



PARC BA BE / NA HANG

FOREST PROTECTION DEPARTMENT (FPD),
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)

Gam River Dam Preliminary Environmental Impact Assessment



Proposed Location of the dam on the Gam River

PARC Project VIE/95/G31&031
Creating Protected Areas for Resource Conservation
using Landscape Ecology

May 2000

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1. Introduction

The Dam Proposal

1.1 Officials in Tuyen Quang say that the first proposal for a dam on the Gam River was put forward 25 years ago. Over the intervening period, a succession of dams has been considered on the Lo and Gam rivers from just upstream of Tuyen Quang to upstream of Na Hang.

1.2 Electricity of Vietnam (EVN) undertook a pre-feasibility study of a proposed dam on the River Gam in 1997. The study examined two possible sites at Pac Ta and Dai Thai and considered a range of development impacts, including the need for resettlement. The Pac Ta site was preferred as it minimized resettlement, agricultural land loss, and the impacts on the Na Hang Nature Reserve. The study considered dams with operational levels of between 115m and 135m above sea level (asl).

1.3 The site has also recently been re-evaluated as part of the National Hydropower Study being undertaken by the consortium composed of SWECO International, Statkraft Engineering and Norplan AS. It has been included on a shortlist of 16 preferred sites following an initial appraisal of 47 potential sites throughout Vietnam. However, although an initial environmental screening of each site took place, the study did not identify the existence of the Na Hang Nature Reserve or its population of endangered species.

1.4 The consultants undertaking the National Hydropower Study identified Pac Ta as their preferred dam site and 120m as their preferred operational level. A more detailed review of all the short listed sites, including baseline studies of environmental and social aspects, is now underway. This will be reported in March/April 2000. Phase III of the National Hydropower Study is intended to lead to the identification of a number of preferred sites for further studies and Phase IV will give recommendations on a commissioning timetable.

1.5 The proposed dam at Pac Ta, below the mountain, exists as a sketch design in the National Hydropower Study. It would impound an area of water of 57km² forming a long, narrow reservoir extending over 30kms up the valley of the River Gam and its tributary valleys. It would have an installed capacity of 300MW.

1.6 In 1999, Electricity of Vietnam prepared the Terms of Reference for a full feasibility study of a dam at Pac Ta. These Terms have been approved and, subject to finance, the study is likely to proceed later this year.

1.7 Any dam would require a formal Environmental Impact Assessment under the Law on Environmental Protection (Article 18).

1.8 The dam project is a national level project and the national government has indicated its intent to commence construction in 2001 with a view to completion in 2004. The construction would also be dependent on raising the necessary finance. It is anticipated that funds would be sought from a major donor such as the Japanese or the Asian Development Bank. Development agencies would also require an EIA before allocating funds.

The PARC Project

1.9 The Protected Areas Resource Conservation (PARC) Project is a joint project by the Government of Vietnam, Ministry of Agriculture and Rural Development (MARD), and the United Nations Development Programme (UNDP), which is funded by the Global Environment Facility (GEF). The implementation of the project is being undertaken by the United Nations Office for Projects and Services (UNOPS) who have subcontracted work to

two consulting groups (Scott Wilson Asia-Pacific Ltd, the Environment and Development Group and FRR Ltd, and GTZ and WWF). The Scott Wilson led consortium is implementing the project in Ba Be National Park and Na Hang Nature Reserve.

1.10 The objective of the PARC project is to conserve the exceptional natural resources of the protected areas through institutional strengthening and through developing sustainable livelihoods for the local communities so that they do not need to deplete the natural resources of the protected areas.

1.11 A dam at Na Hang will potentially have significant impacts on the natural resources of the area and on the local people including both those who will be resettled and those who will remain in the area. Accordingly, the PARC Site Task Manager for Ba Be and Na Hang proposed in his Inception Report that the PARC project assists the Government of Vietnam by conducting a preliminary environmental assessment of the River Gam Dam.

This Report

The objectives of this report are:

- to advise the PARC project about the potential impacts of the proposed dam
- to inform the planning process, particularly the National Hydropower Study
- to provide guidance on the scope of any full EIA for the dam
- to raise awareness of the potential implications of the dam

1.13 This report is presented in six distinct sections:

Section 2 describes the dam proposal, its objectives, and its environment (the area affected by the project).

Section 3 gives a brief resume of the attitudes of key stakeholders towards the dam proposal as required by the brief (see Annex 1). This provides an initial indication of key issues for further consideration.

Section 4 considers the impact of the dam on the northern section of the Na Hang Nature Reserve, which is the principal concern of the PARC project.

Section 5 considers, in summary and preliminary form, the overall environmental, economic and social impacts of the dam.

Section 6 provides findings, recommendations, and conclusions.

Section 7 briefly considers the need for action in the area should the dam not proceed

1.14 This report was prepared over a three-week period by:

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assisted by:

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1.15 Our approach to the preliminary environmental impact assessment broadly follows international practice and particularly the methodology recommended by the Asian Development Bank for initial environmental examinations (IEE). The preliminary nature of the assessment is stressed. As the scheme is still at sketch design stage, no design or

construction details are available. Accordingly, there are a number of potentially significant impacts that cannot be assessed now.

1.16 Time was limited and precluded any substantive new fieldwork although Mr. Chung made a three and a half day field excursion through the Nature Reserve. In total, the team spent over a week in the field; viewing, as far as practicable, all parts of the proposed dam site and visiting a number of the communities that would be affected.

1.17 This preliminary assessment should be treated as an input to the evaluation of the proposed scheme and as a guide to future work if finance is made available for a full feasibility study and formal EIA. Specific recommendations are made as to further work required in any such studies.

2. The Development and its Environment

Introduction

2.1 The proposal comprises the construction of a concrete dam across the River Gam in a narrow section of valley below Pac Ta Mountain (Figure 1). The dam would create a long, narrow, branching lake with a surface area of 57kms² with a full supply level of 120m asl and a minimum operational depth of 95m asl. The dam would have a generation capacity of 300MW and would produce 1090 106 kW/hrs of electricity each year. The capital cost of the dam has been assessed as VND 5970.9 billion (US\$0.42 billion). EVN has estimated that the capital costs could be repaid over 10 to 30 years depending upon the loan sources.

The Need for the Development

2.2 The principal objectives of the project are:

- To meet growing national demands for electricity and to ensure reliable supply
- To regulate river flows downstream contributing both to flood control and irrigation

Electricity Supply and Demand

2.3 Electricity of Vietnam (EVN), under the Ministry of Industry, was established in 1995 and is responsible for the generation and transmission of electricity. Electric power planning is carried out by the Institute of Energy. Two governmental agencies, PECC1 and PECC2 are responsible for project planning, investigation, and design of hydropower and thermal power projects. Three companies, PC1, PC2 and PC3, purchase and distribute power in, respectively, the north, south and center of the country. A single circuit 500kV transmission line links the three power systems.

2.4 EVN has forecast that electricity consumption per head will increase 125% between 2000 and 2010. Total electricity consumption is forecast to grow 170% over the same period. To meet this demand it is proposed to increase the country's total generating capacity from 7000MW in 2000 to between 13,700MW and 14,700MW in 2010.

2.5 Vietnam has an estimated hydropower capacity of 14,000-17,000MW of which 4300MW have been developed or are under construction.

2.6 In the northern supply area there is now significant spare capacity following the commissioning of the Hoa Binh Hydropower Plant in 1992. The planned Son La Hydropower Project could further increase output. The north is also rich in coal resources and has significant investments in coal fired thermal generation. However, the south is an importer of electricity and both the southern and central areas have experienced power shortages especially during the dry season.

Flood Control

2.7 The provincial capital of Tuyen Quang province, which has a population of approximately 40,000 people, is subject to regular flooding from the Gam River during the wet season. Flooding lasts between three and seven days with levels of 27-28m asl compared to an average street level of 26m asl. In 1997 there was exceptional flooding for 19 days with a maximum flood level of 31m asl.

2.8 It was calculated in the EVN pre-feasibility study that a reservoir with a full supply level of 120m asl would have the effect of reducing flood levels in Tuyen Quang town by 0.5m. This reduction, coupled with raising the floor levels of new buildings would substantially alleviate the flood problems and associated costs. The dam option is considered a more feasible alternative than dike building, which is considered costly, unattractive in appearance, and difficult to operate in an upland area.

2.9 The benefits of flood control would apply to Tuyen Quang town and to the agricultural lands downstream of the dam. Neither of the other townships in the valley, Chiem Hoa and Na Hang, suffer from flooding.

Irrigation

2.10 A third potential benefit of a dam relates to the provision of irrigation. In the absence of flat and cultivable land around the dam proper, this benefit would primarily relate to improved irrigation downstream in the dry season. It is anticipated that this would enable the raising of three crops per year, two rice and an intervening crop. EVN estimate that there is approximately 6000ha of paddy rice in the Chiem Hoa and Yen Son districts that could benefit in this way.

2.11 Whilst irrigation is a potential side benefit of the dam, its primary purpose is power generation. Consequently, in the dry season, if the level of the reservoir falls to minimum operational level, the operating company is unlikely to discharge water for irrigation.

Implementation

2.12 The development would involve the excavation of construction materials, the construction of the dam, the power station, access roads, and power lines. Environmental, economic, and social impacts would occur both during construction and during operation.

2.13 The construction of a dam in a remote location with no existing road access will clearly pose a major challenge and involve major environmental and infrastructural change. Few details of the construction program are yet available although officials in Tuyen Quang have been advised by central government that it is likely to last three years. Accordingly, we have set out below, a list of the key operations during pre-construction, construction and operation, as a guide for assessing impacts.

2.14 The pre-construction program will include:

- The construction of a new road from Na Hang township to the dam site
- The selective improvements of road access to Na Hang to facilitate the delivery of construction plant and materials
- The identification of stone quarries and borrow pits
- The building of housing and other facilities for the construction workers
- The building of a site office
- The identification of villages and hamlets to be relocated, and the development of resettlement plans
- The harvesting of timber, which will otherwise be drowned

All of these activities have the potential to create environmental impacts. Areas of particular concern will relate to the selection of sites for extracting construction materials and the proposals for resettlement.

2.15 The construction program will include:

- The construction of a cofferdam to regulate flows during building
- Blasting to obtain rock and prepare the dam site
- The construction of the dam
- The construction of the power station
- The construction of replacement villages
- The erection of pylons and power lines
- The construction of replacement access roads to the remaining communities in the valley

2.16 The operational phase will include:

- The generation of electricity
- The regulation of river flows in the interests of flood control in the wet season and irrigation in the dry season
- The maintenance of the dam, power station and power lines
- Transportation on the lake
- The possible development of fisheries
- The Site and its Surroundings

2.17 The proposed development will take place in the northern part of Tuyen Quang Province. This is a remote, mountainous, and sparsely settled area. The landscape is dominated by limestone, which forms conical peaks, most notably, Pac Ta Mountain, and more extensive uplands with steep slopes. The mountains rise up to 1000m above sea level. The area is drained principally by the River Gam and its tributaries.

2.18 The remoteness and rugged nature of the landscape have limited exploitation of the area. Access is confined to the river and one single track, unsurfaced road that winds between Na Hang and Thuy Loa. Hence, the area contains some of the least disturbed forest in northern Vietnam.

2.19 In consequence, and specifically to protect the Tonkin Snub-nosed Monkey (*Rhinopithecus avunculus*) a Nature Reserve has been established at Na Hang embracing approximately c.22,000ha of the least disturbed forest and an additional buffer zone of c.14,000ha. This is a provincial level reserve following a decree by the People's Committee of Tuyen Quang Province in 1994 (Boonratana 1999).

2.20 Cox (1994) comments, in relation to the Na Hang Nature Reserve, "there are now very few forest habitats of comparable size anywhere in Vietnam north of the Red river." The Reserve is in two parts: Tat Ke in the north (c.10,000ha) and Ban Bung in the south (c.12,000ha). Tat Ke lies immediately adjacent to the proposed reservoir and would be partly inundated by its creation.

2.21 Settlement is almost exclusively confined to the limited flat land in the river valleys. Villages are small and comprise a variety of ethnic groups including Dao, Tay, H'mong and Kinh. The villages are characterized by subsistence farming based on rice and maize, with some cassava, sweet potato, bean and other vegetable crops, chickens, pigs and water buffalo. There is a limited cash economy mostly based on occasional sales of livestock. A minority of the local population is officially defined as lacking security of food supplies.

2.22 Na Hang is a small town, which acts as a market and service and supply center for the district.

2.23 The development will directly affect, by inundation of land, six communes (from north to south): Thuy Loa, Duc Xuan, Khuon Ha, Thuong Lam, Trung Khanh and Vinh Yen.

3. Stakeholder attitudes

3.1 Three principal stakeholder groups were identified for meetings and discussions concerning the dam. They were:

- Government – at Provincial and District level
- Local Communities likely to be affected by the dam
- Non-Governmental Organizations (NGOs)

3.2 It was evident from meetings with the Vice Chairmen of the Peoples' Committees for Tuyen Quang and Na Hang that the proposed dam is seen as a major infrastructure project by the central Government. The Government's initiative was supported in the national interest but it was also perceived that the dam would bring significant benefits to the Province and to Na Hang township. These benefits were expressed in terms of:

- Flood control downstream leading to significant savings for flood relief and enabling new development
- Security of energy supplies
- Significant employment opportunities during construction
- Improved road access to Na Hang leading to development opportunities including tourism associated with the new lake

3.3 Nevertheless, there was recognition that there were potential difficulties related especially to resettlement. Other problems recognized by the Vice Chairmen and senior Government officials included:

- Loss of agricultural land
- Increased problems for forest protection and biodiversity conservation
- Conflicts with species conservation
- Changes to groundwater

3.4 Meetings were held with a variety of local people in areas that will be directly affected by the dam and will require resettlement. In the course of field visits we met and spoke to:

- Commune leaders in Thuy Loa and Duc Xuan
- Village leaders in Bac Vang and Xuan Quang
- Individual villagers in Na Phang and Ban Suong

All those to whom we spoke were aware of the dam proposal and that they might have to move from their existing homes. Generally there was acceptance of the situation with some regret at having to leave areas of long residence. As one woman put it: "We may be poor, but this is our home."

3.5 There were a range of concerns relating to resettlement, which may be summarized as follows:

- a desire to stay in the locality and not to be moved away to a distant area (especially the south)
- a desire to be resettled as a community
- a desire to move houses as well as possessions
- a concern that there should be adequate compensation for fruit trees, crops and, if necessary, houses

- adequate land and water supply at the new location
- the provision of adequate infrastructure in terms of schools, clinics, accessibility etc.

3.6 Meetings were held with the following non-governmental organizations to assemble data and discuss attitudes to the dam:

- Birdlife International
- IUCN (Worldwide Union for Conservation)
- WWF (World Wildlife Fund)
- ZSCSP (Zoological Society for the Conservation of Species and Populations)

In addition a seminar was held in Hanoi to discuss the report findings. Those attending included representatives of:

- the GTZ project on the reform of the forestry administration system
- the SEEDA Mountain Rural Development project
- the GTZ Sustainable Use of Non-Timber Forest Products project
- the EU/Birdlife International project on protected areas in Vietnam

3.8 The NGOs were concerned at the potential impact of a dam on the Reserve and recognized the need to try to identify clearly the nature of the impacts and to identify mitigating measures should the proposal proceed.

4. The impacts of the dam on Na Hang Nature Reserve

Introduction

4.1 The first proposal for a Nature Reserve at Tat Ke – Ban Bung was made in October 1993 in order strictly to protect the Tonkin Snub-nosed Monkey. The Reserve was endorsed by central Government. In 1994, IUCN and a cross section of Vietnamese institutions produced "A management feasibility study of the proposed Na Hang (Tonkin Snub-nosed Monkey) Nature Reserve." The major objective and function of the Reserve was confirmed in 1997 when the Reserve was classified as a protection zone for a seriously endangered species: the Tonkin Snub-nosed Monkey.

4.3 Na Hang Nature Reserve is globally significant because of the endangered species it incorporates. Boonratana (1999) has produced composite lists of mammals, birds, reptiles, and amphibians for the Reserve. He has listed 90 mammals, 247 birds, 61 reptiles, and 20 amphibians, amply demonstrating its biodiversity. Over 2000 plant species have also been identified. These data are gradually being refined and extended through regular record sheets compiled by rangers and visitors.

4.4 The listings incorporate 13 mammals included in IUCN's Red Book of threatened species, although one of these species – the black gibbon (*Hylobates concolor*) - probably never existed in the area. The most notable of these listed species is the Tonkin Snub-nosed Monkey (*Rhinopithecus avunculus*). The Na Hang Reserve was designated specifically to conserve this species.

4.5 A key aim of the PARC project is to ensure the enhanced conservation of the Reserve. The construction of the dam adjacent to and within the northern (Tat Ke) part of the Reserve and its partial inundation will clearly impact on the PARC project and will attract global attention.

4.6 We have sought to assess the potential impact of the dam on the Reserve by reference to published data, by meetings with acknowledged authorities on the Reserve and its biota, by study of the dam proposals and by field surveys.

4.7 In this section, we attempt to predict the impact of the dam on the Reserve by reference to its habitats and species.

Loss of Habitat

4.8 We estimate, on the basis of maps provided by SWECO, that the construction of a dam with a full supply level of 120m will lead to the inundation of approximately 220ha of the Nature Reserve along the banks of the Gam and Pac Vang rivers (Figure 2). This is only a small portion of the total northern part of the Reserve. However, it lies immediately adjacent to or within the area known to harbor the Tonkin Snub-nosed Monkey and the Francois' Leaf Monkey. It is, therefore, a critical part of the Reserve given that it was designated to protect the Tonkin Snub-nosed Monkey.

4.9 It has not been possible, in the time available, to undertake a full vegetation/habitat mapping exercise for the whole of the Reserve area which will be inundated. However, field observations suggest that the area has a varied vegetative cover, including secondary forest, shrub poor forest, and occasional patches of cultivated land.

4.10 The Pac Vang river to the north of the Reserve can currently be crossed by the Tonkin Snub-nosed Monkey (Tuan Rung rangers pers. com.) giving access to the relatively

undisturbed area to the north. The creation of a forest corridor running north from here is under consideration in the PARC project. The flooding of the valley would effectively cut off this area to the monkey and reduce the potential of any new habitat corridor.

4.11 The flooding of the valley will result in the submergence of the riverbank. This is potentially an important edge habitat of significance for wading birds, herons etc. The riverbank has evolved over time and includes a variety of rocky and softer edges. The edge of the lake will inevitably be different.

4.12 The inundation may also involve limestone caves of value to bats and possibly mammals.

4.13 There is a need to carry out a full vegetation and habitat survey of the area of the Reserve that will be inundated. When this information has been compiled, it would be possible to consider the scope for designing the new lake edge to provide some compensation for the habitats lost.

4.14 Following the flooding of the valley, the Reserve will become more accessible along its western and northern flanks. Prior to 1994, forest clearance averaged 40-60ha per year of bamboo, shrub, and secondary forest. Increased accessibility could lead to renewed habitat loss as forest is illegally cleared for timber or agriculture. The extent of this potential impact is difficult to assess, as the flooding of the valley will also lead to resettlement, reducing human pressure on the Reserve. However, this reduction of human pressure will only occur if the resettlement is successful. If there are problems with resettlement and people return to the area, human pressures on the forest may well be exacerbated, given the absence of cultivable land.

Impact on Protected and Endangered Species

The Tonkin Snub-nosed Monkey (Rhinopithecus avunculus)

4.15 This monkey occurs only in northern Vietnam and "is one of the world's most threatened mammal species (Cox 1994)." It is listed by IUCN as a globally threatened species and classified as "critically endangered." It is a Group 1 protected species under the laws of Vietnam (No.18 HDBT 17 January 1992). The Na Hang Nature Reserve was created specifically to conserve this species and it incorporates the largest surviving population. This was estimated to be in the order of 130 animals in 1993-1994 out of an estimated world population of less than 200 (Cox 1994).

4.16 Cox (1994) states that the Tat Ke section of the Na Hang Reserve contains the "largest known surviving population" of the Tonkin Snub-nosed Monkey. Its continued survival at Tat Ke has been confirmed by recent sightings by members of the "Tuan Rung" patrolling group. (This is the extra patrol group organized by the Na Hang Nature Reserve with funding from ZSCP).

4.17 Information on the ecology and behavior of the Tonkin Snub-nosed Monkey is limited and not always consistent. In terms of habitat, it appears that it prefers tall, mature forest (Ratajszczak 1992) but will tolerate mixed forest with a canopy varying from 3-40m (Le Xuan Canh 1994). The monkeys travel through the forest in groups generally moving from tree to tree, with little resort to the ground. They often rest in large groups in the tree canopy.

4.18 Observations by patrol groups suggest that the monkeys are intolerant of disturbance. Thus, a monkey seen at one point, which sees his observer, is unlikely to be seen there again (Martin pers. com.). Boonratana and Le Xuan Canh (1998) likewise comment, "the monkeys were shy to observers. Although they did not flee immediately when we were spotted, they would nevertheless flee." This "delayed" reaction makes the monkeys an easy target for hunters.

4.19 The intolerance of the monkeys to disturbance is also seen in relation to the development of villages and an access track that runs north south through the center of the Tat Ke section of the Reserve. These are considered to have restricted the habitat of the monkey to the western and northern areas. Certainly observations since 1992 (Boonratana 1999, pers. com. Tuan Rung) appear to locate the monkey primarily in the western central section of the Reserve bounded by the Gam River in the west and the Nam Vang river in the north.

4.20 One of the difficulties of establishing the potential impact of the dam on the Tonkin Snub-nosed Monkey is the lack of comprehensive data on the monkey's range. For this study, Mr. Chung has concluded that the monkey is most adapted to the higher slopes of Khau Tep mountain in the dense, evergreen forest around 800m–1000m asl. However, in windy conditions or typhoon the monkeys will seek places under dense bamboo canopies and in narrow valleys at lower altitudes. Le Xuan Canh (pers. com.) suggests that this thesis has to be tested by extended field observations. There is a need to reassess the extent of the habitat that may well have changed since the last comprehensive surveys in 1992. There is evidence for the changing range of the monkey in observations by former gold washers who saw monkeys close to the river (Martin pers. com.).

4.21 The potential impacts of the dam construction on the Tonkin Snub-nosed Monkey relate primarily to:

- Loss of habitat
- Increased disturbance
- Loss of Habitat and Habitat Fragmentation

4.22 The dam will raise the water level by up to 120m, drowning the lower slopes of the Gam and Pac Vang rivers. Around 220ha of the Reserve would be lost. There is no clear evidence as to whether the monkeys use this area and Mr. Chung suggest that they do not because of disturbance, lack of suitable food sources and the open character of the area. However, it lies within or adjacent to their core habitat. If it lies within their core habitat the dam will reduce the area available to this endangered species. Even if it is not used by the monkeys, but it separates the activities on the river from their habitat, the dam will still displace this effect and will restrict the habitat. Only if the monkeys are confined to the highest areas of high quality forest is the impact on the habitat likely to be minimal.

4.23 The conventional mitigation for habitat loss is the provision of new habitat of comparable size and quality. The resettlement of villages within the Reserve, which are thought to restrict the monkeys' habitat, is already under active consideration. Similarly the PARC project is reviewing the possibility of creating new habitat corridors further east, perhaps linking Na Hang and Ba Be, further north lining the forest with forested areas in Sinh Long and Duc Xuan and between the northern (Tat Ke) and southern (Ban Bung) parts of the Na Hang Reserve. These potential extensions of habitat are therefore proposed regardless of whether the dam proceeds and thus cannot be considered as mitigation for habitat loss arising from the dam. Effectively therefore it would not be possible to mitigate the loss of habitat, although the possibility of the dam strengthens the case for trying to expand the habitat.

Increased Disturbance

4.24 Increased disturbance will result from the construction and operation of the dam. In the pre-construction phase, it is likely that timber will be felled from the area to be inundated, thus increasing disturbance within the Reserve.

4.25 During development, there will be a major construction site close to and within the Reserve, although not immediately adjacent to the known monkey habitat. However, traffic and construction noise, explosions, and human activity will transform an area where the greatest noise at present is that of an outboard motor. The construction labor force may

intrude into Reserve and may provide a ready market for hunters and poachers operating in the area.

4.26 When operational the dam will substantially increase the accessibility of the Reserve at the points closest to the monkey's core habitat and may thus lead to disturbance. There will be road access to the dam and, behind, the lake, which will be more easily navigable than the existing river. The flooding will also fill the valley of the Pac Vang River making this area navigable by boat. Increased accessibility will facilitate hunting and poaching, informal settlement, timber extraction and slash and burn agriculture. The likely growth of Na Hang town during and after construction may introduce new pressures. It will make more difficult the task of the Forest Protection service.

4.27 However, there will be fewer people resident in the valley and thus some reduced pressure on the Reserve. Currently these local people place most pressures on the natural resources. If the resettlement program is successful, then these pressures will decline. However, if the resettlement program is not successful, local people may seek to colonize new areas and, with restricted cultivable land, may put greater pressures on the natural resources.

4.28 A possible mitigation for disturbance is translocation. However, translocation is fraught with problems, often fails, and is generally considered an undesirable form of mitigation unless it is the only possibility for survival. Boonratana and Le (1994,1998) have recommended against any attempt to capture for any purpose including translocation until there is a better understanding of the monkey's ecology.

Francois langur (Trachypithecus francoisi)

4.29 There is believed to be a small population of the Francois Leaf monkey resident on the slopes of Pac Ta Mountain. Ratajczak suggested a population of up to 20 family groups in 1992, whilst Boonratana records the species as present in 1993 and 1994 and provisionally sighted in 1998. The Francois' Leaf monkey is listed by IUCN as a globally threatened species and is classed as "vulnerable."

4.30 The Francois monkeys live in harem groups with one male overseeing a group of between three to twelve individuals. They select permanent, overnight stopping posts usually near caves and on inaccessible cliffs (Ratajczak 1992). The remote cliffs high on the almost vertical faces of Pac Ta Mountain thus appear as suitable habitat.

4.31 The dam will not absorb this habitat but will bring increased disturbance from construction work below. This will be especially so in the construction phase as the dam will be built below Pac Ta Mountain. In principle, the habitat will also become more accessible and more prone to disturbance given the rise in water levels and the easy navigation on the lake.

Other Threatened and Protected Species

4.32 The other threatened mammal species listed by Boonratana (1994) for the Na Hang Reserve are shown below, with their IUCN classification.

Table 1. Threatened Mammal Species in Na Hang Nature Reserve

Key:

Latin Name

Common Name

IUCN Status

Typical Habitat

<p><i>Nycticebus pygmaeus</i> Pygmy Loris/Lesser Slow Loris Vulnerable Dense Forest</p>	<p><i>Chrotogale owstoni</i> Owston's Palm Civet Vulnerable Secondary Forest, Dense Forest</p>
<p><i>Macaca arctoides</i> Bear Macaque/Stump tailed Macaque Vulnerable Dense Forest</p>	<p><i>Neofelis nebulosa</i> Clouded Leopard Vulnerable Secondary Forest</p>
<p><i>Macaca assamensis</i> Assamese Macaque Vulnerable Secondary Forest, Bamboo Forest</p>	<p><i>Panthera tigris</i> Tiger Endangered Open Areas</p>
<p><i>Macaca nemestrina</i> Pig tailed Macaque Vulnerable Open Areas</p>	<p><i>Ursus thibetanus</i> Asiatic Black Bear Vulnerable Open Areas</p>
<p><i>Cuon alpinus</i> Dhole Vulnerable Open Areas</p>	<p><i>Capricornis sumatrensis</i> Serow Vulnerable Limestone Forest</p>

4.33 There are also threatened birds, a threatened butterfly and threatened tortoise as listed in table 2.

Table 2. Threatened Birds, Butterflies and Tortoises in Na Hang Nature Reserve

Key:

Latin Name

Common Name

IUCN Status

<i>Picus rabieri</i> Red Collared Woodpecker Vulnerable	<i>Mandarina regalis</i> Vulnerable
<i>Lophura nycthemera</i> Silver Pheasant	<i>Indontestudo elongata</i> Vulnerable

4.34 Thirteen threatened species of plant have also been identified.

Burretiodendron Hsienne

Markhamia Pierrei

Podocarpus Fleuryii

Kateleeria Calcarea

Chukrasia Tabularis

Dracontomelum Deeperreanum

Annamocarpa Sinensis

Terminalia Myriocarpa

Garcinia Fragraoides

Acorus Gramineus Soland

Polygonnus Siense

Morinda Officinalis

Cassia Tora.

4.35 Limited knowledge of the distribution and ecology of these species has prevented an accurate assessment of the impact of the dam on these threatened species. Further survey work would be a vital component of any full EIA.

Conclusions

4.36 It is difficult, based on known facts, accurately to predict the impact of the dam on the Nature Reserve. There must be concern, however, that some loss of habitat and, more significantly, increased disturbance, could endanger the globally important and small populations of the Tonkin Snub-nosed Monkey and the Francois' Leaf monkey. There is an urgent need for further study of the ecology and range of these species and for the detailed specification of mitigating measures should the dam proceed. Recommendations on research and mitigation are made in the next section.

5. Preliminary Environmental Impact Assessment

Introduction

5.1 In this section we consider the principal environmental and socio-economic impacts of the dam. In keeping with the guidance provided by the Asian Development Bank for EIA of dams and reservoir projects (ADB 1993) we consider physical resources, ecological resources, human use values, quality of life values, and individual topics as per the Bank's checklists under these headings.

5.2 We seek to identify the relative significance of these impacts in terms of their scale and the sensitivity/value of the resource affected. Impacts are classified as minor, significant, or very significant. We consider whether there is any scope for reducing adverse impacts (mitigating measures) and we make recommendations for further study to clarify impacts. We also note where data is lacking and/or we have been unable to reach any conclusions on impacts in this preliminary assessment.

Physical Resources

Geological and Soil Resources

5.3 The construction of the concrete dam and roads will require the extraction of construction materials including limestone, river sands and gravels, and topsoil. Given the availability of construction materials around Na Hang and the costs of transportation, there is a strong likelihood that materials will be extracted near the development site. Such extraction could result in a variety of environmental impacts including the loss of landscapes and habitats of value and disturbance, in terms of noise and dust, to local communities and wildlife. Until the quantity of materials needed is calculated and potential sites identified, it is not possible accurately to predict the impacts, but they are potentially significant adverse impacts.

We recommend that any full feasibility study/EIA should address the issue of demand for construction materials and from where they should be sourced.

5.4 Mitigation will relate to careful site selection and restoration. Clearly any extraction of materials from the Nature Reserve should be avoided.

Erosion and Sedimentation

5.5 The reservoir will potentially fluctuate between 95m and 120m above sea level, exposing up to 25m of bank side with limited vegetative cover. This exposure could give rise to erosion and siltation of the dam. Whilst this is in part an operational issue it is also an environmental issue given the possible loss of soil and the visual impact. This is classified as a significant adverse impact.

We recommend that any full feasibility study/EIA should consider measures to reduce bank side erosion during draw down having regard also to the visual impact of the works.

Ecological Resources

Climate

5.6 The introduction of a large body of water into a relatively enclosed upland valley is likely to substantially increase humidity and may have an advantageous effect on forest growth and agriculture. It has not been possible in this preliminary assessment to substantiate or quantify this impact.

We recommend that any full feasibility study/EIA should seek to establish and quantify the likely climatic effects of the reservoir.

Fisheries

5.7 Discussions with local communities suggest that the upper River Gam, which will be lost if the reservoir is created, is not used to any great extent for fishing. Indeed, comments were made that the numbers of fish had declined and that fishing was no longer a useful source of food.

5.8 At the time of writing we have been unable to assemble a species list for fish and other aquatic life. There are significant potential impacts relating to migratory fish that are likely to experience difficulty navigating past the dam even if fish ladders are included. There are also potentially significant adverse impacts for downstream fisheries because of the inevitably increased quantities of silt, which will be discharged during and possibly after construction.

We recommend that any full feasibility study/EIA should consider the existing fishery value of the Gam River and the need to protect these resources during construction and operation.

Aquatic Biology

5.9 The development of the dam will result in the loss of over 30kms of natural river, associated islands, sand banks, and riverbanks. Wege et al (1999) note that "the riverine forest ecotone remains seriously under-represented in the protected areas network (in Vietnam). A number of globally threatened species are dependent on riverine forest habitats. To ensure their conservation, it is important that entire watersheds are included within protected areas." The loss of the riverine habitats is therefore a significant adverse impact and cannot be wholly or adequately compensated.

We recommend further surveys, as part of any full EIA, to identify key riverine habitats and to establish the range of aquatic life in the river. Such surveys will also provide the basis for developing mitigation measures such as the design of the lake edges.

Terrestrial Wildlife

5.10 As described in section 4, the proposed development is likely to reduce the habitat available to the Tonkin Snub-nosed Monkey and to increase disturbance especially during construction. Given the small population and critically endangered status of the species, this is a very significant adverse impact.

We recommend that any full feasibility study/EIA should include a new survey of the status, ecology, range, and survival prospects of the Tonkin Snub-nosed Monkey.

5.11 It is difficult to mitigate this impact. Extension of the monkey's habitat eastwards, through resettlement and habitat extension should take place prior to any construction work. Efforts should also be made to restrict blasting and other noise and to restrict access to the Reserve during the construction period. Effective resettlement and enhanced forest protection may also increase the possibility of the monkey's survival.

5.12 The development, especially the construction phase, is also likely to increase disturbance to the Francois' Leaf Monkey. Again given the small population and endangered status of this species, this is considered a very significant adverse impact.

We recommend that as part of any full feasibility study/EIA, new surveys be made of the habitats and distribution of the Francois' Leaf Monkey.

5.13 We also noted in section 4 a range of other threatened mammal, bird, butterfly, tortoise and plant species. There is a need to undertake further research into the impacts of the dam on these species.

We recommend that as part of any full feasibility study/EIA, new surveys be made of the habitats, which will be inundated by the dam, and explicit consideration be given to the impacts of construction and operation on the threatened species found in the Reserve.

Forests

5.14 The majority of the land that will be inundated constitutes natural or semi natural forest vegetation. FIPI forest inventories and preliminary field surveys suggest that the quality of forest that will be inundated is not of the highest quality. Based on his field surveys, Mr. Chung has concluded that the existing forest that will be lost is almost all secondary forest and scrub of very low value. However detailed surveys are necessary and forest conditions are better than in neighboring provinces. Given the scale of loss, we conclude that this constitutes a significant adverse impact. However, it should be possible to mitigate this impact by harvesting commercially valuable timber prior to flooding. Taking into account such mitigation, the impact may then be classified as a minor adverse impact.

We recommend that a detailed study of the forest types to be lost be undertaken as part of any full feasibility study/EIA.

Human Use Values

Agricultural Land

5.15 The EVN pre-feasibility study concluded that 1020ha of agricultural land would be lost. Government officials noted that the Pac Ta site has been preferred in part because it minimizes the loss of agricultural land. Although the land lost constitutes a relatively small part of the total area, it nevertheless provides livelihoods for some 11,000 local inhabitants. It will also involve the loss of 52 irrigation projects. Given the scale of the loss and the value of the resource, this adverse impact is considered significant.

5.16 This loss cannot be directly mitigated given the lack of flat, cultivable land beside the reservoir. The present inhabitants will have to be resettled in another area and provided with land of comparable size and quality.

5.17 In terms of overall agricultural productivity, it is anticipated that there will be some gains in terms of increased cropping on 6000ha downstream of the dam assisted by the augmented flows in the dry season.

We recommend that in any full feasibility study/EIA attempts be made to calculate the increased output realistically possible from increased water in the dry season.

Aquaculture

5.18 The reservoir will provide a potential resource for the development of aquaculture. Care will need to be taken to avoid introducing species that will upset the local ecosystem. There will also be a need to minimize human intrusion into the Reserve. Nevertheless this is a potentially significant positive impact.

We recommend that in any full feasibility study/EIA, the feasibility of establishing aquaculture on the reservoir should be investigated together with safeguards for the water environment and the Nature Reserve.

Navigation

5.19 The reservoir will provide for easier water-based navigation. However, given the reduction in settlement in the valley, this is considered only a minor positive impact.

Recreation

5.20 The reservoir may be suitable for a variety of recreational activities including boating, sailing, canoeing etc. However, the river is not currently used for recreational activities suggesting that relative remoteness will tend to restrict such uses. This is considered only a minor positive impact.

Power and Flood Control

5.21 These benefits have been outlined in the description of the proposal above. The additional power supply is considered a very significant positive impact and the flood control a significant positive impact.

Highways

5.22 Improved road access is seen as following the decision to build the dam as construction materials, construction equipment, turbines etc. will need to be brought to site from the south. It is anticipated that such improvements, reducing journey times from Hanoi, might bring further development possibilities to the town and area. Road improvements could, of course, be made without the construction of the dam, bringing the same perceived benefits. Nevertheless the impact may be classified as a significant positive impact.

There will also be a need to provide new highways in the valley to replace those inundated and to provide access to the remaining communities. In the absence of detailed plans it is not yet possible to assess these potential impacts.

Quality of life Values

Socio-Economic

5.24 Construction employment will depend on the construction methods adopted by the contractor(s). Previous dam developments in Vietnam have employed tens of thousands of workers but with increased mechanization this figure could be substantially reduced. Government officials estimate the construction labor force as 7000-8000 persons. Clearly this will have a major economic and social impact on Na Hang township. It will bring new expenditure in to the town and create new economic opportunities for local people. This will constitute a significant positive impact.

5.25 Many services and facilities (such as schools, clinics etc.), especially in Na Hang, will have to be expanded and upgraded to meet the needs of the incoming population. This could constitute a significant benefit for the local community.

5.26 However, the presence of a large workforce will also create potential social problems and will increase the likelihood of intrusion into the Nature Reserve.

We recommend that the full feasibility study/EIA consider further the likely scale of the workforce, its housing, and the way in which economic benefits to the local population can be maximized and the social problems minimized.

5.27 After the completion of construction, there will be only some 100 permanent jobs associated with the running of the power station and the maintenance of the dam. This constitutes a minor benefit.

5.28 It is perceived that improved accessibility to Na Hang and easier transportation on the reservoir may open up significant potential for tourism. This would require determined planning and investment and could conflict with the objectives of the Nature Reserve. A possible alternative scenario might involve creating Na Hang as a National Park with a consequent reconsideration of the role of tourism.

Resettlement

5.29 The dam, according to estimates by Government officials in Na Hang will affect:

6 communes (see 2.23 above for details)

45 villages

1766 families

11,125 individuals

5.30 These communities comprise a variety of ethnic groups including the Dao, H'Mong, Tay, Kinh and Hoa. Some villages consist of homogeneous ethnic groups whilst others are mixed. They are principally communities of subsistence farmers with a minority of residents classified as suffering from food insecurity.

5.31 No detailed resettlement plans have yet been prepared. Provisional proposals have been made to relocate 632 households in Na Hang District and 1134 in other districts, primarily Chiem Hoa.

5.32 Preliminary indications are that resettlement will follow the precedent set in previous hydropower projects and will involve an expenditure of 120 million VND per individual. Resettlement costs will therefore account for 15%-20% of the total budget.

5.33 Experience of resettlement suggest that it takes farmers up to three years to stabilize livelihoods. The resettlement will therefore have a very significant adverse impact on the individuals involved. There would also be a significant adverse impact on the communities receiving the settlers.

5.34 This impact can be mitigated by careful planning and action. The authorities need to respond to the wishes of the people as outlined above, viz:

- a desire to stay in the locality and not be moved away to a distant area (especially the south)
- a desire to be resettled as a community
- a desire to move houses as well as possessions
- a concern that there should be adequate compensation for fruit trees, crops and, if necessary, houses
- adequate land and water supply at the new location
- the provision of adequate infrastructure in terms of schools, clinics, accessibility etc.
- the need to respect different cultures and the degree to which they interact.

5.35 Adequate preparations and infrastructure also need to be put in place before resettlement takes place. If all the above is possible, then the impact may be modified to significant.

Cultural/Historical/Archaeological

5.36 We have been unable in the three-week study period to identify data on cultural/historic and archaeological sites and values.

We recommend that as part of any full feasibility study/EIA a survey be undertaken of cultural/historical and archaeological sites and proposals made for their protection.

Aesthetic

5.37 The landscape of the upper Gam valley is very attractive, with spectacular limestone mountains, the river valley itself, and the contrasting areas of settled land and paddy. Although few tourists visit Na Hang, the landscape as well as the wildlife offers a potential resource for tourism development.

5.38 The creation of the dam will inevitably change this landscape, removing the river and most of the cultivated land and substituting a long, narrow lake behind a tall dam. Fluctuations in water levels would, at low water, expose up to 25m of bank side with limited vegetation cover. Road works, the power station, pylons, and power lines may also intrude into this undeveloped landscape. This is considered a significant adverse impact.

5.39 Mitigation will relate to effective landscape planning and to the consideration of the landscape and visual impacts of all the developments relating to the dam.

Public Health

5.40 The process of quarrying rock, extracting other building materials, and constructing the dam, roads, and the power station will generate dust. This should be minimized by good construction management thus making the adverse impact minor.

Conclusions

5.41 The impacts of the proposed dam are summarized in table 3. Positive impacts are shown bracketed and unknown impacts with question marks. It is evident that the dam will have a range of positive economic impacts. However, there are a number of potentially very significant and unknown environmental impacts that require greater attention and mitigation before any development.

6. Findings, Recommendations, and Conclusions

6.1 The proposal to dam the River Gam below Pac Ta Mountain will create a long narrow reservoir stretching over 30kms up the valley and its tributaries. The principal impacts of the dam will relate to:

- the resettlement of 11,125 people
- the inundation of 57km² of land including 220ha of the Na Hang Nature Reserve, and 1020ha of agricultural land
- the loss of over 30kms of natural river
- a potential reduction in the habitat of the Tonkin Snub-nosed Monkey and increased disturbance especially during construction but also potentially during operation
- disturbance to the Francois leaf monkey during construction
- the regulation of river flows below the dam contributing to reduced flooding in Tuyen Quang and increased irrigation for farmland in the dry season
- improved access to and increased development in Na Hang.

6.2 We conclude that the significance of some predicted environmental impacts and uncertainties about other impacts demonstrate the need for a full Environmental Impact Assessment.

6.3 This assessment must:

- assess the demand for construction materials and likely sources
- consider the issue of bank side erosion
- establish the likely climatic effects of the reservoir
- assess the fishery value of the River Gam
- establish the nature and extent of riverine habitats
- establish the current status, ecology, and range of the Tonkin Snub-nosed Monkey
- establish the habitat and distribution of the Francois' Leaf monkey within the Reserve
- establish the likely impact of the dam on other threatened species within the Nature Reserve
- assess and map the forest types in the area to be inundated
- calculate the likely additional agricultural output arising from downstream irrigation
- consider the size and housing of the construction workforce
- assess cultural/historical/archaeological resources in the area

7. Alternative Development

The PARC project is concerned with the long-term conservation of the Na Hang Nature Reserve. It is therefore worthwhile posing the question what actions should be taken if the dam proposal does not proceed? We see two principal areas for planning and action. First, it would be appropriate to consider the potential for economic development within Na Hang without the dam. What scale and type of tourism would be compatible with the conservation of the Reserve? How can access to Na Hang be improved? Are there other economic activities that could be promoted? Would it be appropriate to make Na Hang a National Park to enable tourism development?

7.2 Secondly, if the dam does not proceed, there will be a need to review alternative proposals for safeguarding Tuyen Quang town from flooding.

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