APPENDICES

with the advisory review of the
environmental impact statement of the
Arun III hydroelectric project,
Nepal

(Appendices 1 to 4)

APPENDIX 1

Projectinformation

Proposed activity: The Nepal Electricity Authority plans to establish in the Arun Valley, in eastern Nepal a 402 MW run off river hydroelectric project consisting of a reservoir of 50 hectares, a dam, twin headrace tunnels (11.5 kms), a power station, power transmission lines (380-410 kms) and an access road of 122 kms from Hile to the dam site. A US$ 764 million loan has been solicited from the World Bank.

Categories: Hydroelectric power projects, power transmission lines, roads.

Project number: WW/92/850 vlgnr. 10.

Progress: An environmental Impact Statement has been submitted to the board of directors of the World Bank. An internal Study Appraisal Report is in preparation at the World Bank. This report will be discussed in the board of Directors by the end of May 1994.
A review advice on the Executive Summary of the EIS has been submitted to the Netherlands Minister for Development Cooperation on the 2nd June 1994.

The composition of the working group of the Commission for EIA is as follows:
- mr. J.F. Agema;
- mr. L. K. Chettry (resource person in Nepal);
- ms. J.C.A.M. Leesberg;
- ms. R. Noorduyn;
- mr. J.T. de Smidt (chairman);
- mr. J.C.J. van Wetten;
- mr. J.H. van Wijnen;

- mr. R.A.M. Post acts as technical secretary.

APPENDIX 2

Review framework for the environmental impact statement of Arun III Hydro electric project

This review framework should be seen as a near to complete checklist of subjects that could have been addressed in the EIS. It lists, irrespective of their relative importance, all EIA-related aspects that might be relevant for decision making. It has been used by the Commission to check whether all aspects have been covered in the EIS. Review findings are formulated on headlines, which summarise most of the relevant aspects, mentioned in this review framework.

The EIS should describe:

1) Project Title

The project title should identify the type of project proposed and its general location. It should also indicate whether the project is part of a larger plan or series of projects.

2) Project Initiator

Which public or private organisation has initiated the project. If the EIA is not drawn up by the initiating organisation, the name of the organisation that carries out the EIA should be stated.

3) Justification of the project

This should outline the background of the project and the reasons for it being proposed. It should also explain a social and/ or economic need for the project.
Population groups and sectors of the community that will benefit from the project, must be described.
The objective of the project should be explained. A clear analysis of the problems in relation to the aspects which form the starting point of the project should be formulated. (Production of energy, export of electricity to enhance national income).
Upstream as well as downstream parts of the river should receive attention in this analysis. Integrated policy for the whole river basin should be formulated.
The analysis of the problems mentioned above, the objective of the project and the reasons for it being proposed should set limits to the identification of alternatives.

Relate to main objectives: Improvement of the social economic position of the total population (Basic Needs); preservation or improvement of nature and natural resources.

4) Conditions

The EIA should present the legal and policy framework. It should mention the development programs and policy conditions, national and international agreements, that may have an impact on the project et cetera (e.g. Nepalese government has decided in June 1993 to develop small and medium size hydro power installations).
The decision, the EIS is made for, should be specified.

5) The Proposed Activity

The activity will be implemented in two phases. Each of these should be described quantitatively (as much as possible) and graphically (with maps, photographs et cetera).

The following aspects of the building and the exploitation phase must be addressed in detail in the EIA.

a. **Construction phase:**

Costs.

Technical data on the hydro works, road and transmission lines (design, dimensions, construction itself; foundation and building materials for hydro works, road and power transmission lines; design, place and management of headrace tunnels, spillways et cetera; electric capacity of the total installation; design, type et cetera of turbines, special measures against erosion by road construction).

Methods of flushing (how and where) and desanding of the water needed. Location of desanding basins.

Size of reservoir and water quantities in the reservoir over the year.

Necessary infrastructure (transportation of materials and energy), also temporary infrastructure.

Exact location and route of hydro works, road, bridges and transmission lines. (maps).

Dimensions of the required area for hydro works, road and power transmission lines, (divided into agricultural land (types), forest (types) and residential areas), and space needed (temporarily or permanent) for building activities, working and living camps.

Location and lay out of the camps must be described. Steepness of slopes and existence of terraces in these areas should also be described.

Building materials needed, the places where they will be borrowed and the ways in which they will be transported to the construction area must be described.

Energy (the quantity needed, nature, origin and means of transport). Are generating facilities temporary or permanent. For which purpose will they be used then and for what price?

The provisions made for the construction phase: Quantitatively, where and how (storage of materials, fuel and machines; storage and disposal of waste water and solid wastes; the quantities of and the way of dealing with emissions to the air; other support facilities such as helipads).

Provisions made for the workers (housing [how and where], safety, health [water, sanitation and medical facilities], nutrition [food and food storage], waste disposal, regulations and supervision of public life in temporary communities).

Mitigating measures anticipated in the design, especially with respect to environmental pollution, prevention of erosion, conservation of forest, optimal fish migration, prevention and repair of damage and disturbance on account of the construction and construction workforce or on account of indirect effects of hydro works, road, power transmission lines and increased access to the total area. Also mitigating measures for Socio-economic adverse impacts must be described.

The EIS must describe how the participation of the people involved has been organised (information and consultation).

Resettlement of inhabitants and their houses (numbers, specific groups) from the construction areas of hydro works, road, power transmission lines and camp sites. Participation of the affected people in the decision making with regard to the location and conditions of their resettlement and other compensations (Land assignment, farm construction, infrastructure, credit facilities, water and electricity supply, education, health infrastructure et cetera).

Time table (schedule) of construction of hydro works, road and power transmission lines.

Establishment and enforcement of the rights (and duties) of the people involved.

Numbers of workers required for hydro works, road and power transmission lines; How many skilled and unskilled workers; whether or not from the Arun valley, the rest of Nepal or from abroad; How will the origin of the workers be controlled?

Numbers of people coming with the workers (their dependents or people just attracted by presumed greater opportunities).

The planned filling of the small reservoir (time table, will there be water downstream during the filling et cetera).

Composition of construction team and distribution of responsibilities.

Methods used for vegetation clearance and the effects.

b. **Exploitation phase:**

Water management regime as result of the exploitation of the hydro works, downstream and upstream and also seasonal influences on that regime (e.g. which proportion of the water will pass undisturbed? Which proportion will pass through the turbines?).

The fluctuations in water levels down and upstream, especially between the entrance and the outlet of the headrace tunnels.

Measures to reduce emissions to water, soil and air from the hydro works or from attracted industries, also along the road and the track of the power transmission lines.

Monitoring and management program (directed at water quality, control and maintenance of the hydro works, road or power transmission lines [which materials, how, which schedule et cetera]). Starting from scratch onward.

(Environmental) factors that influence the functioning and live span of the hydro works, road, bridges and power transmission lines (erosion, corrosion of hydropower units, GLOFS, earthquakes et cetera). Risk analysis including effects of the natural hazards on project components, people and nature during construction and functioning of the components.

Project team (size of workforce and type of training of attracted persons, Nepalese or not, local or not) and distribution of responsibilities during exploitation as well as provisions for the permanent staff members and workers (where and how, what are the costs).

Mitigating measures in the building phase, especially for indirect effects (better access, resettlement of inhabitants to the road, leaving the terraces on the hills and thus less maintenance of the terraces et cetera).

A short description of the other similar projects foreseen in the Arun valley (Upper and lower Arun).

6) Alternatives

a. Both the proposed plan and the alternatives (one of which is the 'no action' alternative, see point 7) will have to point out if and how the objectives of the project (see point 3) will be achieved. An indication must be given of the costs per alternative.

b. Alternatives should include alternatives for one "large" dam, i.e. alternatives for the total hydro project (e.g. a series of small dams, such as Plan B), alternative locations (for the road: valley or hill route) and alternatives (for example other materials) for the implementation of the hydro works, the road and the power transmission lines.

c. Each alternative should be described in the same way and for the same aspects and phases as the intended activity (see point 5).

7) Existing situation

a. Description of the existing environmental situation and the development if the intended activity or its alternatives will not be implemented ("the autonomous development").

b. This "no action" alternative will be the reference for comparison of the environmental impacts of all the alternatives.

c. The boundaries of the study area have to be defined. (The total Arun river basin, the tributaries as well as the rivers into which it drains itself, the Right Of Way of the road, the total resettlement/ land acquisition area and the route of the transmission lines are part of the study area). The effects of the mining, of the transport and supply of (building) materials, effects of the realisation of necessary infrastructure, of the relocation of great numbers of people, of better access of the valley and of emissions may pass the boundaries of the river basin. Each environmental aspect may have its own area of influence.

d. The description of the existing environment should comprise the following aspects:

1. **Physical and chemical aspects:**

Water quality up and downstream (temperature, siltation, dissolved compounds (toxic and non-toxic), nutrients).

Water flow in different seasons, the gradient, the pattern of flooding, the management and/ or use of the flooding, the morphology of the river bed, the sediment load, sedimentation et cetera).

The climate in relation to the hydrology and, if relevant, in relation to the occurrence of calamities.

Ground water flows up and downstream and their relation. Ground water quality.

Geomorphology of the river bed and the region of the hydro works, the road and the power transmission lines.

Soil structure and soil stability. How is the infiltration capacity of the soil, how is the sensitivity for erosion both up and downstream and around the road and the power transmission lines?

Tectonic and seismic activity of the area. (Does the road pass the Main Central Thrust fault?) Risk analysis and effects.

Extent and type of erosion (Risk analysis) in the hills, the valley and the Terai (power transmission line route) and the effects.

Air quality (if the hydro works or road attracts industry, possibly in the longer run).

Other (environmental) hazards, such as GLOFS, and their effects on the environment and the people.

2. **Biological Aspects:**

Type of vegetation in relation to climate, soil et cetera

Existence of "Conservation areas" in the areas where hydro works, the road and power transmission lines have been planned.

Presence of rare and /or threatened animal or plant species in the rivers and on the land in the study area and their specific needs within their habitats. With maps to specify their specific habitats. Indicate their special value (local, regional, national, international).

Presence of specific and /or sensitive ecosystems in the rivers or on the land. (maps).

Possible functions of (parts of) the plan area for animal species from outside the region (e.g. migratory birds).

Inventory of how much primary and secondary forest and what type of forest exists in the project area, in the region and the country; Indicate the local, regional, national or international value.

Present and ongoing pressure on the forests by human use.

Various biological parameters related to water quality of the river (plankton, benthos, insects (pathogenic organisms, vectors of diseases and others), water plants et cetera).

Migration patterns of fish species in the river and of vertebrates on the land (Ganges dolphin, Indian elephant et cetera).

3. **Human Aspects:**

Numbers of people living in or deriving their subsistence from the areas that will be occupied, also in relation to the rest of the region. Describe to which cultural or ethnic group they belong. Population growth in this area should be specified and the future population pressure estimated.

Means of living and dependence on the local natural resources. This information should as much as possible be given quantitatively (types of crop, yield, use of minor forest products and medicinal plants, livestock, is there optimal use of the land, how are energy requirements met and how much energy is needed, carrying capacity of the environment, also in relation to the population growth, how much seasonal out-migration for jobs et cetera).

Landownership and land use. Does legal landownership exist?

Numbers and kinds of livestock. How are they used and how are they fed, their pressure on the environment.

Socio-economic situation of the population (if necessary distinguish between men, women, ethnic minorities and landless) of the total area influenced by the project, also in relation to the rest of Nepal.

The health situation. Distinguish between different groups. Try to point out causes of specific health problems.
Take income level and possible malnutrition into account.

Existence of drinking water supply (availability, sources, water quality for domestic or agricultural use), sanitation, waste disposal, housing.

food situation (why is this area called "food grain surplus area"? Is there presently a food deficit?).

Availability of proteins (the role of fish, game or livestock).

Analysis of the Socio-economic importance of vector diseases c.q. waterborne diseases or other diseases and health problems.

Valuable cultural, historic (archaeological), recreational and aesthetic objects (e.g. scenic values, old trade routes), that could be affected by the project.

Social or economic contacts and activities made (im)possible by project implementation.

Local and regional institutions and governments.

Other projects and programmes for the Arun valley or the region, and their objectives.

e. The inventory should focus on insight into environmental aspects that will suffer most from implementation of the project: which persons are the most vulnerable, which areas are most sensitive and valuable?

8) Description of the Impacts of the Proposed Activity and the Alternatives

a. Impacts -during the construction and exploitation phase- of the hydro energy components of the project as well as from the road and the power transmission lines, should be addressed.

b. Beneficial and adverse impacts should be described.

c. Mitigating measures for negative impacts (if there are opportunities for positive influence, also when there are no negative impacts) should be described.

d. The term of influence, the reversibility, cumulation, synergism and antagonism of effects should be indicated.

e. Used research and prediction methods should be described, including their uncertainties and restrictions. The choice for these methods should be justified scientifically and socially.

f. Relevant aspects of water, soil, air, human beings (population, health, safety), animals, plants and their relations, as well as aesthetic, cultural historic and scientific values should be given due consideration.

The following aspects should be distinguished (see also under 7):

1. **Physical and Chemical Aspects:**

Impacts of the hydro works, the road and the power transmission lines on the water flow specified per season (i.e. upstream of the dam, directly downstream of the inlet of the tunnels and downstream).

Changes in water quality (emissions of salts and toxic compounds from the soil, contaminants from the turbines, oxygen over-saturation due to high pressure in the turbines, changes in sediment load, pollution caused by industry or waste and waste water from the workforce and other incomers [on work camps, living camps or along the road], et cetera).

Effects of decreased downstream flow rates during the filling of the reservoir.

Effects of decreased water flow rates in the river between tunnel inlet and outlet.

Changes in ground water levels and flows.

Analysis of the risks of erosion, landslides et cetera, as a result of ground works for hydro works, road and power transmission lines and on borrow pits or indirectly because of forest clearance et cetera Also secondary adverse impacts (on agricultural systems, roads, people's settlements, nature, et cetera).

Changes in air or soil chemical composition c.q. quality, due to construction activities, possible industrial development, use of road sealing materials, waste disposal, use of pesticides as a result of better access, et cetera.

Effects on hydrology and erosion of forest clearance (see indirect effects of better accessibility).

2. **Biological Aspects:**

Effects of changes in water flow regimes (especially between tunnel inlet and outlet) and in water quality of the rivers and the dam on fish stocks and stocks of species and for fish migration patterns over the seasons. Other changes in biotic aspects in and along the rivers.

Impacts of water flow through the turbines, (e.g. over-saturation with oxygen and its effects on water organisms downstream).

Damage to and disappearance of vegetations, (rare) plant and animal species, not only as a result of direct land take and removal of vegetations for the project itself, but also indirectly, because of changes in (ground)water flows and levels, higher population pressure (workforce and dependents) and better access (hunting, illegal and legal forest exploitation, export of major and more minor forest products, more livestock, land clearance for agricultural [export] production, increase of erosion et cetera).

Disturbance of plant and animal species and ecosystems due to the activities during the construction phase of the hydro works, road and power transmission lines (noise, vibrations, pollution), due to the construction and the use of infrastructure (interference with migration routes of birds, fish and other animals) and during the exploitation phase due to increased (industrial) activity and traffic on the road or due to the existence of the power transmission lines and the electro-magnetic fields thereof.

Effects for the environment of increase in tourism.

Effects for the environment of changes in means of living et cetera (e.g. increase in livestock numbers means greater pressure on the forests and increase of erosion risks).

3. **Human Aspects:**

N.B.: Special consideration has to be given to gender related problems and to the participation of the local people in mitigating adverse impacts of the project.

Numbers of people who have to be resettled or otherwise compensated, because their land is taken.

Numbers of people (of men and women respectively) who need supplementation of their means of living as a result of (temporary) impoverishment due to the implementation of the project (also by indirect effects of the project).

Effects of changes in fish population rates for the nutrition, subsistence and income of the local people.

Risks of over-exploitation of fish resources due to increased population densities, and its the effects on environment and people.

Possible new jobs in the hydro works (directly) or along the road (indirectly, e.g. transport, industry, trade).

Rate of increase in the demand for food, energy, health facilities et cetera.

Effects of increased population densities on food prices.

Improvement or deterioration of food supply of the population, also in relation with protein supply (livestock, game, fish), in relation to effects on the means of living and food prices, especially of marginal households, women and children.

Improvement or deterioration of local availability of fuel and on fuel prices.

Socio-psychological impacts due to the loss of traditional areas, means of living, existing family and organisation structures, or cultural norms, values and habits.

Temporary or permanent effects on means of living of people who have to remove or people who stay in the area (agriculture, animal husbandry, forestry, minor forest products, fishery, porters). Also improvement of means of living (improvement of markets). In this context consideration should be given to areas upstream, to slopes above the hydro works, to the road and the power transmission lines and to areas directly along the road.

Influence of resettlement of hill people, with their knowledge of terrace building, on the stability of the slopes in the hills.

Numbers of (unforeseen) immigrants to be expected, attracted by suspected opportunities to earn a living in the project neighbourhood and as a result of better accessibility, and the pressure on the area this influx will cause. Encroachment of local people along the road.

Improvement or deterioration of the accessibility of health facilities, midwives et cetera.

Risks for public health (e.g. water related diseases in relation to hygiene, water pollution, lack of sanitation and drinking water supply, proper food storage, import of contagious diseases, electro-magnetic fields). Specify the risks for different sections of the population (see point 7.d.3) as well as for the workforce and relate to their present state of health.

Risks for the state of health of livestock, specially water related diseases (see above) and their economic effects.

Information given to the people and the way this information has been communicated. (Information about impacts on their lives and means of living, about possible functional defects and faults for the construction phase as well as the exploitation phase of the project components. Defects and faults that may affect them. Information about mitigating measures). Describe also the way in which the local people have been allowed to decide on mitigating measures.

Impacts on the population health as a result of the increase in the use of fertilisers and pesticides on cash crops as a result of better market access.

Increase of tourism and trekking due to better access and its consequences for incomes.

Inconvenience and health risks due to dust and dust particles, diffusing pathogens during the construction phase.

Damage or disappearance of valuable cultural or recreational objects and economic and Socio-psychological effects thereof.

Effects of the project on energy (electricity) prices and population's capacity to pay these new prices.

Effects of increase in land prices on Socio-economic position of local people and on the environment.

Direct and indirect effects of incomes of project workers and the increase in the amount of money circulating in the valley on the valley's economy.

Effects of the project on the Nepalese international debt and possibilities for other projects.

Effects of the project on the other programmes (see point 7.d.3).

Compare the electricity tariffs with those of India and estimate the possibility of selling the electricity at reasonable prices to India.

Estimate the pressure during construction and exploitation of the project on local institutions.

Long term effects of "Boomtown" development (both on town itself and on surrounding environment).

9) <u>Comparison of the proposed activity and its alternatives</u>

a. Comparison of each environmental aspect. The "no action" alternative should serve as reference. Comparison should be effectuated on the basis of formulated standards and criteria.

b. Comparison with objectives (point 3), costs, usefulness and suitability for the local circumstances; what is necessary on institutional, educational et cetera, level; Which mitigating measures are necessary and relevant and what do they cost, et cetera.

c. a and b should lead to selection of the best alternative.

10) Lacunas, gaps in knowledge

a. What are the uncertainties in the predictions and why are these important for the implementation of the project and for the environment.

b. Proposal for an evaluation program:

1. A research program to fill the gaps in knowledge.

2. A monitoring program to check the actual environmental impacts and the effectiveness of the mitigating measures as well as to investigate possible unexpected effects (Methods and techniques to be used; data that should be monitored; time schedule of monitoring; way of reporting the results; budget et cetera).

3. Which institutions have to be established to implement the project, to implement environmental and other mitigating measures, to monitor all activities? (There should be not only an implementation unit within the project management team, but also one outside). What are the difficulties in relation with these institutional requirements. (e.g. legal provisions, budgets, staff, training, management and control [also of the institutions] and maintenance). How much time will it take to realise adequate institutional strength?

11) Summary

In the summary the most important elements of the EIA should be described in a nontechnical manner, intelligible to the broad public.

APPENDIX 3

Alternatives

In this appendix alternative technologies as well as analyses on capacity expansion and alternative sites for electricity generation are described. This description is based on studies performed by the L.C.G.E.P. in 1987, 1990 and 1993.

1. ALTERNATIVES

1.1 Generating sources

The following sources for electricity generation have been considered:
a. Fuel wood and other forms of biomass;
b. Fossil fuels (diesel and gas);
c. Nuclear;
d. Solar, wind and geothermal and
e. Hydro (run-of-river and storage).

The use of fuel wood has to take into account that harvesting of remaining forest in Nepal is unsustainable. Biogas has limited possibilities. Fossil fuels must be imported which means drain of foreign exchange. The EIS states that nuclear power is not a realistic option. Solar- and wind energy have possibilities for some contribution, while geothermal electricity generation has not been explored in Nepal.
As the country has a huge hydroelectric power potential (about 25,000 MW), its exploitation is considered a feasible option. The EIS concludes that thermal stations and hydropower are options, which can fulfil the power demand of Nepal.

1.2 Installed capacity

The currently installed electrical generation capacity is some 250 MW which in reality is about 200 MW. According to the EIS, measures are being prepared to apply electricity demand management which includes cutting system losses and illegal connections.

1.3 Analyses on capacity, expansion and alternatives

The optimal mix of thermal stations/diesel and gas/run-of-river - and storage hydropower sites at the Arun and other rivers was studied by L.C.G.E.P. (1987). In this study the Arun hydropower sites are consisting of three main components, viz.:
- Upper Arun.
- Arun III and
- Lower Arun.

In order to avoid large reservoirs, preference has been given to run-of-river hydropower.
The above mentioned study concludes that for reasons of robustness Arun III should be built as a priority, followed by the upper Arun scheme. Further it concludes that implementation of Arun III should pursue wether or not intermediate schemes were implemented.

As leading candidate for such an intermediate project Kali Gaudaki (102 MW run-of-river) was identified. Detailed engineering of this project is said to be ongoing.

Since the lower Arun scheme will be supplied by the Arun III plant, it has to be realized after Arun III is operational. It should be remarked that in the 1987 study **Arun III** Hydroelectric project was identified as the best major hydro power scheme for early addition to the Nepal Inter connected System under the L.C.G.E.P.
This conclusion was confirmed on the base of an updated study (1990) which has taken also into account aspects as displacement of investment by one large project, recovery of local costs through significant electricity tariff increases, risk of inflation, effects on the Nepalese balance of payments and requirements to pay for the overall power expansion plan.

The EIS mentiones that analytical work is presently done regarding:
- financial resource allocation;
- measures to avoid that investment in Arun III will not crowd out other projects, particularly those in the social and rural infrastructure sector;
- steps to open up the electricity supply system to competition in the private sector.

The above described considerations are derived from the Executive summary, based on the studies of L.C.G.E.P. in 1987 and 1990.

As has been reported to the Commission by NGO's in Nepal, it appeared that a third L.C.G.E.P. study has been carried out (1993). In addition to the fore mentioned hydropower project other small and medium sized projects, ranging from 22 MW - 660 MW, were studied for two expansion options viz 'Plan A' and 'Plan B'.

In the 'Plan A' the candidate hydroelectric projects were specified in two sequences and allowed to compete between themselves and with other thermal expansion candidates for the position in the least cost expansion plan. Eight candidate projects were chosen for this purpose. 'Plan A' also assumes a 50 MW long-term firm sale to India, starting from 2002, which was modelled as an additional load in the 'Plan A'. The commissioning of Arun III in the plan was assumed to be in 2002.

'Plan B' seems to have been studied by the World Bank for their internal review. It has not been published. According to information furnished by the Commission's resource person in Nepal, in 'Plan B'/Arun project was not allowed for commissioning before 2010, and in this sequence 15 projects ranging from 22 MW to 660 MW were analyzed. This plan assumed no long term firm sales to India.

This study concluded that even if the benefit of 50 MW is not included in the Plan A Scenario, the generation expansion sequence with Arun III hydropower project with commissioning date of 2002 was the least cost generation option (although NGO's state that it only differs 3% from the next most feasible option).

1.4 The Arun III Hydroelectric project

The installed capacity of the Arun III project will be 402 MW. Development of the project is envisaged in two equal stages of 201 MW. It is a "run-off river" facility which utilises normal flows in the river. Water diverted from the river will flow through a twin headrace tunnel (length 11.5 km) to an underground powerhouse, and then be discharged back into the river channel. For diverting the water into the tunnel a dam with a crest length of 155 meters and a height of 68 m. is required. The dam will be a concrete gravity structure. The reservoir created by the dam has a surface area of some 50 ha. and will extend about 4 km upstream.

2. ACCESS

2.1 Technology alternatives

As the sites for the Arun III power facilities are some 50 km north of the nearest road head, an access for building and operating the power facilities, has to be established. The following access technologies were considered in the EIS:

a. air (helicopter, fixed wing very short take off and landing and power balloons);
b. rope ways;
c. inclined railways;
d. river transport (barges) and
e. roads.

The EIS states that analyses showed that only roads formed a feasible option.

2.2 Road options

The 1986 Arun III feasibility study recommended a route ("Valley Route") descending from Hile tot the river and then following the valley throughout to the intake site at Physak sinda.
In 1987 a detailed feasibility study, concerning possible alignments based on the objective of maximising economic and social benefits to the region as well as providing access for the project, has been carried out. As a result the alignment "Hill Route" was recommended. Due to a decision to revise Arun's III development, the Valley Route (length 197 km) was investigated again in 1992. According to the EIS, the 122 km long Valley Route was chosen mainly for reasons of construction time saving (one year).

3. TRANSMISSION LINES

3.1 Routes

The direct route from the Arun III powerhouse to the major load centre Katmandu has a length of 200 km. Taking into account, construction constraints with regard to the terrain, only connections to the existing power transmission system have been considered in the EIS.

Power House to Hile
Initially the line was planned parallel to the access road along the "Hill Route". Shifting of this road to the "Valley Route" has resulted in a realignment over the Tumlingtar - Hill sector.

Stage 2 Lines: Hetanda versus Sindhuli
Two routes were considered both following roads viz:

- the proposed Sindhuli - Banapa road (130 km) and;
- the existing highway via Hetanda (215 km).

In the EIS the first alternative is favoured, provided that it is built before the transmission line.

Stage 2 Lines: Sapta Koshi Crossing

This line is in general following the East-West highway, between Duhubi and Dhalkabar. There is one major obstacle, namely the crossing with the Sapta Koshi river. This crossing is only possible upstream of the flood control structure near the border with India.

Two solutions are possible:

- parallel to the existing transmission line from Toom Dhalkabar to Duhubi (southern option) and
- the norther option north west from Duhubi, intersecting the river and crossing at Chatra Gorge and then in south west direction again intersecting the East west highway.

The EIS anticipates route selection on the base of risk analysis and environmental aspects.

APPENDIX 4

Involvement of the local public in the EIA process

On request of the Commission for the EIA in the Netherlands a review was made of the Main EIA reports in relation to the World Bank requirement of local involvement in EIA procedures. Local involvement has been assessed in the field. The findings are as follows:

The EIA was done in 3 parts: 1) 1990 EIA study (Hydroelectric power Components);
2) 1992 EIA Addendum;
3) Access Road EIA 1992

As not indicated in the executive summary (EIS), also no evidence was found of local public involvement in part (1) of EIA.

The breakdown of the local people contacted in part (2) of the EIA (see EIS page -A-4) is as follows:

In Tumlingtar:		In Hile:		In Basantpur:	
Teachers	2	Businessmen	2	Businessmen	2
Businessmen	3	Hotelier	1	Trader	1
Hoteliers	3	Porter	1	Ranger	1
Farmers	5	From Koshi Hill		Banker	1
Students	2	Devp. Program	1		
Staff of small hydro power project	4				
rest	3				
Total	22		5		5

Similar breakdown for part (3) of the EIA (EIS page- A-4):

In Hile:		In Basantpur:	
VDC members	2	Businessmen	2
Hotelier	1	Banker	1
Policemen	2	Hotelier	1
Shopkeepers	2		
Rest	1		
Total	8		4

In addition the EIS (part 3) mentions a list of 8 local people of similar categories who have been contacted on the way from Basantpur to Tumlingtar.

No formal announcement/notice of the EIA procedure was made. Local people were contacted and interviewed during field visits by the EIA preparation team. The information collection methodology used in these interviews was Rapid Rural Appraisal.
There was no involvement of the local public during Scoping.

Report made up in Nepal by mr. Laxman K. Chettry