

### 5.4.3.2 GENERAL STATUS OF THREATENED SPECIES

Threatened species are those considered as threatened globally or at least regionally, and for which conservation measures are internationally recommended.

#### Terrestrial Vertebrates

The species occurring in the Nam Ngiep catchment considered to merit conservation concern, according to Salter (1993) and The Wildlife Conservation Society (WCS) (1995), are:

#### Asiatic Black Bear and Malayan Sun Bear

These species have "Immediate" action priority (Salter 1993). According to IUCN this would be:

- protection from hunting
- control of sales of (live) bears and bear parts

WCS(1995) makes no recommendation in respect of bear conservation.

In the consultants view these measures are not at present practical. There are virtually no enforcement personnel, no funds to pay them, and no popular support for such action. Bears will survive in Lao only if a suitable forest/woodland is reserved, properly protected and managed for this purpose.

#### Asiatic Elephant

This species has "Immediate" action priority (Salter 1993). According to IUCN this would be:

- studies
- habitat management, hunting and access control
- control of trade in trophies and other parts
- appropriate design of any development projects close to elephant habitats, to minimise the chances of elephant damage

Some of these measures may eventually be effective, but will require considerable resources. Non-specialists frequently over-estimate the migratory requirements of elephant. It is possible, provided there is management of the balance between elephant numbers and the food supply, and if mineral licks are available, or are provided, to manage wild elephant populations in fairly small areas (say 100 sq.km). A case in point is provided by the Tree Tops Salient elephant population in the Aberdares National Park, Kenya.

We have recommended a study be made with a view to determining if the Nam Ngiep catchment would be suitable for the creation of a reserve dedicated to the sustainable management of viable populations of elephant.

The presence of an elephant population in the area of the dam site will stimulate the interest of wildlife NGO's in the project. It will be necessary to develop a mitigation plan which effectively improves the chances for the survival of wild elephant populations in Lao PDR, if the project is not to experience difficulties as a result of international reaction to project induced impacts on this population.

#### Gaur and Wild Buffalo

None of these were seen, although some Gaur tracks were identified and four villages reported the presence of Gaur in the catchment. Gaur has "Immediate" action priority (Salter

1993) and Wild Water Buffalo has "Urgent" action priority. According to IUCN this would be:

- studies
- habitat management, hunting and access control
- control of trade in trophies and other parts

We have recommended a study be made with a view to determining if the Nam Ngiep catchment would be suitable for the creation of a reserve dedicated to the sustainable management of viable populations of elephant, gaur and wild buffalo.

#### **Otters**

None of these were seen, nor any traces of them, in the catchment. Although one village reported the presence of Common Otters. All species have "Immediate" action priority (Salter 1993). According to IUCN this would be:

- studies
- habitat management
- control of pollution of wetlands

WCS(1995) makes no recommendation in respect of otter conservation.

#### **Asian Wild Dog and Asiatic Jackal .**

None of these were seen, nor any traces of them, in the catchment. Although three villages reported one or the others presence. It is classified by IUCN as having "Immediate" action priority (Salter 1993). Recommendations made for its conservation are:

- status surveys
- total protection from hunting
- compensation for farmers losing livestock

In the consultants opinion these proposed measures are not working, and could not work at the present time.

#### **Hog Deer**

None of these were seen, nor any traces of them, in the catchment. Although five villages reported the presence of Hog Deer. It is classified by IUCN as having "Urgent" action priority (Salter 1993). Recommendations made for its conservation are

- status surveys
- habitats identified in status surveys should be protected

In the consultants opinion these proposed measures are not working, and could not work at the present time.

#### **Tiger**

It is classified by IUCN as having "Immediate" action priority (Salter 1993). Recommendations made for its conservation are:

- habitat management, hunting and access control
- control of trade in trophies and other parts
- compensation for livestock predation

In the consultants opinion these proposed measures are not working, and could not work at the present time.

The apparently healthy tiger population in the reservoir area will, as for elephant, provoke considerable interest in the project among wildlife and conservation NGO's. It will be necessary to develop a mitigation plan which effectively improves the chances for the

survival of wild tiger populations in Lao PDR if the project is not to experience difficulties as a result international reaction to the impacts on this population.

#### **Others**

The Slow Loris, Phayre's Langur, Assamese Macaque, Rhesus Macaque, Stump-Tailed Macaque, Malayan Pangolins, Red Giant Flying Squirrel, Lesser Giant Flying Squirrel, Variable Squirrel, Grey-Bellied Squirrel, Fishing Cat, Leopard Cat, Marbled Cat, Asian Golden Cat, Yellow Tree Monitor, Water Monitor, Siamese Fireback, are all categorised as of short to medium term action priority by Salter (Ibid)

#### **5.4.3.3 Potential impacts on wildlife**

##### **Logging and clearing**

##### **Biomass Clearance and Logging**

The inundation zone surveyed to date is severely degraded in terms of habitat and species diversity. Most of the impact of a logging operation will come from the labour camps and ancillary services which develop to support a labour force in the area. It will be necessary to control logging labour in respect of hunting excursions, starting fires and cutting trees outside the inundation zone. The consultants conclude that there need to be no significant adverse environmental impacts from the biomass clearance and logging of the inundation zone provided there is responsible management of the whole operation. The most important impact will be the potentially adverse reaction of the international donor community to badly managed or unregulated logging outside the reservoir boundary.

##### **Inundation**

The inundation event will have a number of complex impacts on the terrestrial fauna, which will react in a number of ways, namely:

##### **Out-migrations**

It is not yet certain what level of activity will occur in the inundation impact zone prior to flooding. If there is timber removal and/or biomass clearance this could disturb many of the large animals and cause them to move out of the area. Even if these activities do not occur most large animals, and highly mobile small animals, will successfully leave the IIZ as the water rises. Water will advance over the land at an average horizontal advance of a few tens of metres per hour. There will of course be local exceptions as small land basins become rapidly filled. It must also be appreciated that the inundation event runs steadily through the 24 hour period, offering strictly nocturnal and strictly diurnal animals special problems. Flooding is however a natural phenomenon and most large and small mobile animals are well adapted to avoid being drowned.

This problem is in any event not ecologically speaking very significant. "Displaced" animals may escape drowning, but are usually so disadvantaged by displacement that they suffer accelerated mortality from other causes. Even those animals which successfully establish themselves after displacement will temporarily at least, until population pressures decline through natural regulation processes, be subject with all other members of the species and its competitors, to higher rates of mortality.

##### **Animal drowning**

### **Contribution to biomass degradation processes**

Most of the animals which drown will be small flightless terrestrial animals, immature and injured animals incapable of moving, and soil fauna. Even at 5 tons per ha., a high biomass density for these animal, the bodies of animals drowning will make only a minor contribution to the total biomass decomposition pool. This is unlikely to have any significant effect on future water quality.

### **Floating carcasses**

Very few floating carcasses are to be anticipated. Any which are found during the more rapid filling period will be towed to a landing place and dragged ashore to undergo decomposition on land.

### **Suffering and distress**

Some slower moving faunal components of the reservoir ecosystem will be drowned when the inundation occurs, and in any case most of those displaced by flooding will not successfully establish new home ranges. Although the long term ecological affects of this will be inconsequential it is necessary to consider the prevailing attitudes of the developed world in respect of animals living in distant locations, perceived as "natural and unspoiled". It is suggested that some measures, limited to the actual periods of rapid inundation, should be taken to provide safe retreats for, and to collect the slow moving flood survivors. This will be achieved using tethered floating rafts (felled low-density timber trees of no commercial value lashed together and distributed as capture sampling points), and "flood survival" trees (i.e. one or a small clump of, tall but timber defective tree(s) every 1000 m<sup>2</sup> to be left standing after timber felling), which will be patrolled daily by a fast speedboat to capture stranded animals. Captured specimens will be identified. Some will be kept alive for scientific study and breeding, a few will be preserved as scientific specimens and most will be released. The data such an exercise will produce will give a unique picture of the slow moving and burrowing fauna (invertebrates, reptiles, small mammals) which persist in an area even after timber felling and destruction of above ground biomass.

### **Island refuges, overpopulation and animal rescue**

The more rapidly moving fauna will by and large have left the inundation area during logging and biomass destruction (if these measures are taken). Those which remain in the area or which return could become trapped on the numerous temporary and permanent islands which may form as inundation proceeds. Regular boat patrols should be made during rapid filling to capture these stranded specimens which will be processed in the same way as the slow-moving species.

Animals which become trapped on islands will be difficult to capture, and unless some exceptional species are involved the efficient solution to the problem is to allow the population of islands to stabilise to levels which can be sustained by the food supply, or, for large animals on small islands, to allow the animal to swim to the mainland.

### **Vector/pathogen/pest habitats**

The ecological instability generated by the flooding of 156 sq. km. and the consequent movement of large numbers of animals can have an impact on public health and on crop pests. If large numbers of rodents and carnivora are displaced there are possibilities that the human health environment will be temporarily disturbed. For similar reasons crops pests could become a more serious problem for a short period on fields close to the reservoir. This situation will require monitoring during, and immediately after, reservoir filling.

#### **5.4.3.4 RECOMMENDATIONS**

##### **Mitigation Of Short Term Impacts On Terrestrial Vertebrates**

The possible recommended mitigations have already been touched upon in Section 3.3 above. They are re-stated systematically below:

##### **Logging**

- Logging tracks, camps and sorting yards to be located on reservoir floor (if pre-inundation logging strategy adopted)
- Logging to be carried out during inundation (the preferred strategy)
- Logging labour to be strictly controlled in respect of hunting, setting fires, felling trees
- Logging to be highly accountable to the concerned NGO's, demonstrating no timber is 'being' extracted beyond the reservoir boundaries.

The cost of controlling and supervising reservoir logging would be about \$200,000.

##### **Clearance of Vegetation Biomass**

- Labour control (as described for logging above).
- The need to prevent the in situ fires spreading outside the inundation zone, which will require a substantial fire break. Fires in the dry season have the potential in dry years of causing extensive damage to vegetation, with negative consequences for terrestrial vertebrates.

The cost of vegetation biomass clearance would be about \$6 million.

##### **Inundation Event**

- Out-migration from inundation zone to be encouraged prior to filling by permitting hunting and allowing other uses of the area such as labour camps, quarrying etc.
- Rescue of stranded & trapped animals from artificial refuges and natural temporary islands using frequent fast boat patrols during periods of rapid filling
- The establishment of a scientific programme to document and manage the results and products of the rescue programme
- Removal to a suitable disposal site of floating carcasses
- Monitoring and intervention as necessary for public health & crop pest consequences of the reservoir's creation

The cost of managing the filling event over the filling period and the first year's operations would be about \$250,000.

##### **Mitigation Of Long Term Impacts On Terrestrial Vertebrates**

##### **Alternative River Basin Conservation**

The creation of the reservoir will result in a large number of people being resettled in the general vicinity of the reservoir and the project will also result in a significant increase of immigration into the area. The inevitable development pressures that follow will result in severe degradation of the vegetation and wildlife. For these reasons it is probably impractical to try and conserve the vast majority of the habitats in the vicinity of the reservoir. The strategy recommended here is to first identify a similarly rich river basin approximately 2000 sq. km in size and a reasonable distance from the reservoir. Once identified an environmental management plan should be prepared for the new area in coordination with the relevant government ministries. The approximate cost to identify a suitable area and prepare an environmental management plan would be in the region of \$100,000.

The environmental management plan would outline effective control measures which would have to be put in place to prevent it being just another line on the map. These would include highly motivated and well paid park rangers, checkpoints, access roads, fencing, firebreaks, and a tourism development plan and a villager participation programme. The villager participation programme would mitigate for the loss of use of the forest (hunting and collection of forest products) and demonstrate the benefits of maintaining the reserve (for example wage earning jobs in the park and tourist industries) The annual budget to protect such an area would be in the region of \$100,000 per annum.

If this approach is effective, the negative impact of damaging a rich faunal community, which it has to be said is already under intense hunting pressure, would be more than balanced by the substantial positive impact of the new reserve.

#### **Elephant, Gaur and Wild Buffalo**

The elephant population already present in LS2 and LS1 will come under intense pressure during construction of the project. After the reservoir is created, the large numbers of people that need to be resettled in the vicinity of the reservoir will sustain or even increase this pressure. It is however difficult to translocate elephant and there are only limited areas of the complex habitat that they require left in the Lao PDR. One possibility which should be investigated is to move the elephant, using a number of domesticated elephant to the eastern parts of the Phou Khao Khouay NBCA. If this measure is to be adopted there would need to be a strengthening of the management capability of the Phou Khao Khouay NBCA personnel.

However, a less risky solution would be to create a reserve for elephant (gaur and wild buffalo) on the reservoir, including substantial parts of the existing elephant range. It is therefore recommended that a study is made after the reservoir has filled and stabilised biologically, of the desirability and feasibility of creating and managing a strictly protected reserve for Elephant, Gaur and/or Wild Buffalo on the reservoir draw-down zone and its catchment or a selected part of this catchment (For example LS2). The scope of the reserve could be expanded to include other species which are ecologically adapted for the habitats and management systems such as Gaur and Wild Buffalo. Particular attention will need to be paid to the draw-down zone, and to the problem of developing swamp grasslands on suitable parts of it. The management of the populations established in the reserve will initially be intensive, and it is possible that all species will have to be kept semi-tame. Such a project will have to be very effectively managed to have any chance of success. The approximate cost of the study would be \$50,000

#### **5.5 GENERAL CAUTION**

**It must be recognised that environmental and social situations are highly dynamic. Before any of the recommended mitigation measures are actually undertaken it will be necessary to up-date the environmental and social assessments. In general social and environmental impact assessments should be considered to be valid for no more than 5 years.**

## **REFERENCES**

**Salter, R.E. 1993 Wildlife in Lao PDR. A Status Report. IUCN. Vientiane, Lao PDR**

**Wildlife Conservation Society 1995 Preliminary Wildlife and Habitat Survey of the Phou Khao Khouay National Biodiversity Conservation Area Lao PDR. The Wildlife Conservation Society, Bronx, USA.**



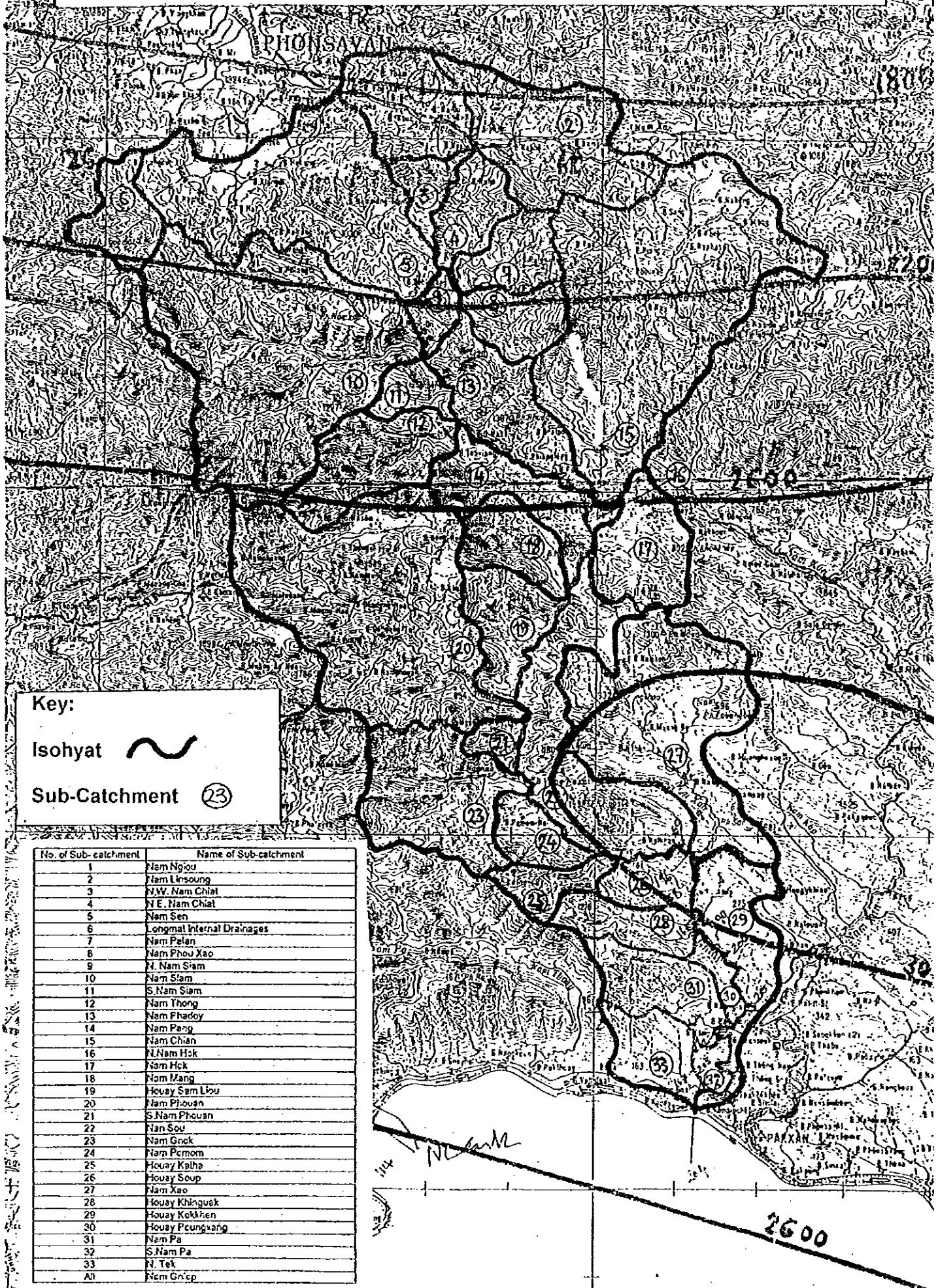
**ANNEX 1**

**FIGURES**



FIGURE 2

SUB-CATCHMENTS OF THE NAM NGIEP RIVER



Key:

Isohyat 

Sub-Catchment 

No. of Sub-catchment	Name of Sub-catchment
1	Nam Ngieu
2	Nam Linsoung
3	N.W. Nam Chiat
4	N.E. Nam Chiat
5	Nam Sen
6	Longmat Internal Drainages
7	Nam Pelan
8	Nam Phou Xao
9	N. Nam Siam
10	Nam Siam
11	S.Nam Siam
12	Nam Thong
13	Nam Phadoy
14	Nam Pang
15	Nam Chian
16	N.Nam Hok
17	Nam Hck
18	Nam Mang
19	Houay Sam Liou
20	Nam Phouan
21	S.Nam Phouan
22	Nam Sou
23	Nam Grock
24	Nam Pcom
25	Houay Kalha
26	Houay Soup
27	Nam Xao
28	Houay Khingusk
29	Houay Kokkhen
30	Houay Pcungxang
31	Nam Pa
32	S.Nam Pa
33	N. Tek
Alt	Nam G'ncp

FIGURE 2

SUB-CATCHMENTS OF THE NAM NGIEP RIVER

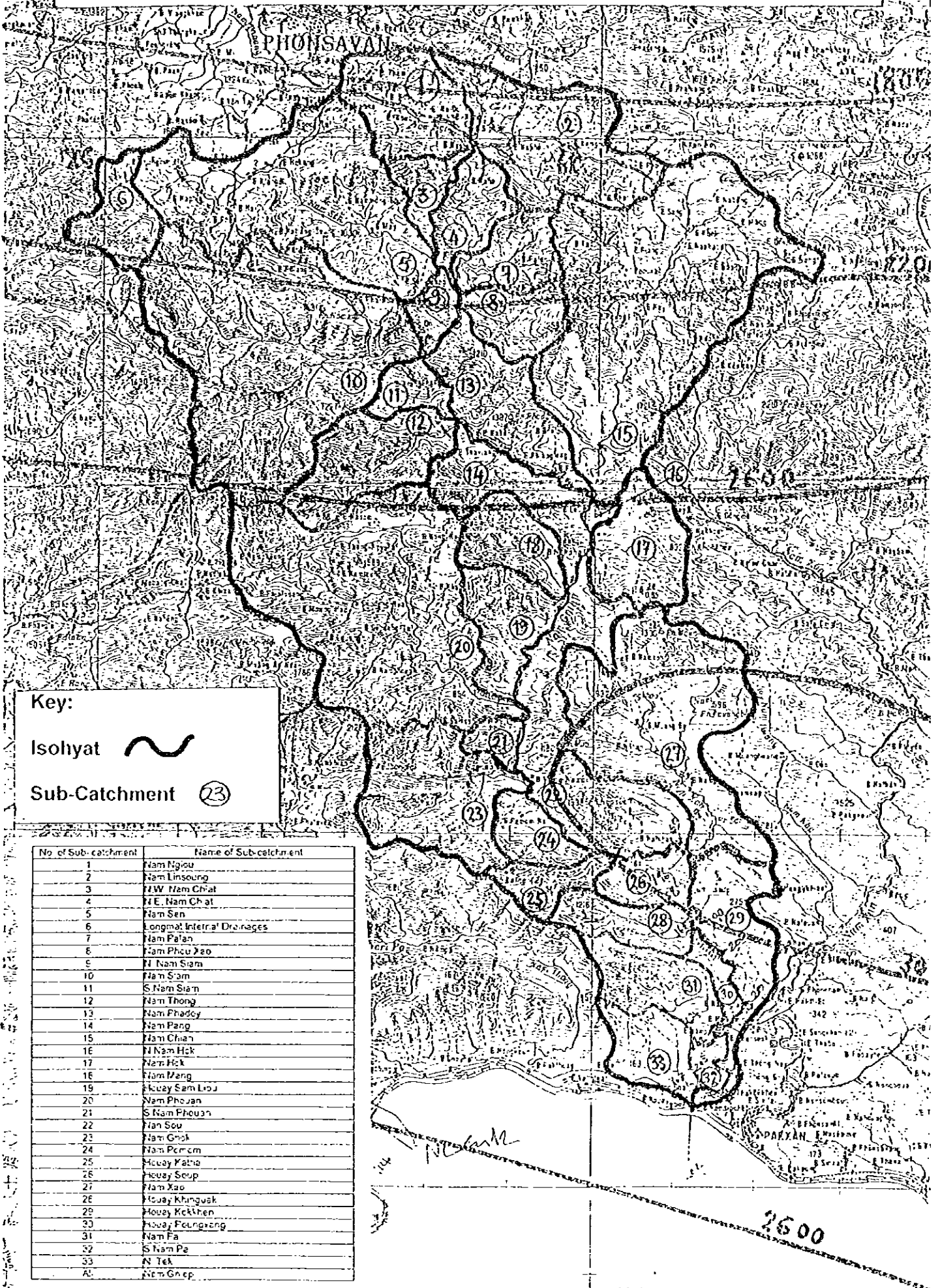


FIGURE 3

LAND SYSTEMS OF THE NAM NGIEP CATCHMENT

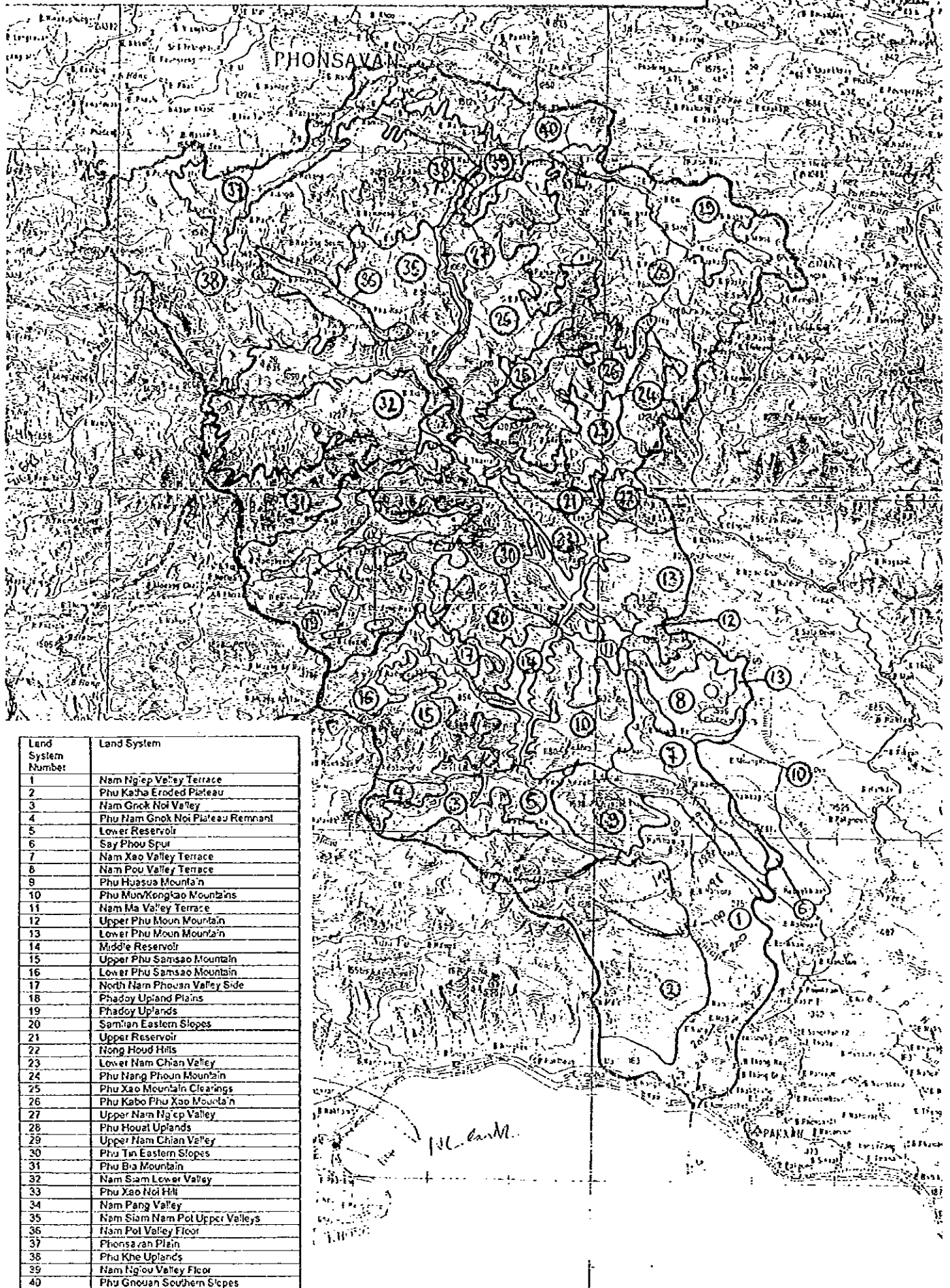


FIGURE 4

AREAS OF SPECIAL INTEREST AND POSSIBLE  
MIGRATION ROUTES

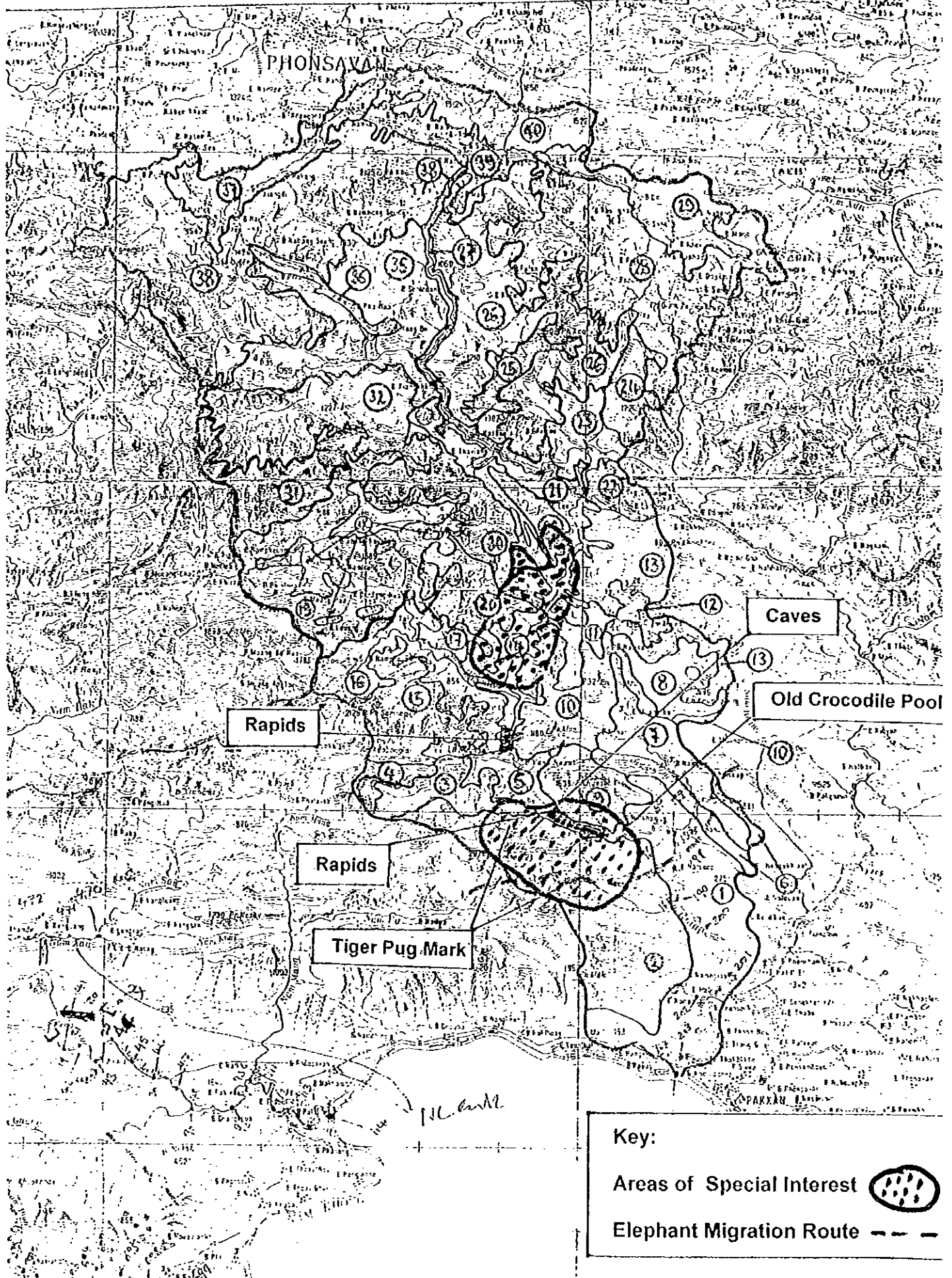
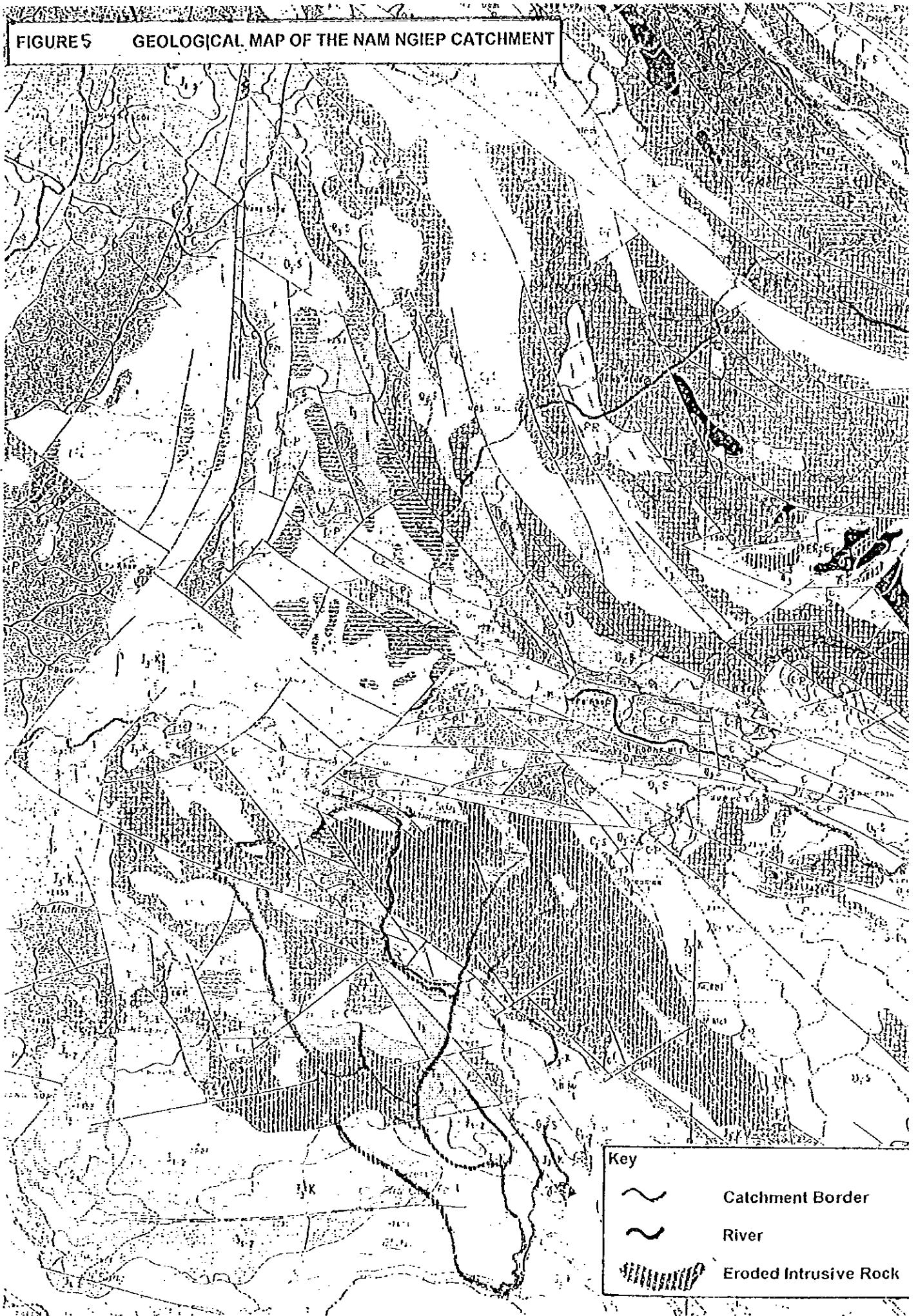


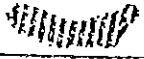


FIGURE 5

GEOLOGICAL MAP OF THE NAM NGIEP CATCHMENT



Key

-  Catchment Border
-  River
-  Eroded Intrusive Rock

**ANNEX**

**PLATES**







Plate 1

Banks of the Nam Ngiep upstream of Ban Houaypamon (LS14). Note the degraded state of the woodland.



Plate 2

West bank of the Nam Ngiep upstream of Ban Houaypamon (LS14). Note the dominant *Cephaelis* spp. covering the rocky island.



Plate 3

Banks of the Nam Ngiep upstream of Ban Houaypamon. A small section of rapids navigable with care (LS21)



Plate 4

Banks of the Nam Ngiep upstream of Ban Houaypamon. At this point the river runs through a very steep sided valley (LS21)



Plate 5 (Above)

Banks of the Nam Ngiep upstream of Ban Sopyouk. (LS5). The rapids between Ban Soppoun and Ban Sopyouk end at this point.



Plate 7 (Right)

Banks of the Nam Ngiep rapids downstream of Ban Sopyouk (LS5).



Plate 6

Banks of the Nam Ngiep downstream of Ban Sopyouk. This point marks the beginning of the impassable rapids below Ban Sopyouk. The gradient is high and the river flow is fast (LS5).



Plate 8

Banks of the Nam Ngiep at the proposed dam site (LS5).



Plate 10 (Above)

Banks of a small tributary of the Nam Ngiep. Local villager cast net fishing in a deep pool. Over 5 kilos of *Poropuntius desauratus* were caught in 5 minutes after they were spotted moving from the main river up the tributary. Note the aroids and ferns lining the banks (LS14)



Plate 12 (Right)

Large pools carved into limestone in the upper Houay Soup (tributary of the Nam Ngiep) (LS2)



Plate 9 (Above)

Banks of the Nam Ngiep downstream of the proposed dam site. The river widens dramatically and is said to be very deep (over 30m). Local guides indicated that this used to be a habitat for Crocodile up to 20 years ago (LS1)



Plate 11 (Right)

Area of limestone rock pavement displaying microsteps and water sculpting in the upper Houay Soup (tributary of the Nam Ngiep). Note the villagers collecting fruit of *Garcinia ferrea*. There was evidence of both monkeys and civets harvesting this fruit (LS2).

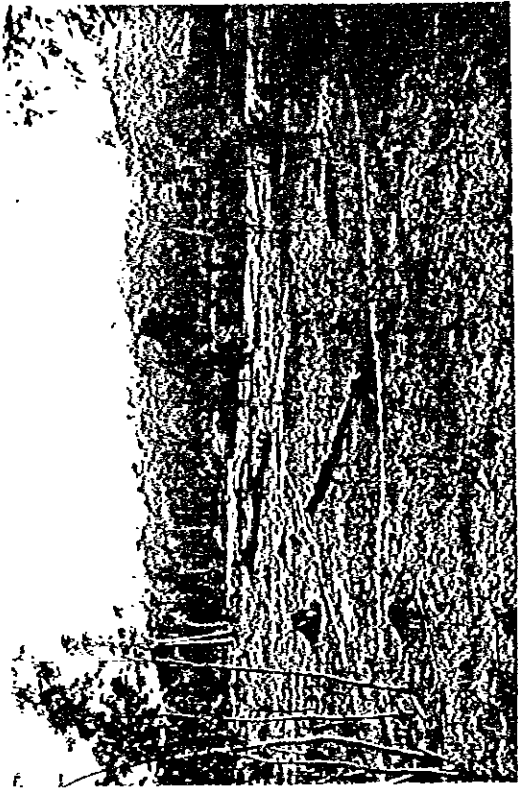


Plate 14 (Above)  
Paddy rice fields east of Ban  
Sopyouk (LSS).



Plate 16 (Right)  
Recently cleared land on the Nam Toum  
tributary south of Ban Namyouk (LSS).

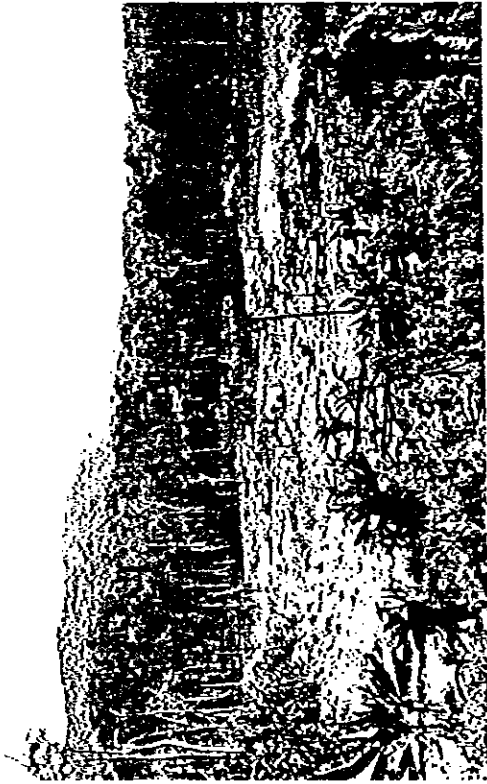


Plate 13  
Dry rice fields on the east bank of the Nam Ngiep. In the distance is the village of Ban  
Houeypamon (LS14).



Plate 15  
Dry rice fields south of Ban Sopyouk  
(LS5).



Plate 18

Small UN sanctioned (1 row) poppy field at the top of a ridge overlooking the Nam Ngiep valley (over 1000m elevation) (LS2).



Plate 20

One day old Seraw droppings amongst some large boulders in the very upper reaches of the Houay Soup (LS2)

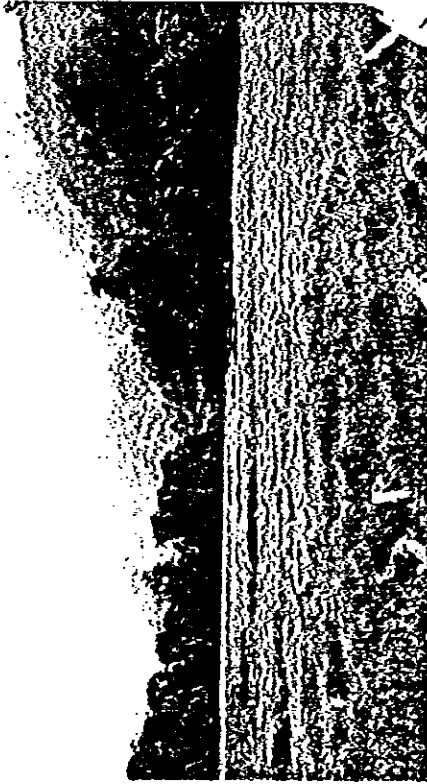


Plate 17

A large natural clearing south of Ban Sopyouk at 800m (LS2). In the rainy season the area floods and forms a Nong. It is a regular watering hole for animals (e.g. deer, civets and cats).



Plate 19

View of the Nam Ngiep valley looking north from the poppy field in Plate 18. Note the large areas under cultivation and the degraded nature of the remaining woodland

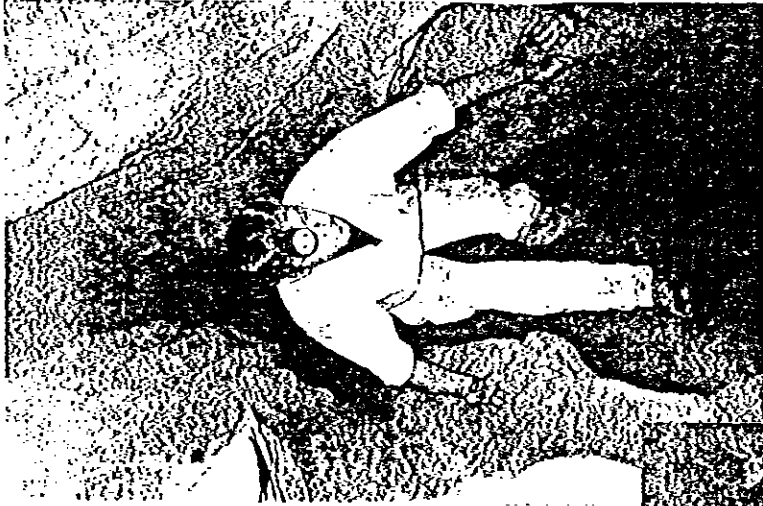


Plate 21 (Right)

A member of the RMR survey team surveying a system of caves carved into an escarpment. These caves were the roosting site of a colony of *Hipposideros lekaguli*.

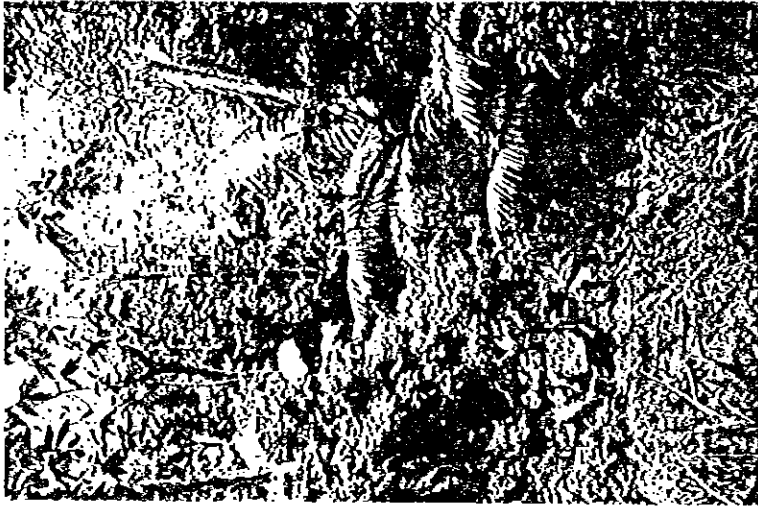


Plate 22

View from the top of a small waterfall in a dense patch of forest situated on very steep slopes in LS2.

Plate 24

View of paddy rice fields on the Nam Mang tributary looking northwest towards Ban Nakang (LS21)

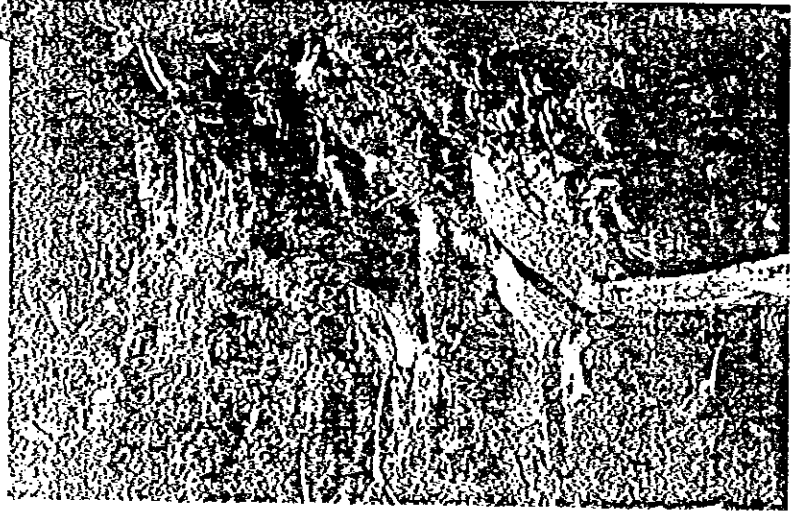


Plate 23 (Left)

A small waterfall in a dense patch of forest situated on very steep slopes in LS2.



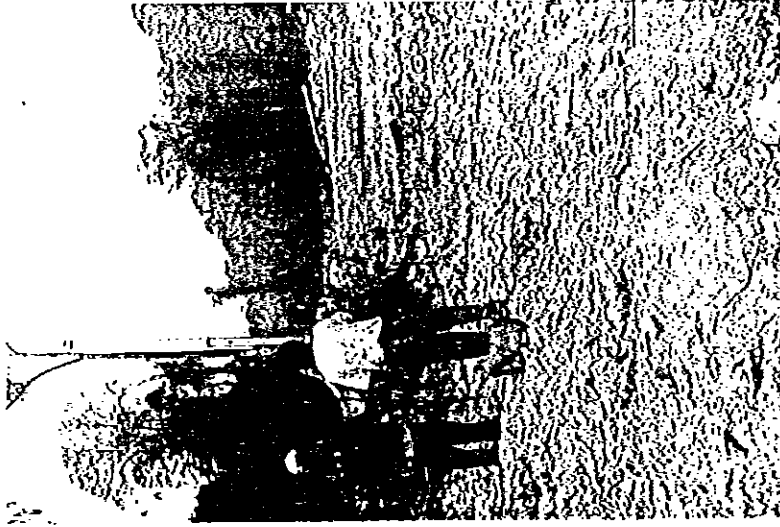


Plate 25 (Right)

A survey team taking levels for the construction of an irrigation canal east of Ban Muang Bo (LS7).

Plate 27 (Below)

View looking west from a ridge overlooking the Nam Xao valley. The valley has almost totally been cleared for an irrigation/resettlement scheme (LS7).



Plate 26

A Water Monitor specimen observed close to Ban Houaypamon near the river bank (LS14).



Plate 28

A Phayre's Langur specimen observed in the upper Houay Soup (LS2).





Plate 30 (Right)

Bear pug marks with a variety of ages in the upper Houay Soup (1 month, 3 month, 6 month and over a year old). Scattered at the base of the tree were the remnants of a bee hive and a large hole was visible 20m up the trunk of the tree (LS2).



Plate 32

Pug marks of a deer, a small cat and a civet found around a watering hole situated in centre of the clearing pictured in Plate 17.



Plate 29

Three to six month old elephant droppings in the upper Houay Soup (LS2).



Plate 31

Pug mark of a cat which had eaten some of the dead bait left south of Ban Nakang (LS21). The next evening the entire carcass was removed. Sadly the IR trap failed to trigger on both occasions.

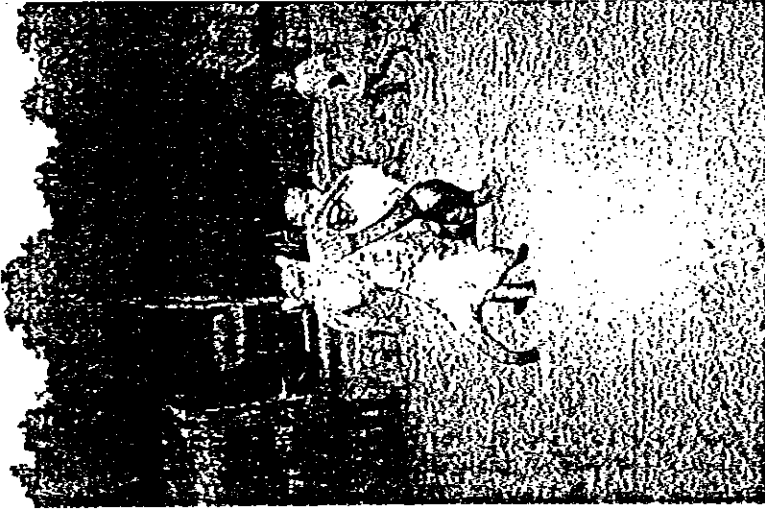


Plate 33 (Right)

An Asian Golden Cat specimen observed in LS14. It was shot in the village while attempting to make off with a domestic chicken.

Plate 35 (Below)

Specimens of *Megacerops ecaudatus* and *Rousettus amplexicaudatus* observed in LS14 south of Ban Sopphoun. The bats were caught in a net trap draped over a watering hole. A total of five bats of two different species were caught in one evening.

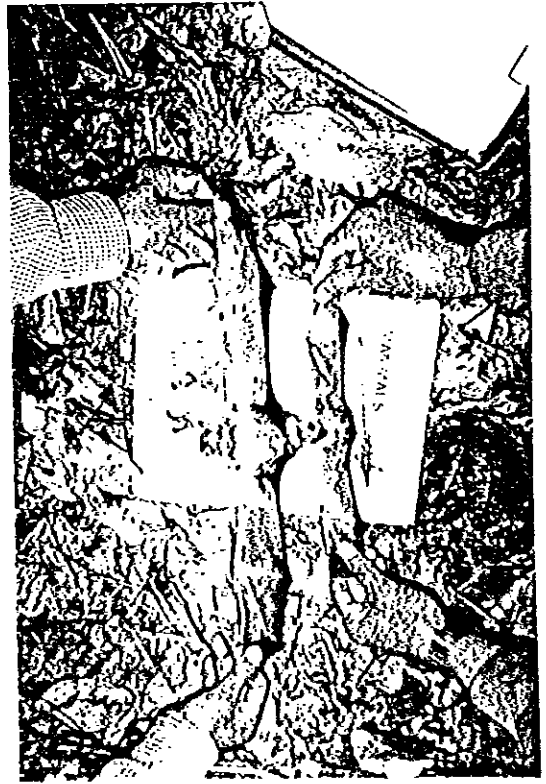


Plate 34  
Test picture from the IR trap camera of dead bat left on the banks of the upper Houay Soup (LS2).

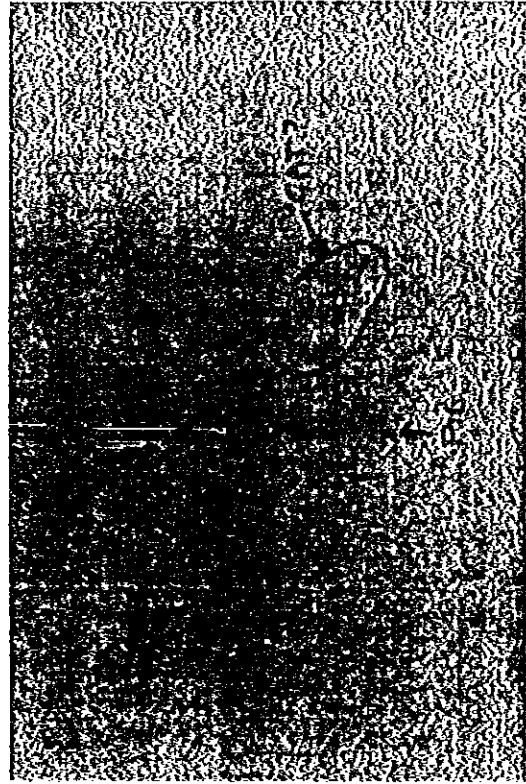


Plate 36  
A fishing or leopard cat caught by the IR trap (Plate 34) inspecting offal left on the fallen log (upper Houay Soup [LS2]). This may be difficult to see when copied



Plate 37

A Large Indian Civet inspecting a 3 day old deer carcass caught by the IR trap. The deer was shot by villagers and died on the edge of the clearing pictured in Plate 17 (LS3).

Plate 39

Slaughtered pig being dragged through the forest to leave a scent trail. An average trail was approximately 2 km in length. The pig is then positioned in front of an IR camera trap.



Plate 38

RMR survey team a biomass component from a sample plot in the upper reservoir (LS21)

Plate 40

RMR survey team conducting a village interview in Ban Houaypamom.



CHAPTER - 6

INVENTORY OF  
POSSIBLE RESETTLEMENT SITES

## TABLE OF CONTENTS

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2.2 Xaisomboun Special Region	7
2.3 Xiangkhouang Province	10
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Location map of site reconnaissance	

## INVENTORY OF SITE RECONNAISSANCE OF RESETTLEMENT SITES OF NAM GNIEP I HYDROELECTRIC PROJECT

### I. General.

The preliminary inventory of the project potential resettlement sites was conducted from mid July to mid August, 1999. The inventory is based on:

1. The discussion with the officials concerned of the Provinces of Xieng Khouang and Bolikhamsay, Borikhan District and Xaysomboun Special Region; Most of the sites for resettlement have been proposed by the provincial and district departments concerned.
2. The aerial photo interpretation (using 1/30,000 photos taken in 1998) is used for identifying the land use and forest types of each site. However, at this stage no ground truth has been carried out.
3. The topographic maps at a scale of 1/100,000; 1/50,000 and 1/25,000 (depending on the availability) have used to study the topographic conditions.
4. Whenever it is accessible, site visits were undertaken in order to obtain a general assessment of the proposed site.
5. In total, there are sixteen (16) proposed sites. Land use and forest type map and topographic map of each site are given in the ANNEX.

In order to assess the number of the households that would be able to be resettled in each site, we have made the following assumptions:

1. The resettled households would need 1 hectare of paddy field and 0.5 hectares for housing, garden and other facilities. These figures on land holding is about 15% higher than the one in the reservoir area.
2. In line with the above, any proposed site without possibility to develop paddy field will be disregarded.
3. In order to assess the area that can be converted into paddy field, we have assumed that about 50% of unstocked forest in the relatively flat area are suitable.

In order to carry out the inventory in a short time frame, three teams were despatched. The STS consultant's team have divided three teams; the first team was conducted to Borikhamxai province and visited resettlement site at Borikhan district, it located at Ban Na-O and Ban Phonkham, There are the focus development sites of Borikhan district (The sites show on Map No. 01 & No.02).

The second team went to Xaysomboun Special Region consultants with Mr. Singkham and Mr. Khamdy chief of cabinet of Xaysomboun Special Region. There are presented two resettlement sites; first site located at Thavieng area, next site located at Hom district. The sites show on Map No.04, No.05, No.06 and No.07.

The last team went to Xiangkhoang province was consultant with Mr. Bounthon chief of planning and investment cooperation cabinet of Xiangkhoang

province. He has presented the resettlement sites. It is located at the Kham and Khoun districts (The sites show on Map No.09 MapNo.10 & MapNo.11).

## II. Results of the inventory.

The results of the investigation of each site are described as follows.

### 2.1 Borikhamxai Province

Persons by the survey team are:

1. Mr. Silivane chief Cabinet of Borikhamxai Province Administrative Office. At the meeting, Mr Silivane proposed two sites for consideration (D6 and D7).
2. Mr.Khamxay, Head of Borikhan District;
3. Mr.Thongsavath, Vice Head of Borikhan District;
4. Mr.Khampome;development planning sector of District;
5. Mr. Khamphe, Arrigation Sector of the District.

The officials of the Borikhan District proposed the sites D1 and D2 resettlement areas.

#### (1) Site No. D1(See Map No.01)

The resettlement site D1 was proposed by the administrative authority of Bolikhanh District. It is located within the Focal Area For Rural Development (FARD) of the District. The total FARD estimated by the District is about 18,000 hectares.

**Location:** The area is about 6 km from the Borikhan District. Boundaries of the FARD are as follows: Northern part is the mountain Phou Ngou, Southern part is Ban Songkhone, Paksan district, Eastern part is Ban Khamphai and Ban Nong Gnoug, Paksan district, and Western part is Nam Xan river. At the time being, there are five (5) villages in the proposed sites, namely Ban Hat Phou along Nam Xan, Ban Phon Kham and Ban Na-O. The majority of the population in these villages are Lao Loum. The main occupation is low land rice cultivation.

**Accessibility:** the site No. D1 can be reached by car. The present road condition is good.

**Topography:** This area has a flat to gently undulated terrain with several swamp and natural ponds. Based on the map of 1/25,000 scale, the altitude is approximately 158~160 MSL.

**Water Sources:** Nam Xan and Houay Sa that flows into Nam Kading and natural ponds such as Nong Veng, Nong Ka and Nong Koy.

**Land Use:** Based on aerial photo interpretation, the present land use and forest types are classified as follows:

Forest Area                      437 ha

Unstocked Forest	3,183 ha
Rice paddy	819 ha
Ray (Upland rice)	160 ha
<b>TOTAL:</b>	<b>4,599 ha</b>

**Suitability for resettlement:** The unstocked forests are relatively flat and thus, would be able to be developed as paddy land. With the assumption that 1.5 hectares of land for housing, agriculture are required for each household, and 50% of the unstocked forest could be used for resettlement purpose, the total number of households that would be resettled in the D1 site is approximately 1,500 Households.

**(2) Site No. D2 (See Map No.02)**

The resettlement D2 was also proposed by the Administrative Authority of Borikhan District. It is also located within another FARD of the District.

**Location :** The area is located Ban Thasi along the Nam Lat in the Borikhan district , Borikhamxai province, about 54 km to the Borikhan district Administrative Office.

**Accessibility:** The site No. D2 can be accessed by boat.

**Topography :** This area has a flat to undulated terrain. It is along the Nam Lat and Nam Hat rivers. The altitude is approximately 220~240 MSL.

**Water Sources:** Nam Hat and Nam Lat flowing through the area and Nam Mang river at the North-western boundary. These rivers could be used as main sources for irrigation development, either by pumping from Nam Mang for area in the northwestern part or by diversion weir on Nam Hat and Nam Lat for other areas. The possibility for irrigation development is the main advantage for this site.

**Land use:** The total area is 4,940ha, of which about 62% is covered by with forest and 33% by unstocked forest. The present land use and forest type is given below :

Forest Area	3,064 ha
Unstocked Forest	1,638 ha
Rice paddy	94 ha
Ray (Upland rice)	92 ha
<b>TOTAL:</b>	<b>5,860 ha</b>

**Suitability for resettlement:**

By assuming that 50% of the relatively flat unstocked forest area can be developed as paddy field, about 450 households could be resettled. As mentioned above the main advantage of the site D1 is the possibility of irrigation development while the major impediment is the accessibility to the site. It should be noted that this assessment is consistent to the one suggested



by the District. According to Mr. Khampom, Development Planning of Borikhan District, the area suitable for agriculture development is about 800 to 1,000 ha.

**(3) Site No. D3(See Map No.01)**

**Location:** The area is located on the left of the Nam Ngiep river bank, close to Ban Muang Mai in the Borikhan district, Borikhamxai province, and about 14 km to the Borikhan District. The area was proposed by Mr. Silivane, Chief Cabinet of Borikhansay Province.

**Accessibility:** The site D3 can be accessed by road No.6, and by boat along Nam Ngiep River.

**Topography:** This area is a flat to undulating terrain. The altitude of approximately 170~180 MSL.

**Water Sources:** The main water source is Nam Ngiep river.

**Land Use:** The northern area is mainly used for upland crops. The rest area is covered with unstocked forest 759.55 ha. The details on present land use is shown in Map No. 1 (c) and also given below:

Forest Area	94 ha
Unstocked Forest	759 ha
Ray (Upland rice)	15 ha
TOTAL	868 ha

**Suitability for Resettlement:** Based on the 1/25,000, the northern unstocked forest area is undulated and likely unsuitable for paddy field. Only the lower part would be suitable for paddy field development. At this preliminary stage, about 25% of the unstocked forest (190 ha) located in the lower part of the proposed site could be developed as paddy field. About 130 households would be able to be resettled in the area.

**(4) Site No. D4(See Map No.01)**

**Location:** The area is located close to Ban Hatsoup and about 18 km to the Borikhan District.

**Accessibility:** The resettlement site No. D4 can be accessed by small laterite road and also by boat on the Nam Ngiep river. The road can be used mainly during the dry season.

**Topography :** Only a small part of the area has a flat terrain. The altitude of approximately 160~180 MSL.

**Water Sources:** The main source for the water supply of the area is Nam Ngiep river and Houay Khinguak, a tributary of Nam Ngiep.

**Land Use:**

The whole area is covered by forest except very few spots of paddy fields and ray totaling less than 1 %. Unstocked forest area of 4,135 ha is very undulated and hilly. It cannot be used for paddy field development except the area on the left bank of Nam Sao, just upstream of the confluence with Nam Ngiep. Details on present land use and forest type is given below:

Forest Area	8,689 ha
Unstocked Forest	4,135 ha
Rice paddy	11 ha
Ray (Upland rice)	122 ha
TOTAL	12,958 ha

**Suitability for resettlement:** Based on the results of aerial photo interpretation and the 1/100,000 map, the unstocked area that would be able to develop as paddy field is about 30 ha, capable to resettle about 20 households.

**(5) Site No. D5(See MapNo.01)**

**Location:** The area is located in the Houay Soup valley on the right of Nam Ngiep, between the damsite and Ban Hat Kham and about 22 km to the Borikhan District.

**Accessibility:** The resettlement site No. D5 can be accessed by road in the dry season and also by boat on the Nam Ngiep River.

**Topography:** This area has a flat to undulated terrain. The altitude of approximately 160~180 MSL.

**Water Sources:** Nam Ngiep and Houay Soup that flows through the middle of the area.

**Land use:**

The present land use in the site D5 is as follows:

Forest Area	165 ha
Unstocked Forest	137 ha
Ray (Upland rice)	12 ha
Grass land	3 ha
TOTAL	317 ha

**Suitability for resettlement:**

About 50% of the unstocked forest area that is about 70 ha would be able to develop as paddy field. About 45 households would be able to be resettled in the site D5.

**(6) Site No. D6(See Map 03)**

**Location:** The area is located in the Ban Muang Bo, about 32 km from the Borikhan District.

**Accessibility:** The potential resettlement site No. D6 can be accessed road in the dry season.

**Topography :** This area has a flat to undulated terrain. The altitude of approximately 180~200 MSL.

**Water Source:** Houay Xao flowing through the middle of the area.

**Land cover:** The unstocked forest occupies most of the area as shown on the Map No.3 (a) and below:

Forest Area	1,048 ha
Unstocked Forest	1,866 ha
Ray (Upland rice)	297 ha
Rice Paddy	230 ha
TOTAL	3,441 ha

**Suitability for resettlement:**

Based on the 1/100,000 map, only the unstocked forest of about 200 ha located on the left bank of Nam Sao and between Nam Sao and Nam Pou could be developed as paddy field. About 130 households could be resettled in that area.

**(7) Site No. D7(See Map No.03)**

**Location:** The area is located in the Ban Muanghuang, Borikhan district, about 25 km to the Borikhan district Administrative Office.

**Accessibility:** The access road to the site D7 is in similar condition than the Site D6

**Topography :** Same as site D6 and the altitude is approximately 180~200 MSL.

**Water Sources.** Houay Huang that flows through of the area into Nam xan.

**Land cover;**

Most part of the site is covered by forest area (about 2870 ha) and unstocked forest (about 1000 ha). Details are given below:

Forest Area	2,869 ha
Unstocked Forest	995 ha
Ray (Upland rice)	38 ha
Rice Paddy	353 ha
Village or Built up area	125 ha
TOTAL:	4,380 ha

**Suitability for resettlement:**

About 100 hectares of unstocked forest area on the left bank of Nam huang, downstream of Muang Huang District could be developed as paddy field and about 65 households could be resettled.

## 2.2 Xaysomboun Special Region

The official met during the mission to Xaysomboun Special Region include:

1. Mr. Somdy, Chief Cabinet of Xaysomboun Special Region Administrative Office on 21/7/1999 , consultant about resettlement site in the Xaysomboun Special Region;
2. Mr. Singkham Head of Industry and Handicraft Department,
3. Mr. Phouthakone Deputy-Head of Development Planning Department of Xaysomboun Special Region. Three sites were proposed by the authority of Xaysomboun Special Region as possible resettlement sites for Nam Ngiep I Project:

### (8) Site No. XSB1(See Map No.04)

**Location ;** The area is located at about 10 km east to the Hom District.

**Accessibility:** The site No. XSB1 can be reached by car. The present road condition is good.

**Topography :** Mountainous area having the elevation of about 560–580 MSL with narrow valleys. Areas suitable for rice cultivation have already been used except the small area of few hectares.

**Water Sources:** Nam Ngok , flows through the area .

#### **Land Use:**

Forest Area	1,033 ha
Unstocked Forest	1,144 ha
Ray (Upland rice)	62 ha
Rice Paddy	90 ha
Savannah	14 ha
<b>TOTAL:</b>	<b>2,313 ha</b>

**Suitability for resettlement:** Unlikely suitable for the resettlement based on agricultural development because of topography condition and the limitation of flat land

### (9) Site No. XSB2(See Map No.05)

**Location:** The area is located at about 3 kms from Thavieng, in the Houay Pang valley, on the right of the Nam Ngiep river.

**Accessibility:** Difficult and almost impossible during the rainy season.

**Topography :** Mountainous with narrow and flat-undulated valley along Nam Pang river. The altitude is approximately 320–360 MSL.

**Water Sources.** Nam Pang river.

**Land cover:**

Forest Area	1,484 ha
Unstocked Forest	80 ha
Ray (Upland rice)	32 ha
Grassland	1,548 ha
<b>TOTAL</b>	<b>3,144 ha</b>

**Suitability for resettlement:**

Unstocked forest area of about 80 ha on the right bank of Nam Ngiep can be developed as paddy field and only 45 households can be resettled.

**(10) Site No. XSB3(See Map No.06)**

**Location:** The area is located at about 24 kms from Thavieng, along Nam Che river.

**Accessibility:**

Access road to Site No. XSB3 is impossible in most rainy season and rather difficult in the dry season.

**Topography:** Mountainous with the altitude varying from 570 to 600 MSL.

**Water Sources:** The main source for the water supply of the area is Nam Ngiep and Nam Che , a tributary of the Nam Ngiep river.

**Land Use:**

Forest Area	1,158 ha
Unstocked Forest	824 ha
Scrub forest	183 ha
<b>TOTAL</b>	<b>2,165 ha</b>

**Suitability for resettlement:**

Unlikely suitable for resettlement based on agricultural development because lack of land.

**(11) Site No. XSB4(See Map No.07)**

**Location:** The area is located on the right bank of Nam Ngiep, upstream of the reservoir and about 22 km to the Thavieng District.

**Accessibility:** The site can be reached by the National Road No.4. The road is in bad condition in the rainy season. The area can also be reached by boat on the Nam Ngiep river.

**Topography :** The area is hilly to mountainous with the elevation varying from about 560 to 600 MSL.

**Water Source:** The main water source is Nam Ngiep river ,

**Land use:**

Forest Area	112 ha
Unstocked Forest	109 ha
Ray (Upland rice)	5 ha
Grassland	6 ha
<b>TOTAL</b>	<b>332 ha</b>

**Suitability for resettlement:**

Unlikely suitable for resettlement based on agricultural development due to lack of suitable land.

**(12) Site No. XSB 5(See Map No.08)**

**Location:** The area is located in the Nam Ngum basin, far from existing road and about 62 km to the Xaysomboun district Administrative Office. The site is in a remote area.

**Accessibility:** At present, the only way to reach the site is by walking from Ban Longcheng.

**Topography :** This area is mountainous with the altitude of approximately 1460~1480 MSL.

**Water Sources:** Small creek flowing through the area

**Land use:**

Forest Area	542 ha
Unstocked Forest	2,405 ha
Grassland	1,582 ha
<b>TOTAL:</b>	<b>4,529 ha</b>

**Suitability for resettlement:**

Unlikely suitable due to lack of suitable land for agricultural development and remote area.

**(13) SITE No. SXB6 (See Map No. 4b)**

**Location:** The area is located about 16 kms east of Hom District.

**Accessibility:** The site can be reached by boat or by walking from Ban Nam Phouang about 10 kms far from the proposed site.

**Topography:** Mountainous landscape with the elevation varying from about 400 to 420 MSL.

**Water Source:** Nam Ngiep river as main water source.

**Land Use:**

Forest Area	3,668 ha
Ray (Upland rice)	52 ha
Bamboo	1,146 ha
Grass land	1,190 ha
<b>TOTAL:</b>	<b>6,056 ha</b>

**Suitability for resettlement:**

Unlikely suitable due to lack of land.

**2.3 XiangKhouang Province**

Persons met during the reconnaissance mission include:

1. Mr. Bounthon Planning, Investment and cooperation Department of Xiengkhouang province,
2. Mr. Bounhom Chief Cabinet of Xiengkhouang province on 15/7/1999,
3. Mr. Thongthep Chief of Agriculture Department, and
4. Mr. Siphonexai Chief of Agriculture Sector of Kham District.

The proposed resettlement sites are as the follows:

**(14) Site No. XK 1(See Map No.09)**

**Location:** The area is located in Ban Xang, Khoun district, about 8 km from the Khoun District. The proposed site is located close to a densely populated area

**Accessibility:** The site can be reached from Phonhsavanh by the National Road No.6. The road condition is good.

**Topography :** This area has a flat to undulated terrain with a relatively slope. The altitude of approximately 1060~1080 MSL.

**Water Source:** The main water source is Nam Ngiou that flows through the area.

**Land Use:**

Forest Area	159 ha
Unstock Forest	5,126 ha
Ray (Upland rice)	135 ha
Rice Paddy	1,154 ha
Grass Land	1,115 ha
<b>TOTAL:</b>	<b>7,689 ha</b>

**Suitability for resettlement:**

Most of land suitable for agricultural development has already been used by the population in the area. The unstocked forest areas, although very large (over 5,000ha) are hilly terrain. The potential for resettlement based on lowland rice production as main occupation for resettled people is limited. The unstocked area might be suitable for upland crop.

**(15) Site No. XK 2(See Map No.10)**

**Location:** The area is located in Ban Tan , Khoun district about 15 km from the District Administrative Office.

**Accessibility:** The resettlement site No. XK2 can be reached from Phonhsavanh by the National road No.6.

**Topography :** Hilly and mountainous with the elevation varying from 1300 to1350 MSL.

**Water Sources:** Nam Phouan that flows through the area.

**Land use:**

Forest Area	421 ha
Unstock Forest	1,177 ha
Ray (Upland rice)	12 ha
Rice Paddy	38 ha
Grass Land	690 ha
TOTAL:	2,338 ha

**Suitability for resettlement:**

As in the case of the site XK1, most unstocked forest area is hilly and thus is not suitable for paddy field development except for other upland crops. Resettlement possibility is limited if rice production is considered as main occupation of the resettled people.

**(16) Site No. XK 3(See Map No.11)**

The proposed site is located within the FARD of the Xieng Khouang province. Presently, the irrigation project with a command area of 4,000 ha of paddy field in the rainy season and 2,000 ha in the dry season is being constructed. The project would be completed by the end of year 2000.

**Location:** The area is located in the Kham district and about 32 km far from Kham district Administrative Office. As in the precedent case , the site is densely populated.

**Accessibility:** The site can be reached from Phonhsavanh by National Road No.4. The road condition is good.



**Topography :** This area has a flat to undulated terrain with gentle slope..  
The altitude is approximately 580~600 MSL.

**Water Sources:** Nam Mat and it tributaries.

**Land Use:**

Forest Area	4,003 ha
Unstock Forest	8,274 ha
Ray (Upland rice)	1,181 ha
Rice Paddy	1,986 ha
Swamp	71 ha
Urban or Built up area	225 ha
TOTAL:	15,740 ha

**Suitability for resettlement:**

Most unstocked forest areas that are relatively flat could be developed as paddyfield. Based on the 1/100,000 map and the result of aerial photo interpretation, the unstocked forest in the flat area is roughly estimated at 4,000 ha. With the assumption that 50% of these unstocked forest areas of 4,000ha can be developed as paddy fields, about 1,300 households could be resettled in the proposed site XK3

### 3. Summary

The results of the inventory are shown in two following tables. The Table I provides the data on the land use and forest types of each of the 16 proposed sites for resettlement. The classification of land use shown in the Table I and in the maps in ANNEX is based on aerial photo interpretation (photos taken in 1998) without ground truth yet. The Table II give an preliminary indicative number of households that could be resettled in each site.

#### **4. Conclusions and recommendations**

The preliminary inventory of the potential resettlement for Nam Ngiiep-I Hydroelectric Project has indicated that out of 16 proposed sites, resettlement would be possible in only 14 sites. The sites that have been disregarded are due to limited possibility to develop paddy field for the resettled people.

Sites most attractive would be the sites D1 and D2 in the Bolikhan District and XK3 in XiengKhouang owing to the following reasons;

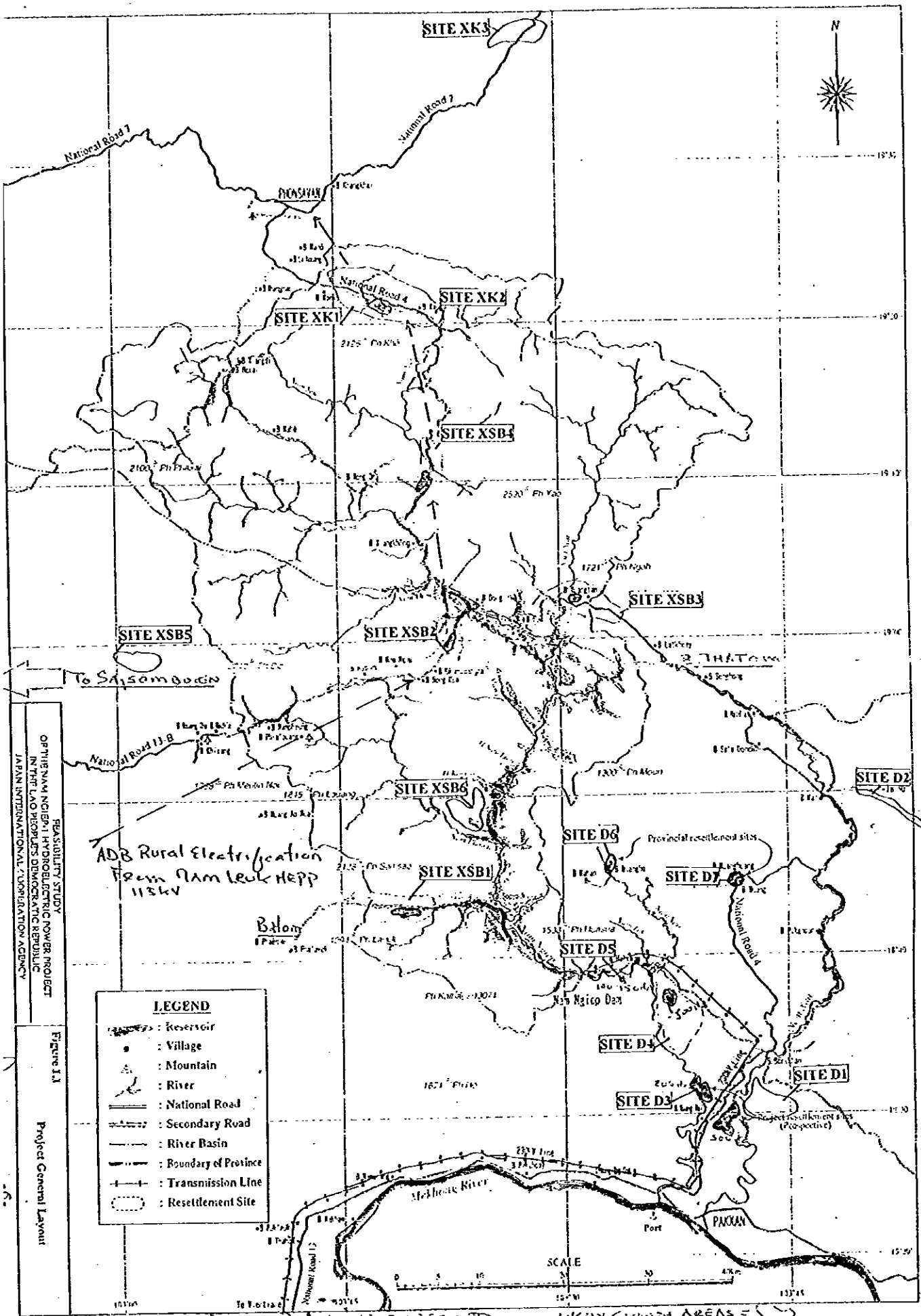
1. Have greater possibility for paddy field development;
2. Located close to the administration center and near populated areas that could provide other earning opportunities;
3. Within the FARD of either the Province or the district concerned;
4. Suggested by the local authorities.

The conclusions drawn from the present inventory is of preliminary level mainly based on desk level study of available information and data. However, it has provided some valuable indication of the possibility of resettlement and could be served as basic information guiding further studies.

In line of the above, it is recommended that future study should include the field work to confirm the suitability of the three most attractive sites mentioned above. The scope of future investigations should include (i) the investigation on the soil suitability for agricultural development, (ii) the possibility of irrigation development, (iii) the prevailing socio-economic and cultural conditions of the sites...

**TABLE I: Land Use and Forest Type  
of proposed resettlement areas  
(based on Interpretation of Aerial photographs taken in 1998)**

SITE	Land use (ha)							Total
	Paddy	Swidden Rice	Forest	Unstocked Forest	Grass land	Village or Built up Area	Water Bodies	
<b>I. Borikhan District Bolikhamsay Prov.</b>								
1.1 D1	819	160	437	3,183	0	80	64	4,743
1.2 D2	94	92	3,064	1,638	0	52	0	4,940
1.3 D3	0	15	95	760	0	0	0	870
1.4 D4	11	122	8,689	4,136	0	1	0	12,959
1.5 D5	0	12	165	137	3	0	0	317
1.6 D6	230	297	1,048	1,867	0	81	0	3,522
1.7 D7	353	38	2,869	995	0	125	0	4,380
<b>SUBTOTAL</b>	<b>1507</b>	<b>736</b>	<b>16,367</b>	<b>12,716</b>	<b>3</b>	<b>339</b>	<b>64</b>	<b>31,731</b>
<b>II. Xaysomboun Special Region</b>								
2.1 XSB1	90	62	1,033	1,144	14	29	1	2,373
2.2 XSB2	0	32	1,484	80	1,548	34	0	3,178
2.3 XSB3	0	0	1,158	1,006	0	0	0	2,165
2.4 XSB4	0	5	111	108	6	0	0	230
2.5 XSB5	0	0	542	2,405	1,582	0	0	4,529
2.6 XSB6	0	52	3,668	1,146	1,190	59	0	6,115
<b>SUBTOTAL</b>	<b>90</b>	<b>151</b>	<b>7,996</b>	<b>5,889</b>	<b>4340</b>	<b>122</b>	<b>1</b>	<b>18,590</b>
<b>III. Xiengkhouang Province</b>								
3.1 XK1	1,154	135	159	5,126	1,115	87	13	7,789
3.2 XK2	38	12	421	1,177	690	4	0	2,342
3.3 XK3	1,986	1,181	4,003	8,274	0	226	71	15,741
<b>SUBTOTAL</b>	<b>3,178</b>	<b>1328</b>	<b>4583</b>	<b>14,577</b>	<b>1,805</b>	<b>317</b>	<b>84</b>	<b>25,872</b>
<b>GRAND TOTAL</b>	<b>4,775</b>	<b>2215</b>	<b>28,946</b>	<b>33,182</b>	<b>6,148</b>	<b>778</b>	<b>149</b>	<b>76,193</b>



FEASIBILITY STUDY  
 OF THE NAM NOEI BURI HYDROELECTRIC POWER PROJECT  
 IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 1.1

Project General Layout

ADB Rural Electrification  
 from Nam Leuk HEPP  
 115KV

POTENTIAL RESETTLEMENT SITES =

LIKELY GROWTH AREAS =











JICA