providing a means of transport for agents. However, in the future when access is improved, the frequency of use of these means of transport should be reviewed.

③ It is necessary to improve the level of technical expertise of agents and, therefore, their active participation in seminars and workshops should be encouraged together with the learning of administrative and technical skills and socioeconomic analysis techniques at the Extension and Training Centre of the Department of Forestry.

④ As the Plan will be implemented using an integrated approach, cooperation with other fields should be sought to ensure a swift and effective response to the diverse needs of local people.

2-6 Integrated Watershed Management Plan Maps

(1) Objectives

① To present a basic plan covering the entire Model Areas

② To show measures to solve main problems in the Model Areas

③ To provide objective materials for judgement by the administration and local people in relation to the needs of the latter

(2) Contents

Based on the objectives described in (1) above, the maps will show the following programmes.

① Land use improvement programme for "forest conservation" and "preservation of land productivity"

② Erosion control programme for "mitigation of disasters, and control of various type of erosion", etc.

③ Footpath and road improvement as well as water source protection and improvement programmes among the planned infrastructure improvement

(3) Use of the Maps

① The maps will provide basic material for policy decisions at the national, district and VDC level.

② The maps will present measures to solve problems in the Model Areas and will be used to coordinate these measures with the VDC authorities.

③ The maps will be used to prepare the ward planning profile which will be described later.

④ In view of the participation of local people in not only plan implementation but also in plan preparation, the contents of the maps should not be treated as fixed contents but as a reference for the planning with the participation of local people.

3. PLAN IMPLEMENTATION METHOD

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The actual implementation of the Plan requires the establishment of an implementation system, finalisation of the implementation schedule, cost estimation and the formulation of an implementation plan, all of which will be conducted by the body directly responsible for plan implementation based on the findings of detailed field surveys. These aspects of plan implementation are tentatively outlined below.

3-1 Implementation System

3-1-1 People Involved in Plan Implementation and Their Roles

For the implementation of the Plan, the project implementation body (hereinafter referred to as the Project Team) will be established, in which related organizations, including the Department of Soil Conservation (hereinafter referred to as the Department of Soil Conservation, etc.) and people involved in the implementation of the Plan locally, including local people (hereinafter referred to as local people, etc.), will cooperate and liaise with each other. While the Project Team will mainly be composed of the Department of Soil Conservation, etc. and local people, etc., NGOs and donor organizations will join the Project Team when necessary.

The following organizations and people, etc. will be involved in the implementation of the Plan.

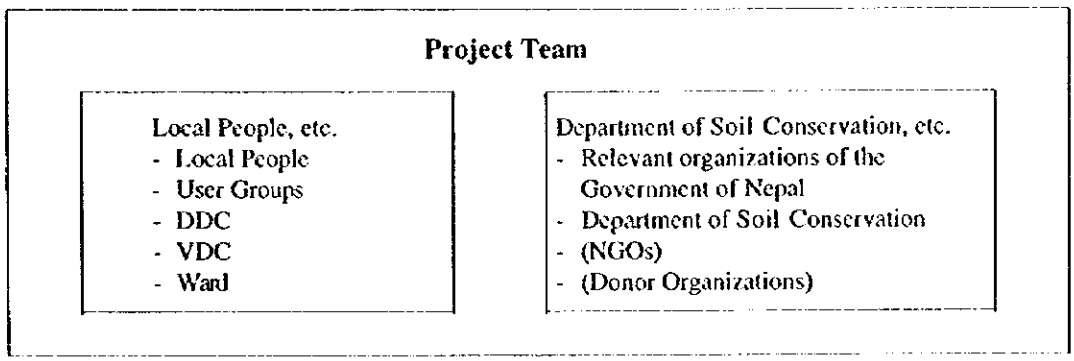


Fig. 3-1 Roles of Various Participants in the Plan Implementation

(1) Local People, etc.

① Raise local problems

② Request the implementation of a programme(s)

③ Formulation and implementation of the implementation plan for each approved programme

④ Provision of manpower and bearing of the costs required for plan implementation

(2) Department of Soil Conservation, etc.

① Dispatch of staff members, etc. to establish a project team

② Provision of policy advice necessary for plan implementation and payment of the necessary expenses

③ Coordination with other related organizations for plan implementation

(3) Local people, etc. and the Department of Soil Conservation, etc. will consult with each other on plan implementation mainly through the Project Team.

(4) At present, the Department of Soil Conservation has local soil conservation offices in Pokhara and Kusma and also has local ranger posts. To ensure efficient plan implementation and appropriate communication with local people, it will be necessary for the local soil conservation offices located in the subject area of the Plan to dispatch staff members to join or assist the Project Team.

3-1-2 Organizational Structure of Project Team

For the smooth implementation of the Plan, the Project Team will consist of a team leader and those responsible for land use management, watershed conservation, women in development, local development and general affairs as well as village extension officers who will directly deal with local people, etc. on site. The organizational structure of the Project Team and the role of each team member is described below (Fig. 3-2).

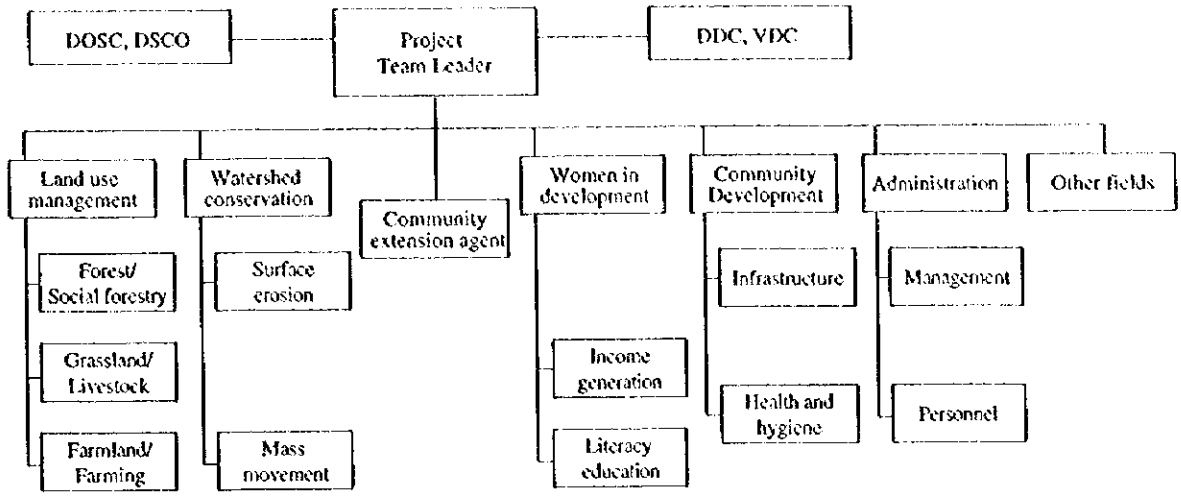


Fig. 3-2 Implementation System (Draft)

(1) The project leader is responsible for the operation and management of the Project Team in general. He also coordinates with such related parties as the Department of Soil Conservation and local people, etc.

(2) The person responsible for general affairs conducts the accounting for the Project Team, personnel matters and employment of local staff, etc.

(3) The person responsible for land use management provides guidance on forest conservation, forest management with a view to maintaining land productivity, farming and stock raising, etc.

(4) The person responsible for watershed conservation provides technical guidance on surveys on landslides and soil erosion and also on the design and implementation of prevention as well as rehabilitation measures while establishing a picture of the devastation and soil erosion throughout a watershed.

(5) The person responsible for women in development conducts the empowerment of women through improved income and literacy education based on the survey and analysis results on women's status and the conditions of the poor in the subject area and assists the participation of women in the implementation of the Plan.

(6) The person responsible for local development provides guidance and assistance for the participation of local people, etc. in the implementation of the Plan by means of facilitating infrastructure development and the improvement of public health.

(7) The village extension officer organizes local people with a view to establishing their needs and implementing the Plan with their assistance and also provides assistance for the concrete implementation of the Plan on site.

(8) Persons dispatched in response to certain needs provide technical guidance and assistance in their respective fields of expertise.

(9) Local staff are employed when necessary to assist the operation and management, etc. of the project team office.

(10) The project team office is preferably located in Pokhara in view of the locations of the Model Areas and administrative convenience as the city has good transport access to the Model Areas.

3-1-3 Coordination with Other Organizations

As the objective of the Plan is the achievement of watershed management through local development, coordination with other organizations will be necessary for its smooth implementation. As in the case of soil conservation policies, the Department of Soil Conservation should consider coordination and liaisoning with the following organizations operating in the subject area via the DDC to ensure the smooth implementation of the Plan.

Field	Coordination/Liaisoning Issues	Related Organization(s) at Field Level
Agriculture	- Crop production - Agroforestry	- District Agricultural Office - Agricultural Experiment Station
Forestry	- Community forests - Nursery	- Regional Forestry Department - District Forestry Office
Stock Raising	- Stock raising	- District Animal Husbandry Office - Agricultural Experiment Station
Irrigation	- Irrigation channels	- District Irrigation Office
Water Supply	- Water supply work	- District Water Supply Office
Roads	- Repair and construction of footpaths and vehicle roads	- Western Regional Management Office, Department of Roads - District Road Office
Education	- Public health and hygiene	- VDC Health Post
Local Development	- Local development in general	- District Local Development Office

3-2 Implementation Process

3-2-1 Plan Implementation

Under the Plan, each Model Area will be considered a single watershed to constitute the planning unit. Based on this planning unit, the plan will be implemented in an administrative unit in view of the smooth organization of local people, budgetary execution, maintenance and management issues.

The minimum unit for development in Nepal is a VDC which commonly consists of nine wards. In the plan, a VDC will be considered to be the implementation unit and within it the wards will be the targets of plan implementation to ensure the efficiency of distribution of the national budget, decisions on plan priority, coordination within a VDC and plan follow-up work. In practice, two methods are feasible and one of these will be decided based on the actual circumstances surrounding the government, VDC and local people.

(1) Implementation in Multiple Wards

This method will be adopted when the many needs of various wards are both strong and urgent. For example, the forest improvement programme will be implemented in Ward No. 1 to supply firewood while the income generation programme through ginger cultivation will be implemented in Ward No. 2 to improve income.

(2) Implementation in Single Ward

This method will be adopted when a single ward indicates several needs of equal urgency which should be given priority over the needs of other wards. For example, Ward No. 7 has a worse firewood shortage, fodder shortage and disaster hazard than other wards, all of which should be dealt with by appropriate programmes.

3-2-2 Implementation Period

It is believed that the length of the plan implementation period should be decided based on the actual size of the Plan, organizational system in place and degree of self-reliance on the part of local people. When taking the necessary preparations for plan implementation, the empowerment of local people and the required maintenance in the post-plan period into consideration, it is assumed that two years and 3 - 5 years will

be necessary for preparation and plan implementation respectively. Accordingly, a project implementation period of approximately five years for each VDC appears appropriate.

The idea is to use the actual results in those VDCs where the Plan is implemented as model cases as lessons to be learned for the implementation of subsequent plans with a view to gradually shifting the responsibility for plan formulation and implementation to local people to encourage their self-reliance. The important point here is to facilitate the participation of local people in the plan (and project) formulation and implementation process to quickly achieve the positive results of plan implementation.

3-3 Cost Estimation

3-3-1 Estimation Principles

The following principles are adopted for cost estimation.

(1) In regard to the budget size and other relevant issues concerning the DOSC, care should be taken to avoid any confusion in hill communities and any damage to the prospect of the self-reliant development of local people by means of, for example, introducing a cost ceiling.

(2) Local people should be encouraged to contribute to the implementation of any programme in which they participate in the form of labour, cash and goods. The policies held by the DOSC are followed in the Plan to determine the extent of local people's share.

(3) In order to facilitate the self-reliant spirit of local people and to ensure programme sustainability, outside aid should, in principle, be limited to physical facilities and materials and local people should be given the responsibility for the operation and management of such facilities.

(4) As the costs related to part of the improvement of the living environment, income generation and extension/training are only determined by local people's needs, these are excluded from the cost estimation.

3-3-2 Unit Prices of Various Programme-Related Items

(1) In principle, the unit prices used by the DOSC are used.

(2) For those unit prices not available from the DOSC, related organizations are interviewed to obtain data from them. These unit prices are shown in Table 3-1.

3-3-3 Total Cost

Based on the design quantities of the various programmes planned, the total cost is estimated to be 369,718,000 NRs, which includes the share of local people, as shown in Table 3-2.

Table 3-1 Unit Costs

(Unit: 1,000 NRs)

Programme and Activities	Unit	Rate	Contribution		Remarks
			Project Team	Villagers	
<Improvement of Land Use>					
- Forest Improvement Programmes					
Programme 1 (Forest Conservation)	ha	2	1	1	Conservation plantations × 20%
Programme 2 (Production of Timber, etc. & Introduction of Cash Crops	ha	5	2.5	2.5	Conservation plantations × 50%
- Grassland Improvement Programmes					
Programme 1 (Grassland Improvement)	ha	4	2	2	Fodder tree and grass plantations × 80%
Programme 2 (Silvopasture)	ha	5	2.5	2.5	Fodder tree and grass plantations
Programme 3 (Reforestation)	ha	10	5	5	Conservation plantations
- Farmland Improvement Programmes					
Programme 1 (Farmland Improvement)	ha	40	20	20	On-farm conservation
Programme 2 (Agroforestry)	ha	5	2.5	2.5	Fodder tree and grass plantations
Programme 3 (Khet Land Improvement)	ha	10	5	5	On-farm conservation × 40%
Pond Construction	no.	40	20	20	Estimation
- Seedling Production Programme					
Production of Seedlings	no.	3	1.5	1.5	Nursery operation
<Erosion Control>					
- Landslide Treatment Programme					
Small Landslides	no.	50	25	25	Landslide treatment
Large Landslides	no.	200	150	50	Estimation
- Gully Erosion Control Programme	no.	90	50	40	Gully treatment
- Bank Erosion Control Programme	km	150	75	25	Stream bank protection
<Improvement of Living Environment>					
- Living Environment Improvement Programme					
Footpath Improvement	km	125	100	25	Trail improvement
Road Improvement (Drainage)	km	13.3	10	3.3	Road office
(Drainage/Cut & fill slopes)	km	4	3	1	Road office
Headwater Area Improvement Measures	ha	15	5	10	Water source conservation
Conservation Pond Repair and Construction	no.	40	30	10	Conservation ponds

Table 3-2 Total Cost

(Unit: 1,000 NRs)

Programme and Activities	Unit	Quantity	Rate	Amount
<Improvement of Land Use>				
- Forest Improvement Programmes				
Programme 1 (Forest Conservation)	ha	12,167	2	24,334
Programme 2 (Production of Timber, etc. & Introduction of Cash Crops	ha	7,316	5	36,580
- Grassland Improvement Programmes				
Programme 1 (Grassland Improvement)	ha	206	4	824
Programme 2 (Silvopasture)	ha	1,274	5	6,370
Programme 3 (Reforestation)	ha	807	10	8,070
- Farmland Improvement Programmes				
Programme 1 (Farmland Improvement)	ha	1,788	40	71,520
Programme 2 (Agroforestry)	ha	9,843	5	49,215
Programme 3 (Khet Land Improvement)	ha	7,818	10	78,180
Pond Construction	no.	307	40	12,280
- Seedling Production Programme				
Production of Seedlings	no.	1,292,000	0.003	3,876
Sub-Total				291,249
<Erosion Control>				
- Landslide Treatment Programme				
Small Landslides	no.	260	50	13,000
Large Landslides	no.	29	200	5,800
- Gully Erosion Control Programme	no.	24	90	2,160
- Bank Erosion Control Programme	km	18	150	2,700
Sub-Total				23,660
<Improvement of Living Environment>				
- Living Environment Improvement Programme				
Footpath Improvement	km	317	125	39,625
Road Improvement (Drainage)	km	13.3	13.3	177
(Drainage/Cut & fill slopes)	km	18	4	72
Headwater Area Improvement Measures	ha	177	15	2,655
Conservation Pond Repair and Construction	no.	307	40	12,280
Sub-Total				54,809
Total				369,718

3-4 Implementation Plan Formulation Process at Field Level

3-4-1 Formulation Process

The implementation plan formulation process at the field level under the Plan is described below (Fig. 3-3).

(1) DDC Level

The problems in the Model Areas and measures to solve these problems will be examined using the thematic maps prepared under this study and contents of VDC/ward selection compiled using the findings of the socioeconomic baseline survey. Based on the examination results, and by taking into consideration the degree of urgency, degree of importance and possibility of plan implementation, the subject VDCs will be selected through consultations with the DOSC and DDC, etc.

(2) VDC Level

The subject wards for plan implementation in the VDCs selected in each Model Area will be examined using various thematic maps, the integrated watershed management plan maps and the VDC planning profile (VPP). The project team, VDC authority, soil conservation office and other related organizations will be consulted in this selection process. At this stage, one ward may be selected or several wards may be selected for plan implementation. It will be essential to explain to local people that the integrated watershed management plan maps and VPP are objectively prepared reference materials and that they do not constitute a compulsory basis for plan implementation.

(3) Ward Level

The plan for the selected wards will be jointly prepared by the project team, VDC authority, ward authorities and soil conservation office using the ward planning profile (WPP). In this case too, the proposed programme will be an option and the programme priority will basically be determined based on the needs of local people. The guidelines of the DOSC will be followed if it is necessary to organize local people to implement the selected programme(s).

(4) Implementation Level

A field survey will be jointly conducted with the organized user group(s) to confirm the participating members and to estimate the programme implementation cost, etc. and the programme(s) will be implemented.

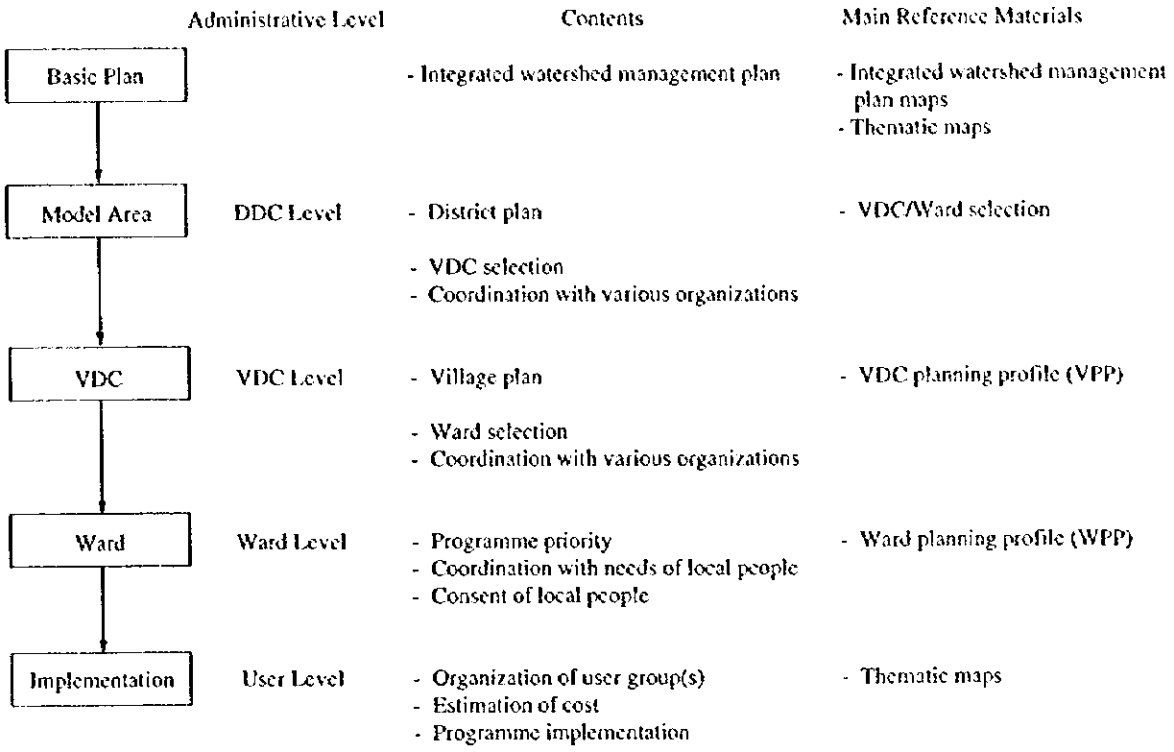


Fig. 3-3 Planning Process by Administrative Level

3-4-2 VDC Planning Profile (VPP)

(1) VDC/Ward Selection Summary

The VDC/Ward selection summary compiles the VPP results as shown in Table 3-3. These tables indicate the socioeconomic problems of each Model Area at the DDC level and the subject VDCs will be selected based on these tables and the examination results of such natural conditions as land use/vegetation and the state of erosion, etc.

(2) VDC Planning Profile

The VDC planning profile provides reference materials for the selection of the subject wards at the VDC level. In addition to such study results as the VPP, thematic maps, the site access and local intentions, etc. will be taken into full consideration in the selection of the subject wards. As Table 3-3 shows, the population, resources shortage, past experience of disasters and issues of public concern will be scored for each ward and the resulting ward rankings based on the total score for each ward will form the basis for ward selection. Table 3-5 shows the VPP details of Katuwa Chaupari in Parbat North Model Area as an example, The VPP details for all VDCs are included in the Appendix.

Table 3-3 VDC/Ward Selection — Summary

District / Model Area	VDC Score	Ranking in			Ranking within VDC								
		Model area	District	Whole areas	Ward 1	2	3	4	5	6	7	8	9
PARBAT DISTRICT													
A. North Model Area													
1. Katuwa Chaupari	61	14	19	25	6	7	3	3	8	9	5	2	1
2. Thapathana	61	14	19	25	8	6	9	1	3	7	3	3	2
3. Shankar Pokhari	87	1	1	1	6	2	6	9	5	8	4	1	3
4. Karkineta	67	10	13	15	6	4	8	7	4	9	1	3	2
5. Khaula Lankuri	70	7	10	11	1	3	2	7	4	6	5		
6. Thuli Pokhari	70	7	10	11	6	3	1	4	6	2	6		5
7. Pipartari	66	11	14	17	3	7	3	3	1			2	6
8. Mudikuwa	59	16	22	29						1	2	3	
9. Bhangara	63	13	18	23	2	1	6	7	8	9	4	2	5
10. Limthana	64	12	17	22	3	8	4	2	9	7	5	6	1
11. Thana Maulo	69	9	12	13	8	1	5	2	6	2	7	4	8
12. Phalam Khani	86	2	2	2	9	5	2	3	4	5	8	7	1
13. Lunkhu Deurali	71	6	8	9	1								
14. Kurgha	77	4	5	5	3	6		1	2	5	4	7	
15. Devisthan	75	5	6	6	3	1	2						
16. Khanigaun	79	3	4	4	5					4	1	2	3
B. South Model Area													
17. Tribeni	58	7	23	34	3	6	7	9	5	3	1	7	2
18. Saraukhola	60	6	21	28	1	5	5	3	2	4	9	8	5
19. Baulibas	84	1	3	3	5	3	7	4	5			2	1
20. Huwas	71	3	8	9	1	4	9	7	2	2	6	5	8
21. Bhorle	75	2	6	6			2	3	1				
22. Bhoksing	55	8	24	40	1								
23. Hosrandgi	65	5	16	21	6	9	8	5	7	3	1	4	1
24. Balakot	66	4	14	17	1	2						3	
KASKI DISTRICT													
A. East Model Area													
1. Deurali	62	3	6	24	5	9	6	8	4	2	6	3	1
2. Siddha	66	2	4	17	7	9	7	6	3	2	1	5	4
3. Thumki	72	1	1	8	6	6	3	9	8	2	1	5	3
B. North Model Area													
4. Arba Vijaya	56	7	13	36	3	5	8	9	5	2	5	1	4
5. Mauja	59	2	8	29	2	8	7	5	8	6	1	4	3
6. Bhalam	58	6	12	34	8	3	2	5	3	1	6	7	9
7. Lamachaur	59	2	8	29	4	8	5	7	9	3	5	2	1
8. Armala	56	7	13	36	4	9	1	7	8	2	5	3	5
9. Kahun	59	2	8	29	5	8	5	3	9	1	3	2	7
10. Purunchaur	59	2	8	29	7	4	4	9	8	6	2	1	3
11. Lahachok	67	1	3	15	3	4	1	5	5	2	7	8	
12. Sildujure	56	7	13	36								2	1
13. Sardikhola	49	11	18	42				1					
14. Kalika	52	10	17	41			3			1			1
15. Rakhi	49	11	18	42	3				1		2		4
C. West Model Area													
16. Kristinachnechaur	56	4	13	36	1	5	8	9	7	1	5	4	3
17. Pumdibhumdi	66	2	4	17	8	3	1	2	4	5	9	5	7
18. Chapakot	69	1	2	13	2	5	1	6	2	4	7	9	8
19. Bhadaure Tamagi	61	3	7	25	4	7	2	1	3	4	7	9	6

Remarks: VDC Score : Total of mean scores for Wards (1-9) in Sub-Items 14 to 33 shown in the VPP
Ranking in Model Area : Ranking of each VDC score for each Model Area
Ranking in District : Ranking of each VDC score for each district, i.e. Parbat and Kaski
Ranking in Entire Area : Ranking in five Model Areas combined together
Ranking Within VDC : Ranking of ward, ranging from first to ninth in each VDC based on total score of Sub-Items 14 to 33 by ward

Table 3-4 VDC Planning Profile

Legend

Items	Sub-Items	Data No.	Data Items	Unit	Legend 1	2	3	4	5	6
Present Condition	Demography & Others	1	Total HH	no.	Actual figures					
		2	Total Pop.	no.	Actual figures					
		3	Occupational caste HH	% of HH	0	0 - 20	20 -40	40 - 60	60 - 80	80<
		4	Absent pop.	% of pop.	< 10	10 - 20	20 - 30	30 - 40	> 40	
		5	Pop. w/o education	% of adults	< 20	20 - 30	30 - 40	40 - 50	50 - 60	60<
		6	Org. member	% of adults	> 30	20 - 30	5 - 10	10 - 20	5 <	
		7	Distance to road (hrs)	hours	Actual figures					
		8	HH w/o Toilet	% of HH	80<	60 - 80	40 - 60	20 - 40	1 - 20	0
	Forestry, Agriculture, & Livestock	9	Member of FUG	% of HH	80<	60 - 80	40 - 60	20 - 40	1 - 20	0
		10	Farm size per person	ha	0.15<	0.12 - 0.15	0.09 - 0.12	0.06 - 0.09	0.03 - 0.06	<0.03
		11	Pop. of Cow per HH	head / HH	Actual figures					
		12	Pop. of Buffalo per HH	head / HH	Actual figures					
		13	Pop. of Goat per HH	head / HH	Actual figures					
	State of Resource Shortage #1	14	Drinking water	% of HH	< 5	5 - 10	10 - 20	20 - 30	30 - 40	40<
		15	Fuelwood	% of HH	< 10	10 - 20	20 - 30	30 - 40	40 - 50	50<
		16	Fodder	% of HH	0	0 - 5	5 - 10	10 - 20	20 - 30	30<
		17	Food (cereals)	% of HH	< 30	30 - 50	50 - 70	70 - 90	90<	
		18	Cereal deficit period	months / year	< 2	2 - 3	3 - 4	4 - 5	5 - 6	6<
	Damage to Farm by #2	19	Flood	% of HH	0	0 - 5	5 - 10	10 - 20	20 - 30	30<
		20	Land slide	% of HH	0	0 - 5	5 - 10	10 - 20	20 - 30	30<
		21	Soil erosion	% of HH	0	0 - 5	5 - 10	10 - 20	20 - 30	30<
	Degree of Concern & Interest about #3	22	Food	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		23	Fodder	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		24	Fuelwood	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		25	Drinking Water	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		26	Irrigation	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		27	Land slide / erosion	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		28	Flood	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		29	Cash income	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		30	Motorable road	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		31	Child education	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		32	Health	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
		33	Community meeting	score	< 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
	Priority of Concern & Interest about (among 23 items)	34	Food							
		35	Fodder							
		36	Fuelwood							
		37	Drinking Water							
		38	Irrigation							
		39	Land slide / erosion							
		40	Flood							
		41	Cash income							
		42	Motorable road							
		43	Child education							
		44	Health							
		45	Community meeting							
	Degree of Desire for Lessening Work Load (score)	46	Fetching D. water (F)	score						
		47	Cooking (F)	score						
		48	Shopping in bazaar (M)	score						
		49	Plowing (M)	score						
		50	Transporting compost (F)	score						
		51	Threshing cereals (F)	score						
		52	Milling cereals (F)	score						
		53	Terrace maintenance (M)	score						
		54	Fodder collection (F)	score						
		55	Fuelwood collection (F)	score						
VDC Ranking	Score									
	Ranking in Model Area									
	Ranking in District									
Ward Ranking	Score									
	Ranking in VDC									
	Ranking in Model Area									
	Rankieg in District									

23 items were prioritized based on the

Max. score = 100
Min. score = 0

Remarks :

#1: The percentage indicates the proportion of households who answered : very short (for drinking water & fodder)
very difficult to obtain (for fuelwood)
production is not enough for home consumption (for cereals)

#2: The percentage indicates the proportion of households whose farm has been regularly damaged by these natural disasters.

#3: The interviewees (adults) were asked to indicate their degree of concern or interest on these items using :
After giving added weight (point) to the responses, score was calculated for each ward and VDC.
(Max score=100, Min. score=0)

1. Strongly concerned (3 points)
2. Concerned (2 points)
3. Slightly concerned (1 points)
4. Not concerned (0 points)

Table 3-5 VDC Planning Profile (Ward Selection)

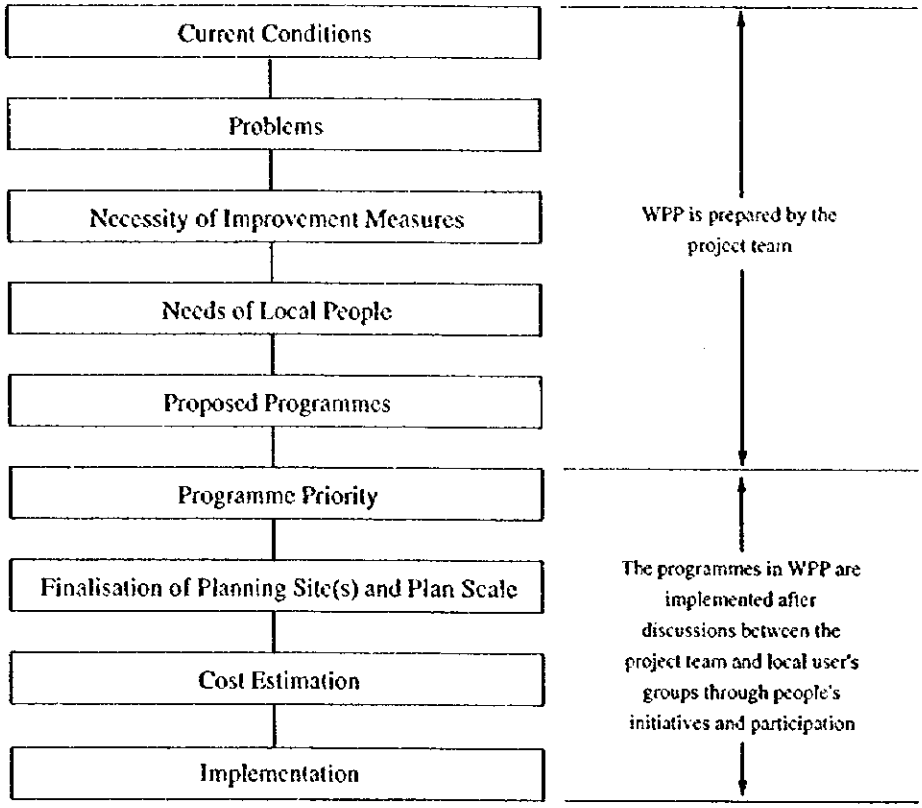
Parbat North Model Area

Items	Sub-Items	Data No.	Data Items	1. Kaluwa Chaupari (PN)									
				Overall	Ward-1	Ward-2	Ward-3	Ward-4	Ward-5	Ward-6	Ward-7	Ward-8	Ward-9
Present Condition	Demography & Others	1	Total HH	362	43	55	29	42	37	33	40	38	45
		2	Total Pop.	1,869	228	253	154	213	262	152	256	186	165
		3	Occupational caste HH	2	1	2	1	2	3	2	1	2	3
		4	Absent pop.	2	3	3	4	2	3	2	1	2	2
		5	Pop. w/o education	4	3	3	4	3	6	4	4	4	4
		6	Org. member	3	3	5	3	5	4	4	2	3	4
		7	Distance to road (hrs)		1	1	1.5	1.5	1.5	1.5	1.5	1	1
		8	HH w/o Toilet	6	6	6	6	6	6	6	6	6	6
	Forestry, Agriculture, & Livestock	9	Member of FUG	4	5	4	5	6	6	4	3	3	4
		10	Farm size per person	4	3	3	3	3	4	3	3	4	5
		11	Pop. of Cow per HH	1.7	1.2	1.8	1.7	1.1	1.1	2.2	1.8	3.2	0.9
		12	Pop. of Buffalo per HH	1.7	1.7	2.0	1.3	1.6	1.7	2.0	1.9	1.7	1.8
		13	Pop. of Goat per HH	0.8	0.1	0.6	0.5	0.8	0.3	2.4	1.0	1.0	0.8
	State of Resource Shortage	14	Drinking water	2	2	2	3	2	2	1	1	4	3
		15	Fuelwood	5	4	4	6	6	4	1	5	6	5
		16	Fodder	2	1	2	1	4	1	1	2	5	3
		17	Food (cereals)	2	2	1	1	3	4	2	2	3	4
		18	Cereal deficit period	2	1	1	1	2	3	1	1	2	3
	Damage to Farm by	19	Flood	3	1	1	4	1	1	1	4	4	5
		20	Land slide	3	4	3	4	1	1	3	5	3	1
		21	Soil erosion	4	5	5	1	1	1	3	3	3	6
	Degree of Concern & Interest about	22	Food	3	1	1	3	4	4	2	2	3	5
		23	Fodder	3	3	3	4	5	3	2	3	4	3
		24	Fuelwood	4	5	5	4	5	4	2	4	4	5
		25	Drinking Water	3	1	5	4	4	3	2	1	3	3
		26	Irrigation	4	5	5	4	5	4	3	3	4	5
		27	Land slide / erosion	1	3	1	1	1	1	1	4	2	3
		28	Flood	1	1	1	1	1	1	1	3	2	3
		29	Cash income	5	5	4	5	5	5	2	4	4	6
		30	Motorable road	5	5	4	5	5	5	2	4	4	6
		31	Child education	3	3	2	4	4	3	2	4	3	4
		32	Health	4	3	4	6	5	3	3	2	2	6
		33	Community meeting	2	1	1	4	2	1	1	2	2	1
	Priority of Concern & Interest about (among 23 items)	34	Food	11	15	19	16	9	4	5	13	11	6
		35	Fodder	10	12	12	11	6	10	8	12	7	11
		36	Fuelwood	3	3	1	7	4	2	10	3	3	4
		37	Drinking Water	12	16	3	5	10	11	9	21	12	12
		38	Irrigation	4	2	2	6	7	5	2	9	6	3
		39	Land slide / erosion	18	12	16	20	21	21	20	7	14	14
		40	Flood	20	19	17	21	22	22	21	10	15	15
		41	Cash income	1	4	5	3	5	1	6	4	4	1
		42	Motorable road	2	8	4	2	1	3	4	2	1	7
		43	Child education	9	9	13	12	12	6	7	6	13	10
		44	Health	6	10	7	1	3	6	1	16	17	2
		45	Community meeting	16	17	20	10	17	14	12	14	19	19
	Degree of Desire for Lessening Work Load (score)	46	Fetching D. water (F)	39	38	57	53	45	49	36	11	31	39
		47	Cooking (F)	27	42	37	26	40	23	9	14	21	30
		48	Shopping in bazaar (M)	15	26	29	22	25	3	9	12	3	8
		49	Plowing (M)	23	16	43	12	31	32	0	29	17	26
		50	Transporting compost (F)	21	41	29	10	10	40	29	16	8	16
		51	Threshing cereals (F)	7	2	5	15	9	8	11	8	8	0
		52	Milling cereals (F)	9	0	10	4	8	2	11	19	12	13
		53	Terrace maintenance (M)	17	15	11	15	11	43	21	0	3	20
		54	Fodder collection (F)	28	36	27	28	23	17	34	35	20	34
		55	Fuelwood collection (F)	46	58	35	33	49	53	18	61	49	53
VDC Ranking	Score		Sum of No. 14 - 33	61									
	Ranking in Model Area		Min=16, 8 (PN, PS)	14									
	Ranking in District		Min=24	19									
Ward Ranking	Score		Sum of No. 14 - 33		56	55	66	66	54	36	59	67	80
	Ranking in VDC		Min=9		6	7	3	3	8	9	5	2	1
	Ranking in Model Area		Min=113, 50 (PN, PS)		101	105	59	59	107	113	93	55	22
	Ranking in District		Min=163		143	148	84	84	152	163	127	78	27

3-4-3 Ward Planning Profile (WPP)

(1) Use of WPP

The WPP will be used when implementation plan is formulated at the ward level jointly by the VDC authority, local people and the DOSC. In regard to the formulation of the implementation plan at the ward level, it will be important to present a topographical map, aerial photographs and GIS outputs in addition to the WPP to facilitate the understanding of local people. In regard to the implementation process, the organization of user groups will be essential together with field verification, surveying, design and cost estimation. The process of using the WPP upto implementation is shown below.



(2) Key Points of WPP

① Present conditions (provision of minimum data and information for planning in each ward)

② Problems from the viewpoints of watershed conservation and local life

③ Measures to deal with problems

④ What are the priority issues to be dealt with

In addition the WPP should have the following features.

⑤ Easy to see and comprehend by user's groups

⑥ Easy to handle (compact size) in the field

⑦ Inclusion of a location map

(3) Contents of WPP

An example of the WPP is shown in Table 3-6.

① Location

a. The names of the Model Area and VDC in which the selected ward is located, the ward number and names of communities listed on the map must be entered.

② Current Conditions

a. The population (by gender) will be entered using the ward profile data established by the socioeconomic baseline survey.

b. The number of households, number of households headed by a woman, ratio of castes, school enrollment rate for girls, participation of various groups and participation in community forest schemes will be entered using data from the VDC Planning (ward selection) profile.

c. Landslide sites, etc. will be entered using the landslide distribution map, etc. and past disasters will also be entered using the ward profile.

d. The land use and vegetation, slope and soil will be entered using data from each related thematic map.

e. Public facilities and community forests will be entered using the ward profile.

f. Measured data using the topographical maps will be entered in the case of such infrastructure as roads and footpaths.

③ The Point at Issue

In principle, the number of households with a shortage of firewood, fodder and water, the ratio of households with experience of landslide, soil erosion and flood disasters and the ranking of degree of concern of local people will be assessed in terms of three grades. Only the concern of local people will be

assessed for roads, hygiene and income in three grades while the total score of participation in various groups and the ranking of participation in community forest schemes will be assessed in three grades in the case of the participation of local people. The ranking for each item is as mentioned in table below. The condition of erosion hazard in the Ward will be assessed using the erosion hazard maps of the area.

Item	Ranking of the ratio of households who complained about shortages and damages	Ranking of degree of concern	Ranking of problems: classification of the sum of shortage + concern into 3 levels		
			Low	Medium	High
Fuelwood shortage	1 ~ 6	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12
Fodder shortage	1 ~ 6	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12
Water shortage	1 ~ 6	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12
Food shortage	1 ~ 5	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 11
Landslide	1 ~ 6	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12
Other types of erosion	1 ~ 6	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12
Flooding	1 ~ 6	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12
Road	1 ~ 6	—	1, 2	3, 4	5, 6
Hygiene	1 ~ 6	—	1, 2	3, 4	5, 6
Income	1 ~ 6	—	1, 2	3, 4	5, 6
People's participation	1 ~ 5	1 ~ 6	1 ~ 4	5 ~ 8	9 ~ 12

④ Necessity of Improvement Measures

Among the main items of various proposed programmes for the Integrated Watershed Management Plan, those with high degree of problems described in ③ above will be selected.

⑤ Needs of People

The needs already suggested by people and/or the needs of people listed in the VPP will be entered to contribute to the decision on programme selection and priority.

⑥ Proposed Programmes

The proposed programmes will be elaborated based on the content of the programmes, various reports and thematic maps, etc. as reference materials.

⑦ Programme Priority

Priority of a programme will be decided by taking into consideration its urgency and necessity and after consultations with local people. In this case local people may give priority to their existing immediate problems. However, it will be necessary to add the option of reforestation and forest conservation to the programme even if local people take up their existing immediate problems.

⑧ User's Groups Planned to be Organized

From among the user's groups that are deemed necessary for plan implementation, those the organization of which is necessary will be entered.

⑨ Ward Planning Map

Land use and vegetation maps, will be used as reference material when proposing programmes and their locations. The most desirable way to use WPP will be together with topographical maps and plans prepared beforehand and by conducting indepth discussions in the field in order to decide desirable programmes.

⑩ Special Notes

The question of land ownership and problems among local people will be entered to assist smooth plan implementation.

Table 3-6 Ward Planning Profile Format

Ward Planning Profile (Format)

[Prepared by]

[Date of preparation]

Model Area VDC

Ward No. Settlement

[Proposed Programmes]

1.
2.
3.
4.
5.

[Program Priority Level]

A

B

C

[User Groups Scheduled to Undergo Organization]

1
2
3

[Current Conditions]

Population Male Female

Households Ratio of female householders %

Ratio of occupational castes % Female non-education rate %

Participation in organizations Male % Participation in community forests %

Female % Community forest sites and land area

Per person farmland area (ha)

Distance from the nearest road (h) Toilet establishment %

Past disasters Distribution of erosion type

Land use(ha) Forest Shrub land Grassland

Bari land Khet land Others

Soil Water resources (exist • not exist)

Slope classes (flat to nearly flat • gentle • moderately steep • steep • very steep)

Hazard (High • Medium • Low)

Public facilities

Infrastructure Roads (km) Footpaths (km) Irrigation facility (km)

[Ward Planning Map]

[Problems]

Firewood shortage	(L, M, S)	Flooding	(L, M, S)
Fodder shortage	(L, M, S)	Concern for road construction	(L, M, S)
Water shortage	(L, M, S)	Concern for sanitation	(L, M, S)
Food shortage	(L, M, S)	Concern for insufficient income	(L, M, S)
Landslides	(L, M, S)	People participation	(L, M, S)
Soil erosion	(L, M, S)		

[Necessity of Countermeasures]

Maintenance of land productivity	(H, M, L)
Forest preservation and utilization	(H, M, L)
Control of erosion	(H, M, L)
Improvement of living environment	(H, M, L)
Income generation	(H, M, L)
Promotion of extension and training	(H, M, L)

[People's Needs]

[Items of Special Note]

Note: L; Large, M; Medium, S; Small H; High, M; Medium, L; Low

3-4-4 Case Studies

(1) Target Areas

Case study target areas were selected from the following:

① One VDC from each Model Area
② One Ward in each selected VDC

Consideration was given to the following conditions when selecting the target areas:

a. VPP and Ward rankings
b. Hazards
c. Landslides and other erosion
d. Local characteristics

(2) Case Studies in Each Model Area

Conditions in the Wards selected based on the above conditions are outlined in the following table.

Model Area	VDC/ Ward No.	Popul-ation	VPP Ranking	Ward Ranking	Hazards	Erosion Type	Characteristics
Kaski North	Arba Vijaya / 2	392	7	5	High ○ Medium ○ Low ○	Landslides : 2 Gullies : 2 Stream bank erosion : 1	Close to Pokhara Large gully erosion There is a JICA M/P team site office
Kaski East	Siddha / 7	747	2	1	High ○ Medium ○ Low ○	Landslides : 2 Stream bank erosion : 1	North slopes are forest, south slopes are cultivated land Water is scarce
Kaski West	Pumudi Bhumudi / 5	1,085	2	4	High ○ Medium ○ Low ○	Landslides : 7 Stream bank erosion : 1	Traversed by Sidhartha Highway Entry to community forests is 100%
Parbat North	Kutuwa Chaupari / 9	165	14	1	High Medium Low ○	Stream bank erosion : 1	Close to Kusma but access is poor Stream bank erosion can be seen
Parbat South	Tribeni / 7	280	7	1	High ○ Medium ○ Low ○	Landslides : 2	JICA M/P team site office, school and VDC office are located downstream Entry to community forests is 0%

(Note) Enter a circle next to the applicable rank for each hazard.

The results of the case studies in each Model Area using the WPP are shown in Tables 3-7 (1) ~ (5).

Table 3-7 (1) Ward Planning Profile – Case Study (Kaski North)

Ward Planning Profile (Case Study 1)

[Prepared by]

[Date of preparation]

Model Area: Kaski North — VDC: Arba Vijaya

Ward No.2 — Settlement: Jimira Yoil, Saja Latabari

[Current Conditions]

Population	392		Male 206	Female	186
Households	80		Ratio of female householders		5%
Ratio of occupational castes	0%		Female non-education rate		48%
Participation in organizations	Male	8%	Participation in community forests		6%
	Female	5%	Community forests: 2 sites (10 ha)		
Per person farmland area (ha)	0.09~0.12				
Distance from the nearest road (h)	0.5		Toilet establishment		40~60%
Past disasters	Landslide (1994)		Distribution of erosion type: 2 small landslides 2 gullies, stream bank erosion 1 km		

Land use	Forest	82.2	Shrub land	0	Grassland	21.1
(113.9ha)	Bari land	6.1	Khet land	2.9	Others	1.7

Soil: Ach, Rgd, Fle/c/d, LPd, CMd

Water resources (exist • not exist)

Slope classes (flat to nearly flat • gentle • moderately steep • steep • very steep)

Hazard (High • Medium • Low)

Public facilities: VDC office

Infrastructure: Roads 4.6km — Footpaths 0.5km — Irrigation facility 9.0km

[Problems]

Firewood shortage	(L, M, S)	Flooding	(L, M, S)
Fodder shortage	(L, M, S)	Concern for road construction	(L, M, S)
Water shortage	(L, M, S)	Concern for sanitation	(L, M, S)
Food shortage	(L, M, S)	Concern for insufficient income	(L, M, S)
Landslides	(L, M, S)	People participation	(L, M, S)
Soil erosion	(L, M, S)		

[Necessity of Countermeasures]

Maintenance of land productivity	(H, M, L)
Forest preservation and utilization	(H, M, L)
Control of erosion	(H, M, L)
Improvement of living environment	(H, M, L)
Income generation	(H, M, L)
Promotion of extension and training	(H, M, L)

[Proposed Programmes]

1. Living environment improvement programme
   Improvement of roads
2. Income generation programme
   Introduction of cash crops into forests
3. Erosion control programme
   Gully erosion control
   Stream bank erosion control
4. Forest improvement programme
   Forest management to boost production of firewood
5. Grassland improvement programme

There is currently no problem regarding fodder trees, but the introduction of silvopasture is needed to prevent sediment runoff to downstream areas

[Program Priority Level]

A

B

C

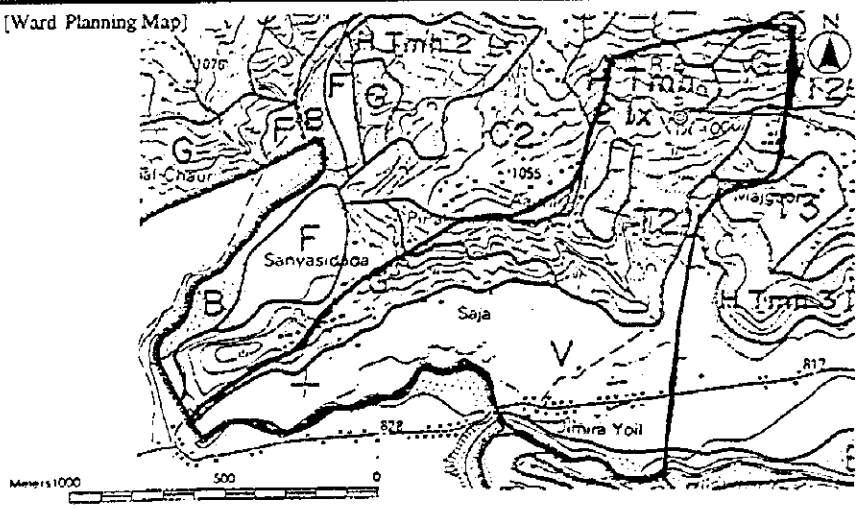
[User Groups Scheduled to Undergo Organization]

1

2

3

[Ward Planning Map]



[People's Needs]

Reduction of time needed to obtain firewood and fodder trees and reduced haulage of compost

[Items of Special Note]

Immediate countermeasures are required to counter gully erosion in the lower reaches of Kahu Khola. It is desirable to use this area as a project demonstration plot. Before introducing an income generation programme, it is necessary to carry out a market survey and take measures that are accepted by people. JICA has already supervised the construction of footpaths by user groups in some areas.

Table 3-7 (2) Ward Planning Profile – Case Study (Kaski East)

Ward Planning Profile (Case Study 2)

[Prepared by]

[Date of preparation]

Model Area Kaski East VDC Siddha

Ward No.7 Settlement Bage Danda, Khalte, Shayal Danda

[Current Conditions]

Population 747 Male 380 Female 367

Households 133 Ratio of female householders 24%

Ratio of occupational castes 10% Female non-education rate 62%

Participation in organizations Male 2% Participation in community forests 2%

Female 1% Community forests: 1 site (25 ha)

Per person farmland area (ha) 0.06–0.09

Distance from the nearest road (h) 5.0 Toilet establishment 20–40%

Past disasters Landslides (1986) Distribution of erosion type: 2 small landslides, stream bank erosion 1 km

Land use	Forest	152.2	Shrub land	0	Grassland	0
(305.9ha)	Bari land	99	Khet land	26.6	Others	28.1

Soil: Cmd, Rgd, Fle/c/d, Ach Water resources (exist • not exist)

Slope classes (flat to nearly flat • gentle • moderately steep • steep • very steep)

Hazard (High • Medium • Low)

Public facilities VDC office

Infrastructure Roads 0.1km Footpaths 11.4km Irrigation facility 0.0km

[Problems]

Firewood shortage	(L, M, S)	Flooding	(L, M, S)
Fodder shortage	(L, M, S)	Concern for road construction	(L, M, S)
Water shortage	(L, M, S)	Concern for sanitation	(L, M, S)
Food shortage	(L, M, S)	Concern for insufficient income	(L, M, S)
Landslides	(L, M, S)	People participation	(L, M, S)
Soil erosion	(L, M, S)		

[Necessity of Countermeasures]

Maintenance of land productivity	(H, M, L)
Forest preservation and utilization	(H, M, L)
Control of erosion	(H, M, L)
Improvement of living environment	(H, M, L)
Income generation	(H, M, L)
Promotion of extension and training	(H, M, L)

[People's Needs]

Reduction of water drawing, threshing and shopping

[Proposed Programmes]

1. Income generation programme
   Rearing of goats and introduction of cash crops
2. Living environment improvement programme
   Repair of footpaths and securing of water supply
3. Extension and training programme
   Implementation of literacy education
4. Forest improvement programme
   Raising of the water resource conservation functions of forests
5. Farmland improvement programme
   Improvement of land productivity through introduction of agroforestry, in particular, planting of Leguminous trees

[Program Priority Level]

A

B

C

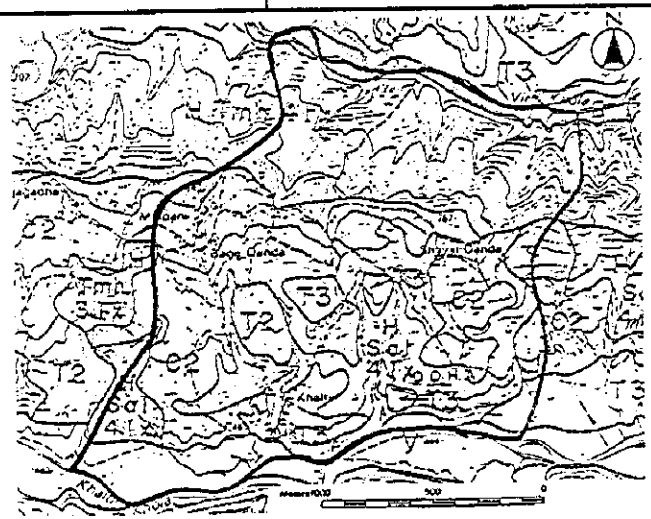
[User Groups Scheduled to Undergo Organization]

1

2

3

[Ward Planning Map]



[Items of Special Note]

There is a high degree of interest in roads, however, it is necessary to confirm the opinions of residents and the wishes of VDC and DDC concerning road construction routes and methods. Since this whole Model Area suffers from water shortages, it is necessary to install pipes, etc. to secure water supply.

Table 3-7 (3) Ward Planning Profile – Case Study (Kaski West)

Ward Planning Profile (Case Study 3)

[Prepared by]

[Date of preparation]

Model Area: Kaski West | VDC: Pumdi Bhumdi

Ward No.5 | Settlement: Simle, Kanlepani, Khalse

[Current Conditions]

Population	1,085	Male 555 Female 530	
Households	218	Ratio of female householders	12%
Ratio of occupational castes	12%	Female non-education rate	55%
Participation in organizations	Male 39%	Participation in community forests	100%
	Female 24%	Community forests: 2 sites (176 ha)	
Per person farmland area (ha)	0.06–0.09		
Distance from the nearest road (h)	0.5	Toilet establishment	20–40%
Past disasters	Flooding and landslides (1989)	Distribution of erosion type: 1 large and 6 small landslides, stream bank erosion 1.6 km	

Land use	Forest	219.4	Shrub land	1.9	Grassland	29.5
(450.6ha)	Bari land	122.1	Khet land	66.1	Others	11.6

Soil: Rgd, Cmd, LPd, Cmu, Flc/c/d, S

Water resources (exist • not exist)

Slope classes (flat to nearly flat • gentle • moderately steep • steep • very steep)

Hazard (High • Medium • Low)

Public facilities: VDC office, school, temple

Infrastructure: Roads 3.0km | Footpaths 10.3km | Irrigation facility 0.0km

[Problems]

Firewood shortage	(L, M, S)	Flooding	(L, M, S)
Fodder shortage	(L, M, S)	Concern for road construction	(L, M, S)
Water shortage	(L, M, S)	Concern for sanitation	(L, M, S)
Food shortage	(L, M, S)	Concern for insufficient income	(L, M, S)
Landslides	(L, M, S)	People participation	(L, M, S)
Soil erosion	(L, M, S)		

[Necessity of Countermeasures]

Maintenance of land productivity	(H, M, L)
Forest preservation and utilization	(H, M, L)
Control of erosion	(H, M, L)
Improvement of living environment	(H, M, L)
Income generation	(H, M, L)
Promotion of extension and training	(H, M, L)

[Proposed Programmes]

1. Living environment improvement programme
   Improvement of roads (provision of drainage facilities,etc.)
2. Income generation programme
   Introduction of cash crops (potential for introduction of vegetables, etc. is high in view of proximity to Pokhara)
3. Farmland improvement programme 2
   Maintenance of land productivity through introduction of agroforestry and reduction of time needed to obtain firewood and fodder
4. Grassland improvement programme 3
   Planting of Alnus nepalensis trees to encourage afforestation and regulation of grazing

[Program Priority Level]

A

B

C

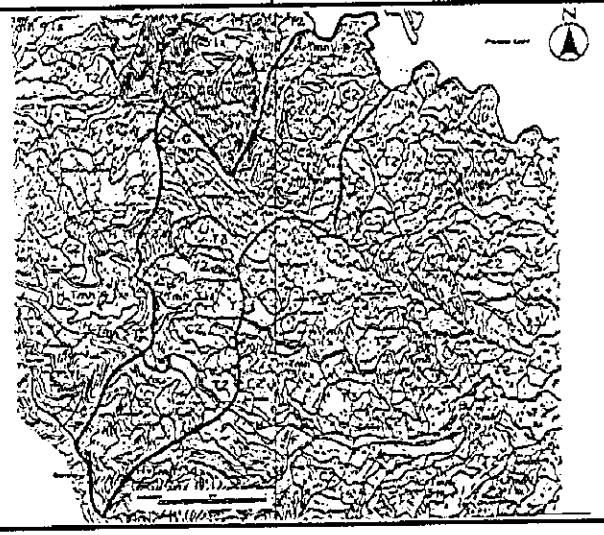
[User Groups Scheduled to Undergo Organization]

1

2

3

[Ward Planning Map]



[People's Needs]

Reduction of firewood and fodder taking and reduced haulage of compost

[Items of Special Note]

The rate of entry to community forests is high. There are two sites of water resources (permanent springs). Hazards in grassland, where the VDC office is located, are high and ample measures for afforestation, etc. are required.

Table 3-7 (4) Ward Planning Profile – Case Study (Parbat North)

Ward Planning Profile (Case Study 4)

[Prepared by]

[Date of preparation]

Model Area Parbat North VDC Katuwa Chaupari

Ward No.9 Settlement Kalimati, Malami danda

[Current Conditions]

Population	165		Male 80	Female 85	
Households	45		Ratio of female householders		42%
Ratio of occupational castes	16%		Female non-education rate		66%
Participation in organizations	Male	12%	Participation in community forests		33%
	Female	2%	Community forests: 2 sites (10 ha)		
Per person farmland area (ha)	<0.03				
Distance from the nearest road (h)	1		Toilet establishment		0%
Past disasters	Landslides (1994)		Distribution of erosion type: Stream bank erosion 0.5 km		

Land use	Forest	18.8	Shrub land	1.1	Grassland	0
(51.4ha)	Bari land	28.1	Khet land	3.4	Others	0

Soil: Ach, Rgd, Flc/c/d, LPd

Water resources (exist • not exist)

Slope classes (flat to nearly flat • gentle • moderately steep • steep • very steep)

Hazard (High • Medium • Low)

Public facilities

Infrastructure Roads 0.0km Footpaths 0.65km Irrigation facility 0.27km

[Problems]

Firewood shortage	(L, M, S)	Flooding	(L, M, S)		
Fodder shortage	(L, M, S)	Concern for road construction	(L, M, S)		
Water shortage	(L, M, S)	Concern for sanitation	(L, M, S)		
Food shortage	(L, M, S)	Concern for insufficient income	(L, M, S)		
Landslides	(L, M, S)	People participation	(L, M, S)		
Soil erosion	(L, M, S)				

[Necessity of Countermeasures]

Maintenance of land productivity	(H, M, L)
Forest preservation and utilization	(H, M, L)
Control of erosion	(H, M, L)
Improvement of living environment	(H, M, L)
Income generation	(H, M, L)
Promotion of extension and training	(H, M, L)

[Proposed Programmes]

1. Income generation programme
   Introduction of cash crops to raise incomes
2. Living environment improvement programme
   Promotion of toilet establishment. Introduction of improved furnaces to alleviate firewood shortage.
3. Erosion control programme
   Bank protection works to control stream bank erosion
4. Forest improvement programme
   Forest improvement to boost production of firewood
5. Farmland improvement programme
   Improvement of terraces and planting methods to mitigate food shortages

[Program Priority Level]

A

B

C

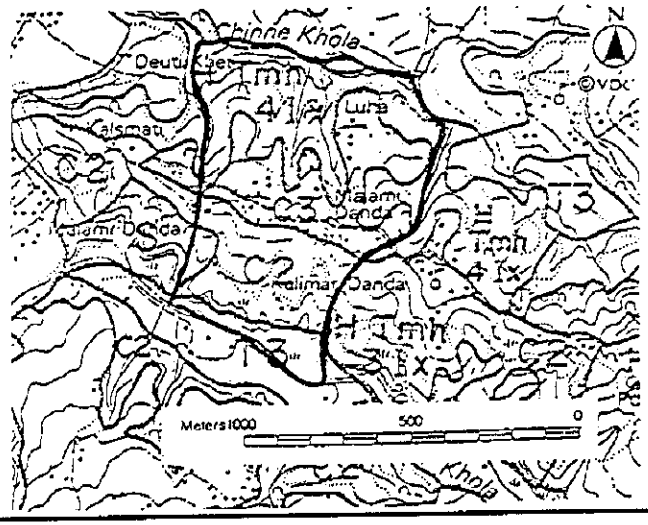
[User Groups Scheduled to Undergo Organization]

1

2

3

[Ward Planning Map]



[People's Needs]

Cash income, sanitation and the introduction of irrigation are hoped for.

[Items of Special Note]

The handover of community forests should be encouraged to deal with the shortage of firewood.
When installing toilets, full consideration shall be given to the impact on downstream areas.

Table 3-7 (5) Ward Planning Profile – Case Study (Parbat South)

Ward Planning Profile (Case Study 5)

[Prepared by]

[Date of preparation]

Model Area Parbat South VDC Tribemi

Ward No.7 Settlement Upplio Chida Kharka, Upplo Ghusung

[Current Conditions]

Population	280		Male 130	Female 150	
Households	40		Ratio of female householders		28%
Ratio of occupational castes	10%		Female non-education rate		68%
Participation in organizations	Male 3%		Participation in community forests		0%
	Female 0%		Community forests: 0 sites (0 ha)		
Per person farmland area (ha)	0.03~0.06				
Distance from the nearest road (h)	5.5		Toilet establishment		20~40%
Past disasters	Flooding and stream bank erosion		Distribution of erosion type: 2 small landslides		
Land use	Forest 16.4		Shrub land 0	Grassland	6.8
(78.6ha)	Bari land 55.4		Khet land 0	Others	0

Soil: Rgd, Cmu, Lpd, Ach

Water resources (exist • not exist)

Slope classes (flat to nearly flat • gentle • moderately steep • steep • very steep)

Hazard (High • Medium • Low)

Public facilities

Infrastructure Roads 0.0km Footpaths 3.5km Irrigation facility 0.0km

[Problems]

Firewood shortage	(L, M, S)	Flooding	(L, M, S)
Fodder shortage	(L, M, S)	Concern for road construction	(L, M, S)
Water shortage	(L, M, S)	Concern for sanitation	(L, M, S)
Food shortage	(L, M, S)	Concern for insufficient income	(L, M, S)
Landslides	(L, M, S)	People participation	(L, M, S)
Soil erosion	(L, M, S)		

[Necessity of Countermeasures]

Maintenance of land productivity	(H, M, L)
Forest preservation and utilization	(H, M, L)
Control of erosion	(H, M, L)
Improvement of living environment	(H, M, L)
Income generation	(H, M, L)
Promotion of extension and training	(H, M, L)

[Proposed Programmes]

1. Living environment improvement programme
   Installation of rice polishing facilities
2. Income generation programme
   Raising of goats and introduction of cash crops into forests
3. Extension and training programme
   Study tours and literacy education
4. Farmland improvement programme
   Introduction of agroforestry
5. Grassland improvement programme
   Introduction of silvopasture

[Program Priority Level]

A

B

C

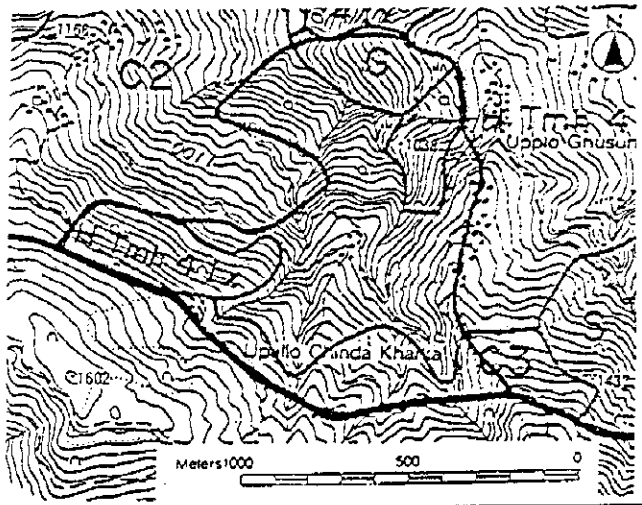
[User Groups Scheduled to Undergo Organization]

1

2

3

[Ward Planning Map]



[People's Needs]

Reduction of firewood and fodder taking and threshing

[Items of Special Note]

Check dams have been constructed by JICA Project and user's groups at Boke Khola, and the empowerment of residents is required to ensure dam maintenance. Grassland is largely located on steep slopes and is used as grassland by the residents. There is a high degree of interest in roads, however, access routes are undecided and it would be more realistic to improve footpaths. The degree of urgency regarding firewood shortages is medium, but it is necessary to improve income from forest resources by encouraging handover to community forests and improving the forests themselves.