No. 2

JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF INDUSTRY AND HANDICRAFTS OF
THE GOVERNMENT OF LAO P.D.R.

FEASIBILITY STUDY
ON
THE NAM NGIEP-I HYDROELECTRIC POWER PROJECT
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC



FINAL REPORT : VOLUME 4

SUPPORTING REPORT (II)
PRELIMINARY
ENVIRONMENTAL MANAGEMENT PLAN



FEBRUARY 2000

NIPPON KOEI CO., LTD.

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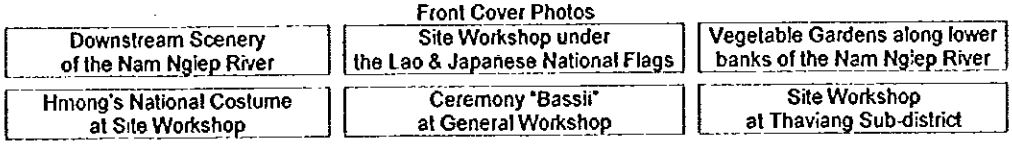
FINAL REPORT

COMPOSITION OF REPORTS

Volume 1	Main Report		
Volume 2	Executive Summary Report		
Volume 3	Supporting Report (I)	:	First Environmental Impact Assessment Report
Volume 4	Supporting Report (II)	:	Preliminary Environmental Management Plan
Volume 5	Supporting Report (III)	:	Preliminary Resettlement Plan
Volume 6	Supporting Report (IV)	:	Sub-Contractor's Field Investigation Report
Volume 7	Supporting Report (V)	:	Records during Field Investigations

Front Cover Photos



VOLUME 4 : SUPPORTING REPORT (II)

PRELIMINARY ENVIRONMENTAL MANAGEMENT PLAN

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1. OBJECTIVES OF THE PLAN

The objectives of the Environmental Management and Monitoring Plan (EMP) is to provide the framework for undertaking all the Environmental Protection Measures (EPMs) recommended and related to direct impacts of the Project, and to establish a monitoring of these measures throughout the life of the project, but with a special focus during the construction and filling phases. The Plan also provides a basis for evaluating the performances of the Project in carrying out the EPMs.

These EPMs include the mitigation measures, monitoring activities and studies for physical and biological impacts of the Project. However, some compensation measures in the downstream area for access road and Power Transmission Line land acquisition have been at this stage of the study included.

The EMMP provides also a possible institutional organization framework for its implementation, defining briefly the roles and responsibilities of each party.

2. SUMMARY OF IMPACTS AND MITIGATION

The following tables present the most probable impacts which may result from the successive development stages of the Nam Ngiep 1 HEPP.

Table 2.1 IMPACTS IN DOWNSTREAM AREA AND CONSTRUCTION ZONES

DEVELOPMENT PHASE	IMPACTED FIELD	TYPE OF IMPACT	CAUSES	CONSEQUENCES	CRITERIA CONSIDERED FOR ASSESSMENT	PROPOSED MITIGATION
CONSTRUCTION PHASE	AQUATIC SYSTEM	Water pollution by accidental release of chemical	Storage and handling of chemicals on construction site (mainly oil products)	Temporary effect on aquatic ecology and fisheries	Type of pollutant Dilution of pollutant at various distance from release	Appropriate storage & handling of chemicals Compensation
					Occurrence of event and severity Local fish consumption	Compensation
		Water pollution by release of pathogens in river	Inappropriate sanitation system of workers camps	Hazardous use of river as source of domestic waterbh	Type of pathogens (survival time) Flow velocity Population at risk Water use	Design of sanitation system Contract obligation for contractor Compensation
		Excessive sediment load	Inappropriate prevention measures during earthworks	Temporary effect on aquatic ecology and fisheries	Load SS Period (DS more affected) Occurence	Construction methods Compensation
		Permanent pollution by chemicals	No treatment of effluents from batching plant before release in the river	Effect on aquatic ecology and fisheries	SS and pH of river water Distance from release	Sedimentation and buffering ponds
	LAND SYSTEM	Impact on land use at construction sites	Implementation of project sites: construction sites, camps, quarries, disposal areas	Loss of natural resources Loss of grazing land Loss of agricultural land	Areas required & location Land use	Design to minimize needs Land acquisition & compensation
			Construction of access roads and Transmission lines	Loss of natural resources Loss of grazing land Loss of agricultural land Disturbance to wildlife	Areas required & location Land use Areas of interest for wildlife	Adjust route to minimize effects on valuable land Land aquisition
	SOCIAL	Local employment and income	Opportunities for unskilled workforce: earthworks, clearing	Improved income for local population	Workforce availability in the villages according to season Priority to local villagers Recruitment procedure	Give priority to local villagers for employment on project sites
		Public safety	Transport of equipment and materials, intense truck traffic	Noise Dust emission Accidents and injuries risk for villages crossed by road	Measures required to minimize the risk	Design Traffic regulations and signs Watering of roads during DS Reduce traffic at night
			Concentration of in-migrants in the construction area	Risk of epidemic diseases Dissemination of HIV and water related diseases	Prevention program and monitoring	Public information and awareness program
					Design and organization of camps facilities	Hygiene in the camps Medical control, equipment, monitoring
RESERVOIR FILLING	AQUATIC SYSTEM	Reduction of river flow	Impounding of the reservoir	If no riparian release (RR), 100% of aquatic habitat and fisheries destroyed for 3-5 years If riparian release, part of fisheries and habitats preserved	Appropriate RR Duration of filling and period Expected reduction of fish catches	Compensation
				Water shortage downstream	Alternative water supply	Compensation
				Irrigation impaired	% of affected rainfed and irrigated production	Compensation for loss
		Alteration of water quality	Flooding of vegetation and soils in the reservoir	Water anoxic after few months of filling	Duration of filling Organic matter available in reservoir and decay kinetic	Partial only Reservoir cleaning
				Unsuitable for domestic use Unsuitable for livestock use	Alternative water supply Village/HH numbers	Compensation
	SOCIAL	Resettlement of reservoir population	Impounding of the reservoir	Potential impacts on land use and on host population	Location and availability of land, Development planning of host or nearby villages	Mitigation measures to be addressed in RAP
		Employment and regional economy	End of construction works	Reduction of workers population and related local economic activities	Number of workers Average contribution to local economy	Public information
		Impaired river transport	Reduction of flow during filling	River transport impossible because of low flow, even with riparian release of 20 cumecs	Number of boats on the river Contribution to the local economy	Compensation
RESERVOIR OPERATION	AQUATIC SYSTEM	Irregular daily flows	Production of intermediate & peak energy (16 hrs/day)	Destruction of aquatic habitats and fisheries Erosion of river channel	100% loss of fisheries 100% loss river transport	Re-regulation pond or compensation
				Danger for people and livestock	High risk of accident	Warning system Re-regulation pond
		Regular seasonal flows	Energy production is stable year long	Improve dry season flow of Mekong	NNG flow as % of MKG flow	Not required
				Improve river transport in dry season	Number boats Increased level of river	Not required
				Provides high potential for dry season irrigation during both wet & dry season	Average discharge Land suitability Location for pumping station(s)	Not required
		No significant increase of flow in wet season	Run off is stored in the reservoir	No attraction of migrating fishes in early wet season Loss for fisheries	Nb of migrating species observed Importance in catches	Compensation for loss
		Low to very low sediment load in the water	Sediment is deposited in the reservoir	Water flow more erosive, mainly during dry season Risk of river bed erosion	Role of backwater effects from Mekong Risk possibly minimized by slow velocity of flow	River protection structures if required
		Short term anoxic water release	Decomposition of flooded vegetation & soil organic matter	Short term release of anoxic water, unsuitable for domestic & livestock	Expected duration of problem is 4 to 7 years according to FSL alternative	Pre-impoundment reservoir cleaning Res. Management
				Destruction of D/S fisheries as function of DO level	Re-aeration rate of water DO concentration at distance from dam	Alternative fisheries development Financial compensation
		Long term seasonal release of anoxic water	Stratification of reservoir Reservoir management	Unsuitable water for domestic and livestock use Effect river fishenes	Period of event: probably October to January, when reservoir level highest	Multi level water intake
		Long term accidental or permanent pollution of water	Development of population and industries around reservoir and in catchment	Unsuitable water for domestic use or for other uses.	Level of risk Type of pollution	Strategic plan for watershed control
	LAND SYSTEM	Loss of river bank gardens	Increase of river level by about 1 m in dry season with potentially more erosive waters	Loss of lower part of the river bank gardens (flooding or erosion)	Initial area of gardens potentially impacted Average crop production	Compensation

Table 2.2 IMPACTS IN INUNDATION ZONE AND CATCHMENT AREA

DEVELOPMENT PHASE	IMPACTED FIELD	TYPE OF IMPACT	CAUSES	CONSEQUENCES	CRITERIA CONSIDERED FOR ASSESSMENT	PROPOSED MITIGATION
CONSTRUCTION PHASE	AQUATIC SYSTEM	No significant impact anticipated				
	LAND SYSTEM	Impact on land use	Implementation inside the future reservoir of quarries, camps and disposal sites	Localized loss of natural resources, grazing land	Limited impact; areas required for construction purposes	Early compensation and land acquisition procedures
	SOCIAL	Local employment and income	Clearing of reservoir Collection of forest products	Improved income for local population	Workforce availability in the villages according to season Priority to local villagers Recruitment procedure	
		Resettlement of affected population	Flooding of the reservoir area	Development of new sites for resettlement to be completed before reservoir impoundment	Population, ethnic groups, needs for livelihood re-development	Resettlement Plan & Compensation for transitory period
RESERVOIR FILLING	AQUATIC SYSTEM	Loss of river habitats as permanent stream and rapids	Creation of reservoir	Loss of fast water habitats Disruption of river integrity	Presence of migratory species	Compensation by contribution to conservation trust fund
		Alteration of water quality	Flooding of areas rich in organic matter	Anoxic conditions of water resulting in fish kills Fish population taking refuge in upper tributaries	Carrying capacity of initial river area	Compensation by contribution to conservation trust fund
				Possible loss of rare fish species	Presence of rare species	Conservation of areas of similar biological value
				Water inadequate for domestic supply purpose (drinking/bathing)	Existing/resettled population around reservoir	Alternative water supply
				Water inadequate for livestock supply	Population around reservoir & estimated number livestock heads	Alternative water supply if required
	LAND SYSTEM	Loss of terrestrial habitats with associated flora and fauna	Inundation of the reservoir area	Loss of rare plant species	List of plants observed in the area	Conservation of substitute habitats
				Loss riverine habitats rich in bird diversity	Length of river flooded Areas of interest for biodiversity	Conservation of substitute habitats
				Loss of rare terrestrial fauna	List of animal species with conservation status	Conservation of substitute habitats
				Drowning of animals during inundation phase	Large mammals possibly at risk Velocity of flooding Pre-impoundment clearing Presence of islands	Pre impoundment program (clearing) Animal rescue program during reservoir filling
		Loss of forest products	Inundation of the reservoir area	Loss of existing forest timber	Type & location of forested areas Commercial timber density	Pre-impoundment logging
				Loss of existing non-timber forest products	Type & location of forested areas Importance in population income	Collection program associated with pre-impoundment vegetation clearing
		Loss of production systems and dwellings	Inundation of the reservoir area	Loss of houses, built-up private & community structures & infrastructures, of cultivated areas and grazing land	(See details in operation stage)	Planned resettlement and compensation
		Loss of mineral production	Inundation of the reservoir area	Loss of sand and gravel production; Possibly gold (not reported)?	Population affected Areas of interest	Provide households with substitute income
		Floating debris	Inundation of cleared area; Only part of wood biomass totally burnt	Threat for water intake and later for boat transport and fishing	Volume of trunks/branches Areas for landing and transforming	Preparation and implementation of a removal program
	SOCIAL	Population livelihood not yet re-established	Displacement of population to new sites just before flooding	New production systems to be implemented	Resettlement Action Plan	Assistance and compensation
RESERVOIR OPERATION	AQUATIC SYSTEM	River system permanently flooded	Creation of the reservoir	Loss of river aquatic products	Area of flooded river system	No mitigation
		Low water quality after filling (short term)	Decay of vegetation biomass and soil organic matter	Problem expected to last 4 (FSL 320) to 7 (FSL 360) years	Evaluation of vegetation biomass Pre-impoundment clearing plan	Vegetation biomass clearing may reduce duration of problem
				No reservoir fisheries until the end of water quality problem	Possible duration of problem Time required in other reservoirs to reach stable reservoir fisheries conditions	Net protein compensation to affected population
		Seasonal long term low water quality	Turn over of stratified reservoir	May limit intensification of fish production using floating cages	Risk of seasonal turn over due to the physiognomy of reservoir	Adjust production schedule in accordance with turn over occurence
		Gain of aquatic resources	Creation of the reservoir; Improvement of epilimnion quality	Increased productivity and potential for fisheries	Potential yield after stabilization of reservoir conditions	Development of a reservoir fisheries program
				Gain from fisheries intensification	Fish cages, fish species production according to management	Preparation of a reservoir fisheries intensification plan
		Increased sediment load in the water	Uncontrolled development in the catchment area resulting in increased erosion	Reduction of reservoir storage and related project life	Dead volume of the reservoir Erosion rate per km²	Strategic plan for watershed control
				Increased sedimentation at the tail of the reservoir May result in higher backwater effects with flooding of fields and built up assets	Hydraulic engineering of river levels Resettlement levels	Decrease FSL or increase resettlement level
		Presence of a long water body	Reservoir creation	Potential for transport of goods and persons	Lakeshore population	Not justified
		Reservoir access restricted by seasonal draw down of 30 m.	Reservoir management for energy production	Loss of potential benefit from transport part of the year (dry season)	Distance from lake shore in wet and dry season	Appropriate berthing facilities adapted to 30 m draw down
		Creation of temporary draw down areas	Reservoir management for energy production	Impaired landscape, possible sites for water related diseases	Draw down area is 54 km² (FSL 360) or 44 km² (FSL 320)	Management Plan for draw down areas
		Reservoir safety	Safety of public transport boats and on reservoir shores	Risk of drowning	Magnitude of transport on the reservoir	Installation of signs Inspection of boats for public transport
		Creation of new wetlands	Reservoir management for energy production	Potential for increased production of aquatic products and improvement of aquatic biodiversity	Location of potential wetlands Draw down area & topography	Management of wetland production Conservation status for key areas
		Creation of new spawning areas	Reservoir management for energy production	Increased fish production and biodiversity	Location of potential areas	Conservation status for key areas
		Improvement of reservoir water quality	Stabilization of reservoir water quality after 10 years	Economic gain of clean domestic water supply	Lakeshore population after 10 years estimated 12 per km of perimeter.	Not justified
				Economic gain of water supply for livestock	Livestock population based on human population;	Not justified
				Economic gain for reservoir side gardens irrigation	75% lakeshore household have garden (or 1.5 garden/km of reservoir bank)	Not justified
				Economic gain for irrigation along reservoir side	1 ha irrigation/km of reservoir shore	
		Long term eutrophication of reservoir	Nutrient inflow from a developed catchment	Development of aquatic weeds and floating vegetation which affects turbines, evaporation and reservoir productivity	Expected Phosphorus loading Magnitude of draw down Residence time for water	Watershed control Removal of vegetation if required
	LAND SYSTEM	Economic loss of future land resource harvest	Reservoir creation	Economic loss of timber resource	Area flooded, type of forest Annual average production	No mitigation
				Economic loss of non timber resource	Area flooded, type of forest Average annual value	No mitigation
				Economic loss for bamboo	Area flooded Density of bamboo	No mitigation
				Economic loss of future rainfed crop production	Area flooded Average production	No mitigation
				Economic loss of future dry season irrigated production	Area flooded Average production	No mitigation
				Economic loss of riverbank gardens	Household affected Average annual production	No mitigation
				Economic loss of grazing area	Number of livestock & cattle to move reflects grazing area	No mitigation
		Financial loss of developed land by displaced people	Reservoir creation	Loss of rainfed paddy fields	Area	Compensation for unmovable asset and 3 years production
				Loss of irrigated paddy fields	Area	Compensation for the unmovable assets plus 3 years
				Loss of gardens (fruits and vegetables gardens)	Area or unit	Compensation for unmovable assets plus

3. PROPOSED INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MONITORING PLAN

The proposed organization presented in the attached figure is based on a 2-level structure:

- An implementing structure, the Environmental Management Unit, and
- A coordinating and advisory structure.

3.1 IMPLEMENTING STRUCTURE

It is recommended that an Environmental Management Unit (EMU) be established under the responsibility of the Executing Agency, to implement all the measures proposed in the EMP. The EMU will provide manpower for monitoring activities, and co-ordination for study activities subcontracted to GOL Agencies or private consultants.

The EMU will be composed of the following members:

(i) The Environmental Manager (EM) , to be appointed by the Executing Agency. The EM will be appointed on a full time basis, for a minimum period of 7 years (5 years of construction and first 2 years of operation). The EM will report directly to the Project Manager. The EM will act on behalf of the Project Manager in dealing with Government Agencies or other parties concerned. He will represent theExecuting Agency in the Consultative Committee and will be responsible for maintaining good relations and communication with the local communities and authorities.

(ii) The Environmental Advisor (EA), to be appointed for the duration of the construction. He will be an environmental engineer appointed by the consulting engineer responsible for the supervision of the construction works. He will work on a full time basis in close relation with the EM, assisting him in the monitoring activities and providing technical assistance for selection and follow up of agencies or consultants in charge of technical studies.

(iii) Representative Engineers from GOL Agencies or private local specialists who will assist the EM in the monitoring of measures implementation. At least 4 specialists will be required on a full time basis: (1) Forest and biodiversity specialist, (2) Aquatic and Fisheries specialist, (3) Land Use specialist and (4) Public Health specialist. These specialists will follow the

investigations carried out at request by GOL Agencies.

(iv) Consultants, in charge of studies requiring an expertise field and level not available in GOL Agencies. They will be appointed on an ad hoc basis.

(v) The Environmental Officer (EO) from the Contractor side, who is in charge to implement efficiently all protection and mitigation measures which are under the responsibility of the Contractor.

3.2 COORDINATING AND ADVISORY STRUCTURE

This structure is composed of 4 advisory bodies:

(i) The Steering Committee, composed of representatives from all concerned GOL Agencies at central and Provincial/District level. It will follow up the progress of the implementation, provide advice and coordination between technical departments of Government Agencies.

(ii) The Local Committees, composed of representatives from Sub District Level GOL Agencies, and of the villages head and representatives of local groups as the Lao Women Union, the Elders association, the Youth Association, farmers association. At least 3 local committees should be required, for Upper reservoir, Lower reservoir and Downstream villages.

(iii) The Independent Panel of Experts, appointed by STENO and composed of at least 2 members, (1) Natural Environmental Expert and (2) Social development Specialist. This panel, following progress of activities every 4 to 6 months, will provide recommendation to EMU and make sure that measures are implemented in accordance with the EMP.

(iv) In case the Project is funded by an International Agency as the World bank or the ADB, the funding Agency will also probably monitor the progress of the work by regular visits of its specialized staff on the field.

3.3 AUTHORITY

For upper level decision making, the creation of an Advisory Committee is also proposed. This Committee, composed of high level members from concerned GOL Ministries and Agencies will provide advice and recommendations in order to reflect in the implementation of the mitigation measures proposed the Government Policy and Strategy. Some measures requiring policy orientation may concern for example watershed management, creation of conservation areas, participation of the Project to Environmental Trust fund. These will require consultation at higher level before implementation

The Committee will also provide advice during the course of the construction phase in case of disagreement or conflicts between parties, particularly for measures involving financial compensation.

It is recommended that this Committee is chaired by STENO, as the Agency is responsible for the enforcement of the Environmental Law and for the enforcement of EIA procedures. Other members should be representatives from each concerned Ministry, together with Provincial and District representatives.

Any decision or requirement of this Committee will be transferred to the executive level through the Steering Committee.

The EMU will be under the Authority of the Executing Agency, either HPO or EDL, depending on the type of Project (Government or private funding). The Environmental manager will report to the Executing Agency. The Environmental Advisor will report to the Resident Engineer and the Environmental Officer to the Contractor site Manager.

Technical staff appointed by the EMU will report to the Environmental Manager.

FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROELECTRIC POWER PROJECT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC JAPAN INTERNATIONAL COOPERATION AGENCY	FIRST ENVIRONMENTAL IMPACT ASSESSMENT	Figure 3.1
	SUGGESTED ORGANIZATION FOR EMU	

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	SUGGESTED ORGANIZATION FOR EMU	

4. ENVIRONMENTAL MEASURES

The Environmental measures are planned activities to ensure efficient and comprehensive environmental management during construction and operation of the Project. The measures recommended at the level of the First EIA Report include also studies and investigations to be carried out during the next stage of the Feasibility study and deemed necessary for a reliable assessment of impacts and for the elaboration of appropriate measures. This Plan does not include measures related to socio-economic issues as they are to be detailed in the Preliminary Resettlement Plan.

The 60 Environmental measures proposed are presented below.

4.1 MEASURES AND STUDIES FOR COMPLETION OF EIA

These studies should be undertaken during the 2 years for Feasibility study and Detailed Design stage of the Project.

A1 Monitoring of fisheries

Monitoring of fishery activities in the downstream villages has already been started during the present study. It is recommended to continue this monitoring every 3 months and to extend it to the upper reservoir villages if the alternative FSL320m is selected. Indeed, villagers of the upper reservoir will not be resettled and will probably be entitled for compensation for the temporary loss of fisheries in the river after impoundment of the reservoir.

A2 Aquatic Ecology Surveys

Two surveys have already been performed by technical staff from the Fisheries Department. It is considered necessary to have additional investigations to be performed by an international expert in Mekong fish ecology, in order to provide to the international community a document scientifically acceptable. Two (2) surveys, one in dry season and one in wet season are recommended.

A3 Study on intensification of fisheries

This study should provide the basis and the cost for the development of the most appropriate production system in the reservoir area and downstream. In the reservoir area, open fisheries and fish cage culture may be promoted after the reservoir has stabilized. In the downstream villages, objective is to provide an alternative river independent fish production system to the existing river subsistence fisheries which will

be probably affected by the Project. This study should lead to a Plan for implementation during the early stage of operation.

A4 Water quality monitoring

The monitoring initiated during the present study should continue during the Feasibility and Detailed Design stage of the Project development, but on a monthly basis instead of the present quarterly basis.

A5 Water quality forecast study

The probable low quality of the reservoir water during filling and first years of operation must be assessed more precisely in order to provide a basis for the justification and selection of a mitigation as for example a re-aeration structure or a multi level intake. The future water quality must be anticipated in the light of actual vegetation biomass flooded and of pre-impoundment strategy selected. This study has very close links with measures A7, A12 and A13.

A6 Study of sedimentation and backwater effects

In case alternative FSL320m is selected, this study is essential for the definition of the water level to be considered for resettlement and compensation in the upper reservoir.

A7 Study of re-aeration structures

The study will investigate the most efficient solutions observed worldwide and identify the most appropriate for improving the quality of the water released by the tailrace channel. The design of the selected structure will be prepared in coordination with the engineering staff of the Project.

A8 Study for optimization of the riparian release

The work will be based on the most probable filling procedure and assess the best release for both the downstream aquatic ecosystems and the Project interest. The option to have no release will also be investigated, depending upon the expected quality of the water during the first months of filling.

A9 Study for downstream villages water supply

The study will cover aspects as alternative source for safe water, water supply system proposed for each village, requirements of nearby resettlement sites if any.

A10 Land use study

A new aerial photo cover will be made available by the Project at the beginning of Feasibility studies. Land use in the reservoir area, along access road and transmission line will be prepared from these photos to serve as a basis for vegetation biomass assessment (A13), for optimization of routes for road and TL, and for estimate of compensation for land acquisition.

A11 River banks garden study

Investigations will be carried out in the downstream area and based on a new aerial photo cover to identify the garden zones on the river banks potentially flooded by a higher dry season discharge. This will serve as a basis for villagers compensation.

A12 Study on wildlife and biodiversity with rescue plan

The preliminary investigations carried out during the present study will be complemented by detailed field studies in the reservoir area and in surrounding zones anticipated to be of interest for wildlife. In addition to field investigations, the appointed consultant will prepare a detailed rescue program for those animals which may be trapped by the flood.

A13 Survey of reservoir timber and vegetation biomass

A survey for the evaluation of commercial timber in the reservoir will be carried out as a basis for the preparation of the logging plan. A map with standing crop of commercial timber distribution will be prepared. Survey of biomass in the reservoir will include the preparation of an amp of stratification of vegetation in the reservoir, the identification of sampling plots for vegetation biomass measure and soil sampling for organic matter content.

A14 Preparation of a logging and clearing Plan

Based on results of A13, a comprehensive Plan for logging and clearing will be prepared including zoning of the area, organization of activities, terms of reference for contractors, management of the plan, schedule and detailed budget.

A15 Strategic study for biodiversity compensation

The disruption of a forested area will have implications on biodiversity even if not major. As a compensation for that, it may be anticipated that the Nam Ngiep Project may follow the path of what has been already decided for Nam Leuk and what may be applied also to Nam Theun 2: an annual financial contribution of the Project to the conservation budget either directly to a specific NBCA, either through a national Conservation Trust Fund. This study will asses the most appropriate procedure to recommend for Nam Ngiep1 HEPP, and the expected participation level. It will analyze institutional aspects for enforcement and procedures for the follow up of funds utilization.

A16 Preliminary Watershed Management Plan

A preliminary study will be carried out within the EIA studies, and will be followed by a more detailed study during the construction of the Project. The aim of the study is to identify multiple potential development strategy for the catchment area taking into consideration sustainable use of resources, the presence of the reservoir as a focal development point and the need to keep land cover and sedimentation under control. From the institutional point of view, the study will benefit the results from the Nam Ngum watershed management program which is under implementation.

A17 EIA for resettlement sites

According to the areas which will be considered for resettlement, full EIA for each site will be prepared, with special attention for impacts on host population.

A18 Preparation of a detailed EMP

To follow this preliminary EMP, the preparation of a final document, based on results from all activities and studies previously listed and presenting detailed organization and task description will be prepared.

A19 Preparation of specifications

Based on the final design of the Project and on technical specifications prepared for bidding, detailed specifications will be prepared as future contractual obligations of the contractors. Procedures for spoil stabilization, sedimentation ponds, water treatment, sanitation etc will be part of this important document. It will include also the basis for fines to be applied to the contractor in case on non respect of the obligations or in case of accidental spill in the river.

A20 Coordination, reporting and presentation

The several activities to be undertaken during this period by several consultants need a strong coordination to come under common and coherent objectives. This must also be reflected in the reporting. Coordination meetings must be organized with several Lao Agencies as some aspects (A15, A16) will have large overlapping with Government policy matters. A Final EIA Report will be prepared in full accordance with environmental requirements of major Funding Agency which may be approached for supporting the Project implementation.

4.2 ORGANIZATION OF ENVIRONMENTAL MANAGEMENT UNIT

The activities related to this aspect have to be carried out during the year which precedes the start of the construction.

B1 Constitution of the EMU

The EMU must be created under the authority of STENO and the Executing Agency. STENO will also be the coordinating body to create with concerned Ministries the Advisory Committee. In close coordination with Advisory Committee members, STENO will identify the 4 Agencies representatives who will join the EMU for a 7 years period (5 years construction plus 2 first years of operation).

B2 Capacity building

Capacity building for the EMU is anticipated over a period of one year. It will consist in a Technical Assistance to the members by Consultants representatives of the major

fields concern. There should be one consultant per technical field (Aquatic and fisheries, Forestry and biomass, Land use, Public health) plus one consultant for training in project management (financial, scheduling and contract management will probably be the most required aspects).

B3 Preparation of a detailed working program for the EMU

The consultants in charge of capacity building will prepare a detailed working program for the EMU including detailed monitoring and reporting procedures, guidelines and schedules.

B4 Appointment of the Panel of Experts (POE)

STENO will identify and propose for approval by the Advisory Committee two independent experts for the whole duration of the Project construction.

One of the first task of this panel will be a review and adjustment of the EMU working program prepared under measure B3.

4.3 MEASURES DURING CONSTRUCTION PHASE

C1 Provide budget for EMU

This will include salary, supporting staff (secretary, driver), office, transport facilities, operating expenses. Budget will be managed by the EM under the supervision of the Executing Agency and with annual audit from the Advisory Committee.

C2 Provide budget for POE

Budget is managed by STENO. It is based on a mission every 6 months of the POE.

C3 Monitoring of Contractor construction sites

This measure is under the direct responsibility of the EM and the Environmental Advisor. Weekly visits of site with coordination meeting with EO. Major aspects will probably concern land use, water supply and sanitation in camps, lodging facilities for workers, safety on sites, public safety along access roads, respect of all environmental obligations as detailed during measure A19 and attached to contract.

C4 Provision for compensation if accidental spill

In case an accidental spill occur at construction sites, with detrimental effects downstream for the population, a compensation will be released to the villagers. A provisional fund must be made available for rapid compensation of the affected villagers. This amount will be then collected back from the Contractor responsible, and in accordance with procedures detailed during measure A19. This provision may not be used during the duration of the project

C5 Provision for independent arbitration

In case an accidental event requires the need for an independent investigation audit and arbitration, a provisional budget must be made available for rapid intervention. This amount will be then collected back from the Contractor responsible, and in accordance with procedures detailed during measure A19. This provision may not be used during the duration of the project

C6 Monitoring of fisheries in reservoir area villages and downstream villages

Subsistence fisheries will be monitored every 6 months (once in dry season and once in wet season) in all villages of the reservoir area and of the downstream Nam Ngiep River during the 5 years of the construction. This will provide the baseline for the evaluation of the compensation for fisheries loss and to establish a minimum target when preparing the fisheries intensification program. The work will be subcontracted to the Fishery Department of the MOAF.

C7 Construction of water supply for downstream villages

This measure is subcontracted to a contractor and must be completed before filling phase for all downstream villages located along the Nam Ngiep River.

C8 Water quality monitoring

Water quality monitoring will be carried out on a monthly basis during the 5 years of construction, under the supervision of the EMU aquatic and fisheries specialist. Sampling and analysis may be possibly carried out by the Vientiane Water Laboratory.

The budget includes activities related to occasional control in the river downstream of construction sites of sediments level, pH in water released from concrete mixing plants, hydrocarbons, or pathogens from sanitation systems.

The budget includes also a provision for a short annual technical assistance of a water quality Consultant for the interpretation of results and re-adjustment of program if required (sampling station, parameters).

C9 Study for the rehabilitation of construction sites

The study will be carried out by a Consultant to define exactly the requirements for rehabilitation by the Contractor of quarries, spoil or borrow areas at the end of the construction phase. The study will include a comprehensive inventory of all sites disturbed during the construction process with specifications for rehabilitation for each site.

C10 Preparation of specifications for logging and clearing

This will be prepared by a Consultant together with tender documents for logging and clearing, based on the logging and clearing plan (A14). Budget will include participation of the consultant to tender evaluation.

C11 Technical Assistance to EMU for supervision of clearing and logging

A specialized consultant should be appointed for monitoring the logging and clearing activities, to ensure that program is implemented in accordance with schedule, that no logging or clearing occurs outside the reservoir, that proposed buffer zones are respected.

C12 Clearing of the reservoir

The operation will be carried out by one or several contractors, and based on the extensive use of local workforce.

C13 Preparation of watershed management plan

Following findings and recommendations from the preliminary study on the subject (A16), a detailed plan will be prepared during construction phase. The Project supports the detailed study cost, but further long term development program will be supported at Government level by concerned Ministries. Only aspects related to Project protection (like reforestation of selected eroded areas) may be eventually supported by the Project. The Plan will provide to key development agencies in Laos a framework for comprehensive and sustainable development.

C14 Study for creation of wildlife conservation areas

Based on results of detailed wildlife investigations, a study to assess opportunity and cost for creation of protected area within the Nam Ngiep catchment will be prepared.

C15 Provide budget for land acquisition

The budget is established on the results of the land use observation along access road and transmission line during the EIA stage (A10). Budget to secure includes estimated compensation to pay to owners plus 50% of cost for a team to follow construction works and implement compensation. Compensation for access road must be available at the early months of Project construction. Compensation for Transmission Line will be required years 4 and 5 of the construction phase.

4.4 MEASURES DURING FILLING PHASE

D1 Provide Environmental budget

Operation budget is provided to EMU as during construction phase.

D2 Water quality monitoring

Water quality monitoring will be carried out on a monthly basis during the filling phase, under the supervision of the EMU aquatic and fisheries specialist. Sampling and analysis may be possibly carried out by the Vientiane Water Laboratory.

The budget includes activities related to occasional control in the river downstream of construction sites of sediments level, pH in water released from concrete mixing plants, hydrocarbons, or pathogens from sanitation systems.

The budget includes also a provision for a short annual technical assistance of a water quality Consultant for the interpretation of results and re-adjustment of program if required (sampling station, parameters).

D3 Specific monitoring of water quality

A special program for sampling and analysis is proposed during the filling period in order to follow as precisely as possible the evolution of water quality. Dissolved oxygen, nutrients (N,P), iron, pH, DBO5, DCO will be the main parameters to be followed on a weekly basis.

D4 . Monitoring of downstream fisheries

Subsistence fisheries will be monitored every 6 months (once in dry season and once in wet season) in all villages of the downstream Nam Ngiep River during the filling phase. This will provide some information on the decline of river fish and catches and a basis for compensation estimate. The work will continue to be subcontracted to the Fishery Department of the MOAF.

D5 Animal rescue plan and management of filling event

This is an important task to be sub contracted to a local consultant. The measure will include the following aspects:

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

D6 Removal of floating trunks

To be subcontracted to a contractor, equipped with boats. Remuneration may be established on a result basis, for example the number of m3 of logs and branches transported on the landing grounds.

4.5 MEASURES DURING PROJECT OPERATION (YEARS 1 TO 5)

E1 Provide EMU operation budget

EMU will operate for one year after impoundment. After, a simplified structure, integrated into the operating team of the project will mainly follow up water quality and fisheries aspects.

E2 Water quality monitoring

Same as usual, but including 2 stations in the reservoir and 2 stations downstream. Parameters related to organic matter and nutrients will be added to the original parameter list after 2 years, when measure E2 stops. Measurement of DO at various depth in the reservoir just upstream of the dam will be also included in order to assess depth of the thermocline.

E3 Specific monitoring of released water quality downstream

The special program for water sampling and analysis initiated during the filling period (D3) will continue during the first 2 years of the project operation. Dissolved oxygen, nutrients (N,P), iron, pH, DBO5, DCO will be the main parameters to be followed.

E4 Management of filling event

The management of filling event will end 1 year after filling. Additional animal rescue and follow up of results from previous year.

E5 Evaluation of loss of river banks gardens

Loss will be actually observed along downstream Nam Ngiep River after one year of operation. Compensation will be evaluated for each concerned villager.

E6 Provision for compensation of river bank gardens

A provision must be secured by the Project to pay justified compensation for the loss of river bank gardens.

E7 Downstream fisheries monitoring

In parallel with the implementation of the fishery intensification program, the monitoring of subsistence fishery will continue. The objective is to take opportunity of the Project to provide information on the evolution of subsistence fisheries after impoundment and comparison with original situation. Information will be useful for further hydro electric projects.

E8 Development of irrigation downstream

The Project supported the studies. The development of irrigation downstream, if justified, will be the responsibility of the MOAF, with its own budget.

E9 Contribution to Conservation Trust Fund

Depending on decision on that matter, the Project may have an annual contribution to a conservation trust fund in Lao PDR. This contribution may be a fixed amount or a percentage of benefits from electrical production of Nam Ngiep.

E10 Implementation of a watershed management plan

The watershed management plan goes far beyond the project role and interests. The Project may participate in financing some activities, at least those directly related to project interest (as erosion control for example).

4.6 MEASURES DURING PROJECT OPERATION (YEARS 6 TO 50)

F1 Water quality monitoring

Activity will continue as a part of project operation budget.

F2 Contribution to Conservation Trust Fund

Depending on decision on that matter, the Project may have an annual contribution to a conservation trust fund in Lao PDR. This contribution may be a fixed amount or a percentage of benefits from electrical production of Nam Ngiep.

F3 Implementation of a watershed management plan

The watershed management plan goes far beyond the project role and interests. The Project may participate in financing some activities, at least those directly related to project interest (as erosion control for example).

F4 Implementation of commercial fisheries in the reservoir

This activity is under the authority of the Fishery Department and probably under a bilateral or multilateral funding. This activity can reasonably start only after 2 to 6 years of reservoir operation, the duration anticipated to be necessary before the reservoir reaches stable conditions (2 years for FSL320, 6 years for FSL360).

F5 Implementation of fish culture in the reservoir

This activity is also under the authority of the Fishery Department and probably under a bilateral or multilateral funding. This activity can reasonably start only after 2 to 6 years of reservoir operation, the duration anticipated to be necessary before the reservoir reaches stable conditions (2 years for FSL320, 6 years for FSL360).

5. MITIGATION AND MONITORING COSTS

The following table provides a summary of proposed environmental measures with cost estimate. These values will be probably subject to changes during the next stage of the EIA study.

Table 5.1 Environmental Mitigation Studies and Measures (1/2)

No	Environmental Measures	Responsible Organism	Executing Organism	Duration of Activity (years)	Unit Cost Estimate (US$)	Total Cost of Period (US$) FSL360	Total Cost of Period (US$) FSL320
A	**Completion of EIA Study to International Standards**	JICA/GOL	HPO/ Consultant	2			
A1	Monitoring of fisheries	JICA/HPO	Dept. Fishery	2	15,000	30,000	30,000
A2	Aquatic Ecology surveys	JICA/HPO	Consulting	2	60,000	60,000	60,000
A3	Study on intensification of fisheries in reservoir area and in downstream villages	JICA/HPO	Consulting	1	60,000	60,000	60,000
A4	Water quality monitoring	JICA/HPO	Consulting	2	25,000	50,000	50,000
A5	Water quality forecast study (reservoir modeling)	JICA/HPO	Consulting	1	60,000	60,000	60,000
A6	Study of sedimentation and backwater effects	JICA/HPO	Consulting	1	100,000	50,000	100,000
A7	Study and design of water re-aeration structures	JICA/HPO	Consulting	1	50,000	50,000	50,000
A8	Study for optimization of riparian release	JICA/HPO	Consulting	1	20,000	20,000	20,000
A9	Study for Downstream villages water supply	JICA/HPO	Consulting	1	50,000	50,000	50,000
A10	Land use study based on new aerial photos for reservoir, access road and TL	JICA/HPO	Consulting	1	60,000	60,000	50,000
A11	Land use study of village gardens along river banks in downstream area	JICA/HPO	Consulting	1	20,000	20,000	20,000
A12	Study on wildlife and biodiversity with preparation of a rescue plan	JICA/HPO	Consulting	1	80,000	80,000	80,000
A13	Survey of reservoir timber and vegetation biomass	JICA/HPO	NOFIP, Consulting	2	150,000	150,000	110,000
A14	Preparation of a logging and clearing plan	JICA/HPO	Consulting	1	50,000	50,000	46,000
A15	Strategic study for biodiversity compensation and support (participation to trust fund?)	JICA/HPO	CPAWM, Consulting	1	20,000	20,000	20,000
A16	Preliminary watershed management plan	JICA/HPO	Consulting	1	10,000	10,000	10,000
A17	EIA for resettlement sites (Provisional budget)	JICA/HPO	JICA/HPO	1	100,000	100,000	70,000
A18	Preparation of detailed Environmental Management and Monitoring Plan	JICA/HPO	Consulting	-	60,000	60,000	60,000
A19	Coordination, reporting, presentation	JICA/HPO	Consulting	-	60,000	60,000	60,000
	SUB TOTAL A					**1,040,000**	**1,006,000**
B	**Organization of the Environmental Management Unit (EMU) and Committee**	GOL/DEV	STENO				
B1	Constitution of EMU	GOL/DEV	STENO/ HPO/EDL	0.5	80,000	80,000	80,000
B2	Capacity building of EMU (1 year Technical Assistance) and Creation of Committee	STENO/DEV	EMU/ Consulting	1	300,000	300,000	300,000
B3	Preparation of detailed working program for EMU	GOL/DEV	STENO / Consulting	0.5	Included in previous	-	-
B4	Appointment of Independent Panel of Experts (2)	GOL/DEV	STENO	-	-	-	-
B5	Preparation of detailed envir. spec. for Contractors	JICA/HPO	Consulting	-	30,000	30,000	30,000
	SUB TOTAL B					**410,000**	**410,000**
C	**Measures during Construction Phase**	GOL/DEV	EMU	5			
C1	Provide operating budget for EMU	GOL/DEV	STENO	5	180,000	900,000	900,000
C2	Appointment of Independent Panel of Experts (2)	GOL/DEV	EMU	-	60,000/yr	300,000	300,000
C3	Monitoring of contractor's construction sites and camps	GOL/DEV	EMU	5	EMU operation	-	-
C4	Provision for compensation for accidental spill or downstream pollution	STENO	EMU	When justified	(reimb.by contractor)	*100,000*	*100,000*
C5	Provision for independent investigation audit and arbitration of impact event if required	EMU	Consulting	When justified	(reimb.by contractor)	*20,000*	*20,000*
C6	Monitoring of fisheries in reservoir & D/S villages	EMU	Fishery Dept.	5	15,000	75,000	75,000
C7	Construction of water supply facilities for downstream villages last 1-2 years of Construction	EMU	Contractor	1-2	250,000	250,000	250,000
C8	Water quality monitoring (incl. tech. assistance)	EMU	Vientiane Laboratory	5	25,000	125,000	125,000
C9	Study for detailed rehabilitation of quarries, borrow and spoil banks	EMU	Consulting	1	30,000	30,000	30,000
C10	Preparation of specifications for logging and clearing tender documents, evaluation of tenders	STENO Forest.Dept.	EMU Consulting	0.5	20,000	20,000	20,000
C11	Technical Assistance to EMU for supervision and monitoring of logging and clearing	EMU	Consulting D. Forestry	2	200,000	200,000	150,000
C12	Clearing of reservoir	EMU	Contractor	2	5800,000	5,800,000	3,000,000
C13	Preparation of a detailed watershed development and management plan	STENO CPAWM	Consulting	1	100,000	100,000	100,000
C14	Study for creation of wildlife reserve	STENO	EMU, Consulting	1	50,000	50,000	50,000
C15	Budget for land acqui.&compens. along A/road & T/L	STENO/DEV	EMU	1	110,000	110,000	110,000
	SUB TOTAL C					**8,080,000**	**5,230,000**

Table 5.2 Environmental Mitigation Studies and Measures (2/2)

No	Environmental Measures	Responsible organism	Executing organism	Duration of activity (years)	Unit cost estimate (US$)	Total cost of period (US$) FSL360	Total cost of period (US$) FSL320
D	**Measures during filling phase**	STENO	EMU	1			
D1	Provide operation budget for EMU			1	180,000	180,000	180,000
D2	Water quality monitoring	EMU	Vientiane Laboratory	1	12,000	12,000	12,000
D3	Specific monitoring of released water quality	STENO	EMU, Consulting	1	12,000	12,000	12,000
D4	Monitoring of downstream fisheries	EMU	Fishery Dept.	1	15,000	15,000	15,000
D5	Implementation of the animal rescue plan and management of the filling event (2 years)	EMU	Consulting, Contractor	1st year	180,000	180,000	130,000
D6	Removal of floating trunks and branches and release on ground landings	EMU	Contractor	1	200,000	200,000	150,000
D7	Implementation of the fisheries intensification program in downstream villages	MOAF	Fish.Dept. Contractor	-	Not project	-	-
	SUB TOTAL D					599,000	499,000
E	**Measures during operation phase (year 1-5)**	STENO	EMU	1-5 Years			
E1	Provide operation budget for EMU	GOL/DEV		1	180,000	180,000	180,000
E2	Water quality monitoring	EMU	Vientiane Laboratory	5	18,000	90,000	90,000
E3	Specific monitoring of released water quality	STENO	EMU Consulting	2	12,000	24,000	24,000
E4	Management of the filling event (2 years)	EMU	Consulting Contractor	2nd year	70,000	70,000	40,000
E5	Evaluation of Compensation for loss of river bank gardens and existing irrigation facilities	STENO	EMU	1	EMU budget	-	-
E6	Provision for Compensation for loss of river bank gardens and existing irrigation facilities	STENO	EMU	1	50,000 (provision)	50,000	50,000
E7	Monitoring of downstream fisheries	EMU	Fish. Dept.	5	15,000	75,000	75,000
E8	Development of irrigation in the downstream area	MOAF	Irrig. Dept. Contractor	-	Not project	-	-
E9	Compensate for lost biodiversity by annual contribution to environmental trust fund ?	GOL	EDL or DEV	5	?	?	?
E10	Implementation of watershed management plan (for aspects related to Project)	GOL	EDL or DEV	5	?	?	?
	SUB TOTAL E					489,000	459,000
F	**Measures during operation phase (year 6-50)**	STENO	EMU	Years 6-50			
F1	Water quality monitoring	EMU	Vientiane Laboratory	5	12,000	60,000	60,000
F2	Compensate for lost biodiversity by annual contribution to environmental trust fund ?	GOL	EDL or DEV	45?	?	?	?
F3	Implementation of watershed management plan	GOL	MOAF	20	?	?	?
F4	Implementation of commercial fisheries program in the reservoir	GOL/DEV	MOAF	5	Not project	-	-
F5	Implementation of fish culture in the reservoir	GOL/DEV	MOAF, Private Sect.	5	Not project	-	-
	SUB TOTAL F					60,000	60,000
	GRAND TOTAL (A to F)					10,678,000	7,664,000

Note: DEV= Developer, EMU= Environmental management Unit, GOL= Government of Laos

6. IMPLEMENTATION SCHEDULE OF MEASURES

Implementation schedule for the proposed measures is presented in following table 6.1.

Table 6.1 Preliminary Implementation Schedule for Environmental Management & Monitoring Plan

No.	TASKS	Feasibility + Final EIA		DD+Funding	Construction				Filling	Operation	
	Period (Years)	1	2	2 to 3 years	1	2	3	4	5	Years 1-5	Years 6-50
	Wet Season										
A	**Completion of EIA to Internat. Stand.**										
A1	Monitoring of fisheries										
A2	Aquatic Ecology surveys										
A3	Study on intensification of fisheries										
A4	Water quality monitoring										
A5	Water quality study (reservoir modeling)										
A6	Study of sedimentation / backwater effects										
A7	Study/ design of water re-aeration struct.										
A8	Study for optimization of riparian release										
A9	Study Downstream villages water supply										
A10	Land use study reservoir, access road, TL										
A11	Land use study of village gardens										
A12	Study on wildlife / rescue plan										
A13	Survey reservoir timber and veg. biomass										
A14	Preparation of a logging and clearing plan										
A15	Strategic study for biodiversity support										
A16	Preliminary watershed management plan										
A17	EIA resettlement sites (Provisional budget)										
A18	Preparation of detailed EMP										
A19	Environmental specific. for Contractors										
A20	Coordination, reporting, presentation										
B	**Organization of EMU (Year –1)**										
B1	Constitution of EMU										
B2	Capacity building of EMU										
B3	Preparation of working program										
B4	Selection Panel of Experts										
B5	Environmental Specification for Contractors										
C	**During construction Phase**										
C1	Provide operating budget for EMU										
C2	Appointment of Panel of Experts (2)										
C3	Monitoring contractor's sites and camps										
C4	Provision for compensation of spill										
C5	Provision for audit and arbitration of impact										
C6	Monitoring of fisheries										
C7	Construction of water supply facilities										
C8	Water quality monitoring										
C9	Study rehabilitation quarries, borrow areas										
C10	Logging / clearing tender documents										
C11	TA for supervision of logging and clearing										
C12	Clearing of reservoir										
C13	Watershed management plan										
C14	Study for creation of wildlife reserve										
C15	Land acquisition road & TL (Budget)										
D	**During Filling Phase**										
D1	Provide operation budget for EMU										
D2	Water quality monitoring										
D3	Monitoring of released water quality										
D4	Monitoring of downstream fisheries										
D5	Filling event management, year 1										
D6	Removal of floating wood										
D7	Implement fisheries intensification D/S										
E	**During Operation Phase (years 1-5)**										
E1	Operation budget for EMU										
E2	Water quality monitoring										
E3	Monitoring of released water quality										
E4	Management of the filling event, year 2										
E5	Evaluation of compensation for bank garden										
E6	Provision of compensation for bank garden										
E7	Downstream fisheries monitoring										
E8	Development of irrigation downstream										
E9	Annual contribution to envir. trust fund ?										
E10	Implement watershed management plan										
F	**During Operation Phase (years 6-?)**										
F1	Water quality monitoring										
F2	Annual contribution to envir. trust fund ?										
F3	Implement watershed management plan										
F4	Implement reservoir fisheries program										
F5	Implement fish culture in the reservoir