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The first part of this chapter describes the organisations within NTPC, the Head Contractor (HC) and GOL that will be responsible for implementing the mitigation and compensation measures and the monitoring of their implementation. The mitigation measures are summarised in the second part of this chapter. The final part of chapter six details how the mitigation measures will be implemented. The mitigation and monitoring measures to be implemented during the Project construction phase are presented in Annex L. The social impacts stemming from the Project are mitigated through the provisions of the SDP. Similarly, the mitigation measures for the environmental and social values relating to the watershed are described in the SEMFOP.



Figure 6.1: Key organizations

Key Organisations in the Environmental Management of the Project

The key organisations responsible for the implementation of the various mitigation measures are: i) the Environmental Management Office (EMO) of NTPC; ii) the HC; iii) GOL organisations including the Science Technology and Environmental Agency (STEA), the Environmental Management Unit (EMU); and the Watershed Management and Protection Authority (WMPA). These organisations are shown in Figure 6.1.

NTPC Environmental Management Office

The EMO will be responsible for the technical planning, implementation and monitoring of all environmental mitigation and compensation measures under NTPC's responsibility, as required by the CA. In addition the EMO will monitor the implementation of mitigation measures that will be supervised and carried out by the HC and the Construction Contractors. This monitoring will ensure compliance with environmental provisions of both the CA and Head Construction Contract (HCC). The EMO will work closely with the EMU and other GOL agencies, as appropriate.

Prior to the start of the Construction Phase, the EMO will:

- Ensure that the relevant environmental mitigation measures are reflected in the Project Contract, including the HCC;
- Prepare plans for mobilising subcontracts for studies that will be conducted by NTPC;
- Hold discussions with the government authorities participating in the Project, such as the WMPA and the EMU, to develop procedures for inter-agency coordination and reporting;
- Ensure that the Construction Phase activities include appropriate environmental monitoring;
- Assist the EMU to plan and manage the environmental public consultation and information programme; and
- Provide any necessary background information to the EMU to enable response to public comments, complaints and inquiries in relation to the environmental mitigation measures.

During the Construction and the Operating Phases, the EMO will be responsible for implementing and monitoring environmental mitigation measures. The management of environmental concerns will include:

- Developing and implementing the monitoring programmes;
- Managing the subcontracts for specialist studies to ensure their performance;
- Liaising and cooperating with the government authorities given responsibility for implementing GOL's responsibilities;
- Preparing work and cost schedules for the monitoring programmes;

- Conducting appropriate testing to ensure that the environmental mitigation measures are effective;
- Arranging for reporting of the results of the monitoring programmes;
- Maintaining records for reporting to GOL and the EMU;
- Preparing budgeting and financial reports for the operation of the EMO;
- Conducting internal and external audits to ensure compliance with the CA and the procedures of NTPC; and
- Assisting GOL with the public consultation programmes and documenting the feedback for incorporation into programme planning.

Throughout the construction period, the EMO will prepare monthly reports for submission to GOL. These reports will address the following items in relation to the EMO responsibilities outlined above:

- Progress made to implement the environmental mitigation measures in compliance with both the CA and the HCC;
- Schedule of implementation of environmental mitigation measures;
- Any difficulties with implementing the environmental mitigation measures and recommendations for correcting the problems; and
- Any aspect that does not conform with the environmental mitigation measures and proposed remedial measures.

The Head Contractor

The HC will be responsible for implementation of measures to avoid or minimise environmental impacts during construction. Examples of aspects these measures relate to are:

- Meeting effluent standards and water quality requirements for discharges into surface waters and groundwater;
- Controlling drainage, erosion and sedimentation;
- Protecting physical and cultural resources;
- Landscaping, rehabilitating and re-vegetating the construction areas;
- Managing on-site waste;
- Managing use and storage of chemicals, preventing and developing emergency plans for chemical pollution incidents;
- Controlling noise emissions and dust from construction activities;
- Surveying, detecting, and rendering safe by removal and subsequent destruction (or by in-situ destruction) of UXO;
- Designing and constructing construction work camps, including planning and provision for spontaneous resettlement;
- Implementing a programme for construction worker education in environmental issues;
- Implementing a health and safety programme for all persons engaging in construction works; and

The provisions of the HCC between NTPC and the HC includes the HC's obligations for undertaking measures to minimise and/or mitigate impacts on the existing environmental and social conditions. In addition to these responsibilities, the HC is responsible for supervision of Construction Contractors. Both the HC and Construction Contractors will have environmental staff to carry out their respective responsibilities.

The HCC Environmental Management and Monitoring Plan

The primary document for implementation of the above measures is the Head Construction Contractor's Environmental Management and Monitoring Plan (HCCEMMP). The HCCEMMP covers environmental measures listed above, and contains an overview of the Project impacts that the HC's work will have on the physical, biological and social environment.

The preparation and implementation of the HCCEMMP is one of the Environmental and Social Objectives of the CA, and is covered by the Project performance guarantees. Failure to respond appropriately is covered in the CA under the provisions for a breach or failure to implement any of the Environmental and Social Objectives (Clause 30 of the CA).

The HCC EMMP is structured in three parts:

- A Master EMMP, which provides organisational and operational procedures for the implementation of environmental measures (Part A);
- Sub-Plans, which describe the environmental measures in terms of subject – such as sediment and erosion control, noise control, etc, including responsibility for implementation, technical details and how implementation is monitored (Part B);
- Site Specific Environmental Plans, which provide for each construction site or camp area a description of the area, how the environmental measures will be adapted to the site, and the design of typical measures (Part C).

The HCC EMMP documentation

- Provides the Environmental Policy of the HC and Construction Contractors dedicated to the Project;
- Addresses HCC and regulatory requirements;
- Provides operational and emergency procedures, developed to address the environmental aspects and risks related to the construction period of the Project;
- Provides for the implementation and operation of the EMMP to ensure that structure and responsibilities are assigned, staff is trained, aware and competent, and that there is proper communication, documentation, operational control and emergency preparedness and response.
- Provides organisational and technical procedures for implementation of the EMMP which ensure that construction activities associated with potential environmental impacts are carried out in a controlled and responsible way.
- Provides checking and corrective action through monitoring and measurement.
- Provides records collection and storage, and program audit;
- Includes Management Review of the EMMP and enables improvements to be incorporated in the Plan.

The HCC EMMP is to be submitted as a Preliminary Draft version nine months before the Project Commencement Date. A Draft version is to be submitted six months prior to the Commencement Date, and a Final version provided for approval four months before Commencement Date.

HC Monitoring and Auditing

The HC is responsible for monitoring and assessing how environmental management at each site, and for the entire project, is performing. To do this, the HC is responsible for monitoring environmental controls employed at each site, and environmental aspects of their construction activities in general.

The HC is required to carry out routine monitoring of construction sites and construction activities in order to ensure that requirements and measures specified in the HCCEMMP are implemented



Figure 6.2: HCC EMMP structure



Figure 6.3: EMU overall organisation

and impacts are minimised or mitigated. This will be on a siteby-site basis, and is intended to be continual and frequent. This includes physical monitoring, such as water quality sampling, air quality monitoring, waste tracking, and tracking amounts of hazardous chemicals in use and to be disposed.

The HC will employ specialist environmental staff to undertake this monitoring. Staff will be selected on the basis of environmental training, skill and experience.

The HC will utilise reporting and non-conformance systems to ensure that corrective action is taken where necessary, and to track environmental performance. The non-conformance system will use three levels of non-conformance to prioritise action according to importance, severity and internal communication requirements.

The non-compliance procedure described above allows the following safeguards:

- work can be stopped in the event of a serious non-compliance situation;
- follow-up visits to the sites of observed non-compliance incidents are required to verify that the situation has been appropriately rectified by the Construction Contractor;
- incident investigation to determine the root causes of significant incidents and evaluate if changes need to be made to the EMMP or other documentation to prevent similar incidents from occurring in the future; and
- In the case that environmental impacts are caused before the non-compliance is observed, rectified and completed, the Construction Contractor responsible will be requested to implement appropriate actions to mitigate any impact already observed.

In addition, periodic auditing will take place. An audit will be undertaken two months after construction has commenced at each site, and six-monthly audits will take place after that. The sixmonthly audits will also include environmental performance at the organisational level. Audits are intended to be periodic reviews to verify conformance.

Together, monitoring, non-conformance systems and auditing will allow evaluation of environmental performance; analysis of root causes of problems; assessment of compliance with contractual and legal requirements, and enable identification of areas requiring corrective action.

The HC will be required to identify and document in the HCCEMMP the specifics of what monitoring and measurements will be performed, and specify the allowable range of results. It will also be required to identify the frequency, locations and personnel performing the monitoring and measurement. The HC will also be required to maintain quality control procedures for these activities. Environmental monitoring by the HC will be required to conform to the requirements of ISO14001.

Also clearly defined will be the International Standard Quality Assurance (QA) procedures to be followed to ensure these obligations are met. There will be periodic independent external auditing of these QA procedures. The HC will also be required to have an environmental management system in place in full compliance with ISO 14001.

GOL Organisations

Under the CA, a number of GOL organisations will be responsible for implementing mitigation, monitoring and management

Table 6.1: Environmental management tasks to be undertaken

Task	Implementation	Coordination Site Monitoring		Oversight	Funding				
Compliance with environmental construction obligations									
Construction sites management according to HCCEMMP	Contractors	EMO	Contractors	EMO & EMU	Contractors				
Resettlement and downstream livelihood activities not included in HCC	Contractors and parties employed by RO	EMO	Contractors	EMO & EMU	Contractors and NTPC				
Control of spontaneous settlement	Provinces / Districts	Provinces	Districts	RC	Provinces				
Prevention of building near to transmission lines	Provinces	Provinces	District	Province					
Adaptive ecological management									
Fish impacts in upstream and downstream rivers	Consultants and GOL agencies	EMO	Consultants and GOL agencies	EMU	NTPC				
Terrestrial animals in the inundation area	Consultants and GOL agencies	EMO	Consultants and GOL agencies	EMU	NTPC				
Asian Elephant programme	Consultants and GOL agencies	EMO	Consultants and GOL agencies	EMU	NTPC				
Transitional strategy for reservoir impoundment	Consultants and GOL agencies	EMO	Consultants and GOL agencies	EMU	NTPC				
Wetland conversion and formation	Consultants and GOL agencies	EMO	Consultants and GOL agencies	EMU	NTPC				
Water quality program and downstream hydrological impacts	Consultants & NTPC	EMO	Consultants & EMO	EMU	NTPC				
Reduction of shifting cultivation	RMU	RMU	RMU	Province	SDP budget				
GOL wildlife and vegetation activities									
Hunting and wildlife trade control and outreach	PAFOs, DAFOs & police	EMU	PAFOs, DAFOs & police	EMU	EMU budget				
Salvage logging in reservoir	Khammouane PAFO, Nakai DAFO	Province	District	Province					

components during construction and operation of the Project. The following descriptions provide the general responsibilities of the agencies within GOL for implementing these measures.

National Environmental Committee

An inter-ministerial working group for the environment was established in 2002 and is known as the National Environmental Committee. Members of the National Environmental Committee include representatives from the Executive Branch (Deputy Prime Minister), MAF, the Director General of STEA, and Vice-Ministers of the Ministry of Commerce and Tourism, the Ministry of Industry and Handicrafts, the Ministry of Public Health, the Ministry of Interior, the Ministry of Justice, the Ministry of National Defence, the Ministry of Education, the State Planning Committee and the Ministry of Communications, Transport, Post, and Construction.

The objective of the National Environmental Committee is to advise the government on the management and protection of the environment and to coordinate the development of environmental management and monitoring plans across the Ministries and at the local government levels. The implementing agency for the National Environmental Committee is the Secretariat. This office is responsible for reviewing environmental assessments of proposed projects, advising the National Environmental Committee relative to environmental issues, disseminating information, and promoting implementation of provisions of the Environmental Protection Law. The Secretariat is also responsible for coordinating local government organisations relative to environmental management and monitoring. The head of the Secretariat is the Director General of the Department of the Environment within STEA.

The Science, Technology & Environment Agency

STEA will have a major responsibility relating to implementation of mitigation and compensation measures associated with the

Project. STEA consists of several departments: Science and Technology, Intellectual Property, Environmental and several Technology Research Institutes. The Department of the Environment within STEA has responsibility for acting in the role of Secretariat to the National Environmental Committee and also for coordinating the interaction of the environmental sections of the other Ministries.

STEA has the prime responsibility for coordinating the environmental policies of the other Ministries within GOL. For example, the MIH is responsible for requiring electricity project developers to provide a Social Impact Assessment, an Environmental Management Plan and implementing an Environmental Assessment pursuant to the Electricity Law. Although the MIH is involved in this process, it is STEA that will determine if the electricity developer has met the environmental requirements outlined in the Environmental Protection Law and the Regulations on Environmental Assessment.

The operational experience of the STEA staff is, for the central ministry at least, extensive. A number of the directors and staff have been involved in the planning, construction and operation of hydropower projects in Lao PDR including Theun Hinboun, Houay Ho, Nam Ngum 3 and Nam Leuk.

Each of the provinces in Lao PDR has STEA offices that work under the Provincial Governors' Offices. Although a Provincial Governor's Office is involved in all decisions relative to development in the province, often their participation is limited to one or a few people.

The Environmental Management Unit

Under the direction of STEA, GOL has established an EMU that will be responsible for the implementation and management of the environmental components of the CA. The EMU will be specifically designed for the Project and will consist of representatives

Table 6.2: Key tasks and responsibilities of EMU teams

Team / Organisation	Responsibilities	Key Tasks					
STEA NT2 Committee	EMU directorship	 Convene quarterly to review EMU progress reports and at other times as necessary. Provide advice to EMU on the execution of their duties and approve workplans and budgets. 					
	Policy setting	 Formulate policy recommendations to resolve novel issues arising among different GOL authorities and the Company relating to environmental measures. Advise NT2 Steering Committee on the adequacy of environmental measures and recommend amend- ments as required from time to time. 					
	Coordination with GOL authorities	 Consult with affected ministries and other GOL authorities over new policy proposals. Allocate roles and responsibilities of relevant GOL authorities to assist GOL in achieving objectives. Coordinate with GOL authorities in implementation of Environmental Objectives of GOL and NTPC. Coordinate between GOL authorities and NTPC. 					
Coordination and Strategy Team	Admin and management	 Establish effective systems for managing EMU financial resources. Develop and update annual work programmes. Develop performance indicators. Organize and implement capacity building programme. EMU performance monitoring. Facilitate visits of POE and other environmental oversight, IAG, IMA and other monitoring groups. Organize appropriate TA. Prepare and issue 6 month progress reports to the NT2 Committee of STEA on the basis of reports submitted by the technical teams and the progress of the Coordination and Strategy team's own activities. 					
	Policy coordination	 Provide policy recommendations to the STEA NT2 Committee, drawing on findings of technical teams and expert opinion within and without STEA as appropriate. Advise the STEA NT2 Committee on the adequacy of environmental measures and recommend amendments as required from time to time. 					
	Communications	 Liaise with external organizations (NGOs, media) in relation to environmental issues. (Vientiane) Establish and maintain national project information center. (Vientiane) Facilitate public inputs, feedback at national level. (Vientiane) Mobilize public information campaigns. Establish and maintain provincial project information center. (Khammouane) Conduct periodic briefing sessions for provincial and district officials on environmental progress (Khammouane) Facilitate public input and environmental grievance process at the local levels (Khammouane) 					
Compliance Team	Compliance with environmental obligations	 Review and approve environmental component of HCC and the HCCEMMP. Review and approve environmental aspects of resettlement construction activities. Review and approve or provide NOL of EMO field activities. Verify monitoring of environmental obligations of GOL and NTPC at the field level through accompanying EFI and/or EMO field visits; carrying out independent spot checks; and parallel and/or additional sampling as appropriate (Khammouane) Periodic briefings with provincial RO (Khammouane) Issue monthly reports on project progress to Coordination and Strategy team. 					
Ecological Management Team	Adaptive ecological management	 Review plans for wildlife studies, fisheries monitoring, water quality monitoring and emergency wildlife management measures. Review progress reports from each of these components. Review and approve adaptive management response proposed under each component on the basis of data collected. Conduct periodic briefings with implementing teams (Khammouane) Verify the quality of research work through periodic field visits, local consultation, and parallel and/or additional sampling where appropriate (Khammouane) Issue monthly reports on project progress to Coordination and Strategy team. 					
	GOL wildlife activities	 In consultation with local implementing authorities and the WMPA, produce plans for measures to address wildlife trade issues around the Project area, wildlife safeguards to be included in the salvage logging program, and vegetation removal in the inundation area (not including Special Conservation Areas) (Khammouane) Coordinate the activities of local authorities in regard to each of these activities (Khammouane) Review progress reports from local authorities in regard to each of these activities, and provide guidance on improving effectiveness. Verify field activities and outcomes through accompanying local authorities staff on field visits, periodic spot checks, and local consultation. (Khammouane) Issue monthly reports on project progress to Coordination and Strategy team. 					

from the MIH Hydropower Office, EDL, the Khammouane Provincial Office, and the District Offices of Nakai and Gnommalat. The representatives will be appointed by the respective organisations and will be, where appropriate, expected to have prior experience with hydropower planning in their respective organisations.

The EMU will be responsible for implementing some of the mitigation measures that are outside the NNT NBCA. STEA, through the EMU, will review reports of the monitoring programmes during the construction and operational periods, as defined in the CA. Responsibilities of the EMU include:

- Reviewing and approving the environmental specifications for the HCC;
- Coordinating the implementation of environmental mitigation measures with GOL and NTPC;
- Allocating responsibilities to other appropriate agencies to assist GOL in meeting their obligations within the CA;

- Monitoring and supervising the implementation of the environmental mitigation measures for which GOL and NTPC are responsible. This includes the provision of non-objection or approvals for specific activities;
- Appointment of an independent international monitoring agency to review the implementation of the environmental mitigation measures by GOL and NTPC and to facilitate management of those activities;
- Conducting monitoring programmes to ensure that NTPC is in compliance with implementing environmental mitigation measures;
- Advising STEA and the relevant government agencies on the adequacy of proposed environmental mitigation or compensation measures and recommending changes based on monitoring results;
- Conferring with other organisations about environmental issues;
- Resolving environmental issues between government agencies and NTPC;
- Developing and updating the monitoring programmes for use during the Construction and the Operating Phase;
- Advising GOL through STEA on the effectiveness of mitigation measures;
- Coordinating necessary meetings between the NTPC EMO and appropriate government agencies;
- Coordinating with the Panel of Experts and the International Advisory Group to assess the performance of the mitigation measures; and
- Providing technical assistance on any required input from the EMO and other government agencies.

The office of the main EMU is located at the STEA in Vientiane, with a field office in the Khammouane provincial STEA office.

Overall organisation

The EMU has a mandate to oversee all environmental aspects of NT2 project with the exception of management activities within the Watershed, which falls under the WMPA.

The EMU will be made of a coordination and strategy team, construction compliance team, and an ecological team, and will interact with the other GOL agencies and parties to the Project as indicated in the figure below.

The Construction Compliance team is responsible for ensuring that all activities associated with project construction accord with environmental obligations under the Concession Agreement, and in particular its Schedule 4, Part 2. The bulk of this work concerns oversight of the EMO's compliance monitoring of the HCCEMMP, but it also includes verification of GOL obligations to minimize impacts of livelihood development activities falling outside of the HCC, and prevention of future construction near to transmission lines.

The Ecological Management team has a similar oversight duty for the adaptive management programmes coordinated by the EMO, but will also be represented on the committees responsible for adaptive management decision-making. The second function of the Ecological Management team is to liaise and coordinate with the local authorities who will carry out field implementation of wildlife and habitat management activities around the project area. This will imply liaison and coordination with the MAF, through the STEA NT2 Committee. The EMU will have responsibility for ensuring that these GOL activities are implemented in a coherent and effective way.

In addition to the two technical teams, the EMU comprises a Coordination and Strategy team and an overall director. The EMU reports to the NT2 Committee within STEA, which reports to the NT2 Steering Committee, provides senior policy advice, ensures timely facilitation of activities and coordination at national and local levels.

Environmental management tasks outside of the Watershed

Table 6.1 shows the various tasks to be undertaken, broken down by broad category and implementation arrangements, rather than by detailed activity. All mitigation measures to be implemented by the HC are shown in brown, and those to be implemented by NTPC are shown in pale blue with mitigation measures to be implemented by GOL unhighlighted (black).

Responsibilities and key tasks

Key tasks and responsibilities for the STEA NT2 Committee and EMU teams are outlined in Table 6.2.

Staffing arrangements and location of offices

It is proposed that the STEA NT2 Committee is made of a maximum of 5 senior staff of STEA.

The staffing of the EMU should follow the following. The Coordination and Strategy team will be made of 2 full time staff including one national and one local communications and outreach specialist. The construction compliance team will be made of 2 full-time STEA staff experienced in EIA and monitoring. Combined with the 1-2 full-time provincial staff, these will provide the core team for reviewing plans, and leading and directing field work. Additional provincial staff could be included in fieldwork according to need. The ecological management team will be staffed by 2 full-time STEA staff, ideally one experienced biological and one in water quality field methods. Combined with the 1-2 full-time provincial staff, these will provide the core team for reviewing plans, day-today coordination with local agencies, and leading and directing field work. Additional provincial staff will be included in fieldwork according to need.

Location: All work teams have some responsibilities that must be carried out at the local level, and significant work that at least could be carried out in Vientiane. It is inevitable that offices will be needed both at the central and local levels. The precise balance of staffing between the two locations will be determined during the inception period of the Technical Assistance Programme to the EMU. Core field staff, those involved in day-to-day coordination with local authorities, and local communications staff should be located at the local level. The suitable location for staff involved in reviewing plans and reports will depend on the locations of their principle NTPC and GOL counterparts and on the constraints that a base in Khammouane may place on retaining the best people.

The Watershed Management & Protection Authority

Management of most of the Project watershed will be under the responsibility and management of GOL. To enable management of the watershed, GOL established the WMPA. The WMPA's mandate to operate in the Nam Theun 2 Watershed Area is legally defined in PM Decree 25, which set out the areas as the NNT NBCA, the NNT – HNN corridor and the NNT – PHP corridor. This organisation was established under the Prime Minister's Office and is responsible for coordinating and managing all activities within the Watershed Area, including:

- Conservation, maintenance and promotion of biological diversity coupled with the development of a national park appropriate for tourism and scientific research;
- Building and strengthening the capacity of the WMPA;
- Facilitating improved livelihoods for inhabitants of the Nam Theun 2 Watershed Area to reduce poverty through environmentally sustainable development; and

 Protecting and rehabilitating forest cover in the Nam Theun 2 Watershed Area to assure adequate water discharge with low suspended sediment.

The WMPA will accomplish these functions through the SEMFOP and its operational plans. The WMPA includes a core component of managerial and technical staff. The SEMFOP gives further details on the organisation, function and planned activities of the WMPA.

Management of Impacts

Mitigation measures were identified with the assessment of impacts in Chapter 3. These measures are summarised below with a discussion of their objective, actions to be taken, and responsibility for their implementation. Mitigation measures to be implemented by NTPC are presented first, followed by measures to be implemented by the Head Contractor during construction, and then measures to be implemented by GOL organisations.

Mitigation Measures to be implemented by NTPC

Water Quality Monitory & Assessment Programme

Objective: Monitor water quality in the Nam Theun and Xe Bang Fai, and some of their tributaries, and the Nakai Reservoir, and monitor groundwater in the Project area, during the pre-construction, during the construction and operation phases of the Project.

Actions: The water quality monitoring programme will determine baseline conditions in the Nam Theun and tributaries, Nam Kathang and Nam Gnom, Nam Phit and Xe Bang Fai, and groundwater in the Project area. The information obtained during this monitoring period will be used to improve the water quality modelling and to compare water quality conditions during construction and operation of the Project.

The monitoring programme (detailed in chapter 3) will assess whether NTPC is fulfilling its goal of maintaining beneficial uses of water within the Project area. The evolution of water quality after inundation of the Nakai Reservoir will also be monitored. Results of the monitoring programme will be available for evaluation relative to reservoir fisheries, the potential impacts of water quality to fisheries in the Xe Bang Fai, and evaluation of impacts on fisheries downstream from the Nakai Dam.

Responsibility: The EMO will be responsible for implementing the water quality monitoring programme from the pre-construction phase through construction and the operating period. It has to be noted that the HC is also responsible for preparing a Water Quality Monitoring Plan as a component of the HCCEMMP. The Water Quality Monitoring Plan shall be designed to monitor the effects of surface water runoff and wastewater discharge from areas disturbed by all construction related activities. This is discussed further below.

Riparian Release to Downstream of the Nam Theun

Objective: Minimise potential impacts on aquatic and terrestrial habitats relating to the damming of the Nam Theun, which will significantly curtail the natural flow of the Nam Theun below the Nakai Dam.

Actions: NTPC will release a minimum discharge of two cubic metres per second from the Nakai Dam into the Nam Theun (or the equivalent volume of water as measured on a weekly basis). NTPC is obliged to use all reasonable endeavours to ensure that the minimum water is released in a continuous manner over the course of each week. Additionally, the agreement provides for a "Complementary Release", the aggregate quantity of which will not exceed a total of five million cubic metres in any twelve-month period. This complementary release is over and above the minimum riparian release (2 m^3/s) and any natural spillage in times of reservoir overflow.

NTPC's ability to vary the flow will therefore be the basis for a strategically focused Adaptive Management programme, which will target the maintenance and enhancement of aquatic productivity in this stretch of the Nam Theun. The Adaptive Management of the riparian release will involve a number of alternative discharge regimes from the dam to help ensure the aquatic system downstream from the dam will function properly.

NTPC will implement a programme to monitor the water quality in the Nam Theun below the Nakai Dam (see measure above).

Responsibility: The intake structure, release structure and controls will be the responsibility of NTPC, supervising the detailed design and construction by the HC. The EMO will be responsible for monitoring and adaptively managing the release from the Nakai Dam.

Aeration of Water in the Downstream Channel and the Nam Kathang

Objective: Increase the dissolved oxygen concentrations in the water discharged from the Power Station and decrease the concentrations of methane and hydrogen sulphide.

Actions: The design of the Aeration Weir is part of the overall design of the Downstream Channel. The design of the Regulating Dam will incorporate a hydraulic jump and simple weir into the Nam Kathang.

Responsibility: NTPC will be responsible for design, and the construction contractors will be responsible for construction of the aeration weir and the structures at the regulating dam.

Downstream Channel In-Stream Degradation

Objective: Avoid and minimise in-stream degradation of the Downstream Channel during operations.

Actions: NTPC will design, construct and operate the Downstream Channel to ensure an appropriate water velocity in regard to soil properties and the sediment load of water discharged from the Power Station. The Downstream Channel will be partially lined from the regulating dam to the tunnel to minimise erosion.

In the Construction Phase, NTPC will ensure that the HC implements the appropriate design in construction of the Downstream Channel. In the Operating Phase, NTPC will monitor the performance of the Downstream Channel and where bank erosion is detected, corrective measures will be implemented as appropriate.

Responsibility: The HC will be responsible for the design and construction of the Downstream Channel. The design must include the above features to avoid in-stream degradation.

NTPC will be responsible for monitoring the performance of the Downstream Channel and correcting any incidences of erosion. Failure to respond appropriately is covered in the CA under the provisions for a breach or failure to implement any of the Environmental and Social Objectives (Clause 30).

Protecting Downstream Channel Fisheries

Objective: Ensure that fish populations that may develop in the Downstream Channel will be maintained through periods of low flow caused by low or no generation events at the Power Station.

Actions: To sustain fish populations that may develop in the Downstream Channel during times when power is not being generated, a minimum flow of 30 m³/s will be maintained in the channel. This release of water will be maintained unless the Power Station is not operated for more than 32 hours on a continuous basis. **Responsibility:** NTPC will be responsible for management of the minimum flow as part of its operational management. Funds for monitoring will be from NTPC's operating costs. Failure to respond appropriately is covered in the CA under the provisions for a breach or failure to implement any of the Environmental and Social Objectives (Clause 30).

Prevention of Increased Flooding at Mahaxai

Objective: Avoid increased overbank flooding along the upper Xe Bang Fai due to additional waters from the Project through the timely cessation of electricity generation.

Actions: The Project will operate in a manner such that overbank flood events at Mahaxai are due only to natural causes. Release of water into the Xe Bang Fai will stop during times of overbank flooding. Outflow restrictions will begin when flow in the Xe Bang Fai at Mahaxai approaches 1,970 m³/s. Outflows from the regulating pond will be stopped sufficiently before the flow in the Xe Bang Fai at Mahaxai reaches 2,270 m³/s, and in any event before the Xe Bang Fai at Mahaxai overflows its banks.

In the Pre-construction and Construction Phases, NTPC will:

- Install a data acquisition system for real time monitoring of rainfall and river levels at, and upstream of, Mahaxai to enable flow to be monitored remotely at the Power Station; and
- Undertake further study to examine the appropriate triggers and operating criteria to ensure overbank flooding is not aggravated. For both reservoir operations and power diversion operations, development of appropriate flood forecasting procedures is essential so that river flows can be predicted.

In the Operating Phase, NTPC will:

- Maintain the data acquisition system, including stations upstream of the reservoir (all information will be recorded via telemetry);
- Monitor flows and rainfall in potential flooding periods at Mahaxai. NTPC personnel will undertake this responsibility with a direct communication link to the Power Station; and
- Measure and monitor the flows in the Xe Bang Fai to ensure that the Power Station's operation management system for flood control is based upon a maximum sample of available hydrographic data.

Responsibility: The HC will be responsible for the construction of facilities for prevention of increased flooding at Mahaxai on the Xe Bang Fai.

NTPC will be responsible for the study and the monitoring of activities noted above, as well as operating the Project facility. NTPC's development and design costs will fund the monitoring during Pre-construction and Construction Phases. Failure to respond appropriately is covered in the CA under the provisions for a breach or failure to implement any of the Environmental and Social Objectives (Clause 30).

Degradation of the Xe Bang Fai River Channel

Objective: Mitigate the potential impact from scouring at the confluence of the Xe Bang Fai and the Downstream Channel, and detect any increase from the natural rate of erosion of the banks of the Xe Bang Fai below the confluence of the Downstream Channel so that remedial works can be undertaken.

Actions: The confluence will be designed, constructed and operated so as to minimise scouring. The confluence of the Downstream Channel with the Xe Bang Fai will be lined with rip-rap to prevent scouring of the river bank and direct the discharge to the main channel of the river.

During operation, the situation will be monitored and any scouring in the area of the confluence which would risk its structural stability will be protected by appropriate stabilisation or protection works.

Where erosion of the Xe Bang Fai banks is apparent, an analysis will be performed to determine if repairs are required. The change in the river channel capacity could affect villages along the Xe Bang Fai, so any erosion will be assessed on a case-by-case basis and the appropriate action implemented. Further details regarding action to be taken is outlined in the Xe Bang Fai Strategy, produced by NTPC in the SDP.

A monitoring programme to determine any alteration in the rate of change in the morphology of the Xe Bang Fai channel will be implemented by NTPC, in collaboration with the EMO and the Resettlement Management Office.

Responsibility: The HC will be responsible for the design and construction of the confluence. NTPC will have the responsibility for monitoring and evaluating any impacts, and for determining if remedial measures or compensation is necessary, as per the Xe Bang Fai Strategy.

Wildlife Management and Protection Programme

The objective of the wildlife management programme is to mitigate, to the extent possible, the potential impacts on the Nakai Plateau wildlife. The assessment of potential impacts on terrestrial ecology has indicated that in order to develop an effective wildlife management plan it is necessary to understand the interactions between species and habitats and the overall ecological dynamics on the Nakai Plateau. This will be incorporated in the approach used for the development and implementation of this programme. Three main areas have been targeted: (i) upstream and downstream rivers, with a focus on fish, (ii) the inundation of the Nakai Plateau and terrestrial animals impacted, (iii) wetland conversion and formation. The entire wildlife programme will be adaptively managed.

1 - Fish impacts in upstream and downstream rivers

A monitoring programme targeting fish species and aquatic habitat will be undertaken in the sections of the Nam Theun and Xe Bang Fai rivers impacted by the Project. The programme will consist of species and habitat inventories and monitoring of fish migrations and fish productivity. The modifications of the morphology of the Nam Theun downstream of the Nakai Dam to the confluence with the Nam Phao will be reviewed at that time.

Responsibility: The EMO will be responsible for monitoring the Project impacts on fish, including fisheries and migration, in the upstream and downstream rivers and reservoir, before and after the impoundment of the reservoir and for undertaking Nam Theun riparian flow assessments, modifying habitats and for the implementation of the adaptive management programme in the downstream Nam Theun.

The WMPA will take over responsibility for undertaking species and habitat monitoring in the NPA and Corridors from NTPC one year after COD. They will also be a member of the committee advising the adaptive management programme in the downstream Nam Theun area. In addition, WMPA will be responsible for incorporation of patrolling, fishing restrictions and other related measures as part of their planned activities under SEMFOP.

2 - Terrestrial animals in the inundation area

A programme for mammal species (excluding the Asian Elephant) found in the area to be inundated will be implemented. It will consist of (i) pre-impoundment species and habitat inventories with the objective to collect information on distribution and movements on the Nakai Plateau, and interactions between species, (ii) development of a post-impoundment species management programme, (iii) implementation of this programme from the beginning of the construction phase, including post-impoundment monitoring of a number of species to determine how the reservoir has affected wildlife populations.

Responsibility: The EMO will be responsible for assessing project impacts on terrestrial animals before and after the impoundment of the reservoir. The WMPA will take over the post-impoundment species management plan for the NPA and Corridors one year after COD. In terms of emergency response and enforcement (including animal rescue, human-animal conflict and enforcement of hunting rules) NTPC along with local authorities will establish an emergency response team and undertake a public awareness programme in conjunction with district and provincial authorities, allowing them to take over the role after COD. The district and provincial authorities will work with NTPC in the emergency response and enforcement team (for conflict situations and animal rescue for elephants and other wildlife) up until after COD when they will take sole responsibility for this programme.

3 - Asian Elephant programme

The objectives of the elephant programme will be (i) to develop and implement a management plan addressing the seasonal movements of elephants and their habitat requirements, (ii) to manage the elephant population affected by the Project, (iii) to help prevent any increase in human-elephant conflicts.

During the Construction Phase, NTPC will develop and implement a survey and management programme to determine the current population of Asian elephants on the Nakai Plateau. The programme will also endeavour to determine seasonal movements of elephants on the Nakai Plateau. The programme will develop an understanding of the ecological role and importance of elephant habitat use, including mineral licks. Various passive and active crop protection methods will be tested and the successful ones implemented to help prevent human-elephants conflicts. The elephant management programme will be developed prior to the initial filling of the reservoir.

Responsibility: The EMO will be responsible for contracting an elephant specialist and developing an effective management programme for the elephant herds on the Nakai Plateau.

4 – Development of a transitional strategy for reservoir impoundment.

The objective of this strategy will be to minimize impacts on animal populations of impoundment of the Nakai Reservoir, especially for animals stranded on islands, and which could become vulnerable to hunting and habitat loss.

NTPC will appoint a wildlife specialist to undertake an analysis of potential threats to animal populations during impoundment. The results of the study will be used to develop a plan to minimise impacts on animal populations during impoundment of the reservoir and during the operation phase, and to deal with wildlife emergency responses.

Responsibility: The EMO is responsible for developing and implementing a strategy for mitigation of impacts on terrestrial animals during impoundment and operation and training WMPA and local authorities in its implementation ensuring they can take over the programme one year after COD. In terms of emergency response and enforcement (including animal rescue, human-animal conflict and enforcement of hunting rules) NTPC along with local authorities will establish an emergency

5 – Wetland conversion and formation.

A programme for fish, birds, reptiles and mammals species associated with the swamps and rivers currently located in the area to be inundated will be implemented. It will consist of (i) pre-impoundment species and habitat inventories, (ii) development of a postimpoundment species management programme, including the Special Conservation Areas, (iii) implementation of the programme from the beginning of the construction phase. The programme will have a dedicated component for the White-winged duck if its presence is confirmed during the initial surveys.

Responsibility: The EMO will be responsible for assessing project impacts on animals pre and post impoundment. The EMO will coordinate with the WMPA to develop plans for post impoundment management of wetland species and fish spawning grounds in Special Conservation Areas. The WMPA will take over the postimpoundment species management plan for the NPA and Corridors, and the Special Conservation Areas one year after COD. WMPA will be responsible for patrolling the Special Conservation Areas of the Reservoir pre and post impoundment, and for implementing their licensing and permitting programme, some of which have conservation implications, in the area of the reservoir outside of the Special Conservation Areas.

Funding Support for the Implementing Agencies in the Pre-Operating Phase

The Environmental Management Plan incorporates measures to support and strengthen the GOL organizations that will be involved in the implementation and monitoring of the Project. Emphasis will be placed on training and skill development in core environment and natural resource protection disciplines as well as acquisition, development and training of relevant GOL officials in data collection, analysis and management information systems procedures.

A: EMU Technical Assistance Programme

Objective: The objective of the technical assistance programme will be capacity building, including technical support, equipment and financial resources for strengthening the EMU (through STEA, the Hydropower office of the Department of Electricity, and provincial and district level staff). The technical assistance will enable the EMU to fulfill their obligations. The physical and technical assistance will facilitate adequate on-the-job training and technology transfer, enabling the EMU staff to undertake their monitoring activities during the Construction and Operation Phases. The Technical Assistance Programme will be for a period of three years commencing at the start of the Preliminary Construction Phase and ending with the Construction Phase. The technical assistance programme includes 12 person-months of international consultants and 100 person-months of Lao consultant and counterpart input.

The Technical Assistance Project will have the following overall aims:

- To help the EMU to implement the core GOL obligations with respect to the Environmental Measures, including the continuous review of the HCCEMMP;
- To help the EMU to monitor all NTPC obligations with respect to the environmental measures, including monitoring of the work to be undertaken by or on behalf of NTPC;
- To provide on-the-job training to officials of the EMU in order to build technical expertise in the environmental and social aspects of hydropower projects;
- To assist the EMU to coordinate its work with other government authorities and non-government agencies concerned with the Environmental Objectives;

 To instruct central and provincial EMU officials in the proper techniques of Project inspection, monitoring, use of field monitoring equipment, data analysis and reporting.

The total Technical Assistance Programme budget is estimated at US\$ 768,000.

B: Contribution to EMU Operational Budget

Formation of the EMU is a responsibility of GOL, which will be supported by NTPC for coverage of meetings, venues and minor technical assistance on an as-needed basis. The budget estimate is US\$ 50,000.

C: EMU Capacity Building at the Local Level

The duties of the EMU will involve capacity building at the local level as part of the overall scope of the Technical Assistance Programme. The Technical Assistance Programme approach at the local level might focus on visual and educational materials, as well as utilisation of the village meeting concept, to explain and resolve issues. There is a separate budget to cover local costs for venues, educational materials and language training. NTPC will provide a budget of US\$ 150,000 for these purposes.

D: EMU Training:

In addition to the on-the-job training that will be provided as part of the Technical Assistance Programme, there is provision for a short-term overseas training course for the staff of EMU, as part of the institutional strengthening programme. The training programme will build EMU technical and managerial skills in environmental assessment of hydropower and water resource projects. Trainees selected will be members of the EMU from both the management and technical/field operation wings.

Control of Synthetic Chemical Use for Pest Management & Other Purposes

Objective: Avoid and minimise potential impacts associated with use, storage and disposal of synthetic chemicals such as pesticides, herbicides, fertilisers, or other agricultural chemicals.

Actions: NTPC will ensure that all synthetic chemical use will be conducted in accordance with the World Bank Safeguard Policy OP 4.09, Pest Management. In the Resettlement Area, an agricultural capacity building and awareness programme will be conducted. This will include long term trials, training and capacity building for technical support staff at various levels including government employees. The plan will promote the use of alternatives to chemicals, and will include a Pest Management Plan. Any synthetic chemicals used must conform to the WHO's Classification of Pesticides. This activity will affect both the Construction and Operating Phases of the Project.

Responsibility: NTPC will be responsible for implementation of the appropriate environmental plan for use of chemicals in the operation of the transmission lines and for resettlement activities.

Compensatory Forestry Programme

Objective: Compensate for the loss of 28,000 ha as a consequence of the Project.

Actions: The Project will restore a similar area of currently degraded forest, under a compensatory forestry programme, that will target a combination of the following areas: (i) the degraded forests within the NNT-NBCA; (ii) the area reserved for the sustainable forestry component of the resettlement action plan; (iii) degraded forests on the Nakai Plateau that will not be affected by the inundation, and (iv), in case these areas are not sufficient, degraded forests outside of the area affected by the Project could be considered.

Responsibility: NTPC will be responsible for the implementation of the programme. \$5 million will be made available to undertake the compensatory forestry work (\$4.2 million plus \$0.8 million contingency). If necessary, GOL will provide the required land for compensatory forestry activities at no cost to the Project.

Mitigation Measures to be Implemented by the Head Contractor

Annex L contains the HCC provisions that relate to the construction phase of the Project. These provisions bind the HC and Construction Contractors to implement, monitor and review environmental mitigation measures related to construction activities.

Erosion and Sediment Control

Objective: Minimise erosion and sedimentation from disturbed areas at construction sites.

Actions: The HCC will include specifications for erosion and sediment control for construction areas. Erosion and sediment control measures will be carried out according to a Erosion and Sediment Control Plan that uses aerial photography, site surveys and construction plans to plan the location and type of controls to be used. The Erosion and Sediment Control Plan will be part of a Site Specific Environmental Plan (SSEP) for each site, which will ensure that controls are well-planned and in correct locations. An SSEP must be prepared for each site prior to construction at that site. A monitoring programme will be established to ensure that erosion and sedimentation control measures are in place. The monitoring programme will include water quality monitoring, which is discussed below.

Responsibility: The responsibility for implementing these actions at each site will be the HC and Construction Contractors. The HC is responsible for determining the type and locations of controls. The HC will also be responsible for supervising each construction area to ensure the above activities are implemented.

The EMO will ensure that erosion and sediment control specifications incorporated into the HCC are adequate and fulfill the obligations of this EAMP. The EMO will also be responsible for ensuring compliance of the HC and construction contractors with these specifications.

Spoil Disposal

Objective: Minimise impact of disposal of spoil from excavation activities.

Actions: The HC will undertake consultations and studies at least six months prior to commencement of construction at each area to determine the locations of the various spoil disposal areas. This will include a landuse impact assessment, community consultation and determination if those areas might affect flooding in the adjacent areas. Determination of the effects on flooding will include evaluation of historical land use, frequency of inundation, reduction in flood storage volume and significance of impact.

The HCC will include specifications for control of erosion from the spoil disposal areas that will be incorporated into construction contracts. When a spoil disposal area is closed, the construction contractors will be required to stabilise the spoil disposal area with grass, vegetation and permanent drainage.

A report on the environmental studies and consultations will be prepared for each spoil disposal site, based on the HCC Spoil Disposal Management Plan.

Responsibility: The HC will be responsible for the pre-construction studies and consultations. The HC and construction contractors, in consultation with NTPC, will select the spoil disposal areas.

Table 6.3: Wildlife programme schedule

	TIMELINE												
	·05 ·06 ·07					' 08					' 09		
	Salvage Logging Programme			e Reservoir Impour				ound	ment				
Fish impacts in Upstream and Downstream Rivers													
Species and habitat inventory (NT, XBF)													
Monitoring of fish productivity													
Fish migration studies in Nam Theun and NPA, and XBF													
Nam Theun habitat and flow studies													
Modification of downstream N1 habitat, it appropriate													
Implementation of flow adaptive management programme and related activities													
NNT and Corridors													
Impacts to Terrestrial Animals in Inundation Area													
Programme for mammal species (list of species to be confirmed after completion of pre-impoundment survey)													
Pre-impoundment species and habitat inventory, distribu-									_				
tion and movement on the entire NP.													
tion and movement (non-inundated part of the NP).													
Development of a post-impoundment species manage-													
ment programme												-+	
ment programme													
Asian Elephant Programme													
bution, movements.													
Implementation of a pre-impoundment elephant manage-													
Post-impoundment monitoring of movements and distribu-													
Training of local authorities in conflict response and													
emergency response													
Establishment and implementation of an elephant conflict response team													
Development of a transitional strategy for reservoir impoundment													
Implementation of a reservoir impoundment elephant													
Development of a post impoundment elephant strategy										_			
Implementation of post impoundment elephant pro-													
gramme Transitional Strategy for Reservoir Impoundment									_	_		_	
Development of a strategy/measures targeting wildlife									_	_			
during salvage logging of the Nakai Reservoir				_				_					
Development of a transitional strategy for resonair							_			_			
impoundment													
Implementation of transitional strategy for reservoir													
Training of local authorities in wildlife emergency response													
Establishment and implementation of an emergency													
response team													
Public awareness programme													
conversion and formation													
Programme tor wetland species (including tish, birds, reptiles and mammals)													
Pre impoundment species and habitat inventory, distribu- tion and population													
Development of strategy for species and habitat manage- ment after impoundment													
Implementation of habitat and species management													
Implementation of biodiversity aspects of reservoir man-													
agement plan													
Patroning of special conservation areas													
tion													
Post-impoundment reservoir fish productivity and species													

Note: brown: NTPC responsibility; light brown: GoL salvage logging team responsibility; blue: WMPA responsibility (including management of reservoir, dark blue); light blue: District and provincial authority responsibility

'09 '10 **'**11 '12 '13 '14 **'**15 **Commercial Operations** I 1

Note: brown: NTPC responsibility; light brown: GoL salvage logging team responsibility; blue: WMPA responsibility (including management of reservoir, dark blue); light blue: District and provincial authority responsibility

The EMO will conduct a monitoring programme to ensure that the spoil is placed according to plan and in the appropriate areas, evaluate the potential for failure of the slopes, and monitor the effectiveness of erosion control at each site. Much of this effort will be incorporated into the water quality monitoring programme discussed below.

Quarries

Objective: Minimise impacts of quarrying activities.

Actions: Two quarries have been identified for acquiring aggregate and additional areas have been identified for acquiring sand and laterite necessary for construction. Environmental assessments of the quarry and borrow sites will be undertaken six months prior to quarry operation. The assessments will be reviewed and require approval by STEA. Mitigation measures and procedures for closure of the quarries will be included in the assessments. The environmental assessments will incorporate requirements contained in the HC's Quarry Management Plan, from the HCC, and will be submitted to EMO and GOL for review and approval. Specifications for the use of quarries and borrow areas will be incorporated into the construction contracts.

Responsibility: The HC will be responsible for management of the quarries and borrow areas in accordance with the provisions of the environmental assessments. The EMO will review the assessment and ensure that the specifications are incorporated into the construction contracts. The EMO will develop a monitoring programme to ensure that quarry operations are in accordance with the HCC and are in compliance with the respective environmental assessment.

Water Quality Monitoring (HC)

Objective: Monitor the effects of surface water runoff and wastewater discharge from areas disturbed by all construction related activities on water quality.

Actions: The monitoring program will include monitoring for both point sources and non-point sources of pollution. This includes (i) stormwater discharge from all construction sites (in-stream and point of discharge monitoring); (ii) runoff from construction work camps; (iii) runoff from waste disposal areas and construction work areas; (iv) effluent from crushing plant. A Water Quality Monitoring Plan will be prepared as a component of the HCCEMMP.

Responsibility: The HC will be responsible for the preparation of the Water Quality Monitoring Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan.

Chemical Waste & Control of Spills

Objective: Minimise the potential for impacts associated with handling, storage, use and disposal of chemicals on site during construction.

Actions: Materials and chemicals that will be used during construction includes explosives, fuel and oils, paints, solvents, acids, coagulants, bentonite and concrete additives. A Chemical Waste and Spillage Management Plan will be prepared, which will include implementation and monitoring of the use of chemicals and chemical waste. All pesticide use will be conducted in accordance with the World Bank Safeguard Policy OP 4.09, Pest Management. Activities to be conducted by the HC will be controlled to prevent or minimise impacts from synthetic chemical use. The Chemical Waste and Spillage Management Plan will describe which chemicals can and cannot be used during construction.

Responsibility: The HC will be responsible for the preparation of the Chemical Waste and Spillage Management Plan, which will be

approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan.

Emergency Plan for Hazardous Materials

Objective: Minimise or prevent impact in the event of spills or accidental releases of hazardous materials.

Actions: Preparation of an Emergency Plan for all hazardous materials used or stored on site. The emergency plan will cover planning, response and training measures for various emergency scenarios. Health and Safety Plans prepared by each Construction Contractor will cover other emergency situations.

Responsibility: The HC will be responsible for the preparation of the Emergency Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan.

Air Quality

Objective: Minimise emissions from vehicles and equipment used for construction activities, and minimise fugitive dust from construction areas and unpaved roads within construction areas.

Actions: Preparation and implementation of an Emissions and Dust Control Plan. This Plan will be prepared by the HC for implementation by the construction contractors. The Plan will contain measures such as regular spraying of unpaved roads used by construction vehicles, regular maintenance of vehicles and equipment, and limiting burning of waste.

Responsibility: The HC will be responsible for the preparation of the Emissions and Dust Control Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan. The HC will develop an air quality monitoring programme to ensure that specifications within the HCC are respected.

Noise Management

Objective: Minimise the amount of noise generated at construction sites.

Actions: Preparation of a Noise Control Plan.

Responsibility: The HC will be responsible for the preparation of the Noise Control Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan. Monitoring of noise in the construction areas will be the responsibility of the HC.

Physical Cultural Resources

Objective: Avoid or minimise impact to physical cultural resources affected by the Project construction, inundation and operation. This includes items having archaeological, paleontological, historical, religious, sacred or unique natural values.

Actions: The HC will prepare a Physical Cultural Resources Plan. In addition to outlining measures to protect identified physical cultural resources, the plan will also include a 'Chance Find Procedure' that outlines actions to be taken in the event of a previously unknown resource being found.

Responsibility: The HC will be responsible for the preparation of the Physical Cultural Resources Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan. The HC will be responsible for notifying the EMO of any previously unknown physical cultural resources uncovered during the preparation of sites for construction activities, using the 'Chance Find Procedure'.

Vegetation Clearing (HC)

Objective: Minimise vegetation clearing for construction activities and control erosion and sedimentation from disturbed sites.

Actions: The HCC will include specifications for the removal of vegetation from the construction areas and management of runoff from disturbed areas. All land and vegetation clearing activities will be carried out according to a Vegetation Clearing Plan that uses aerial photography, site vegetation surveys and construction plans to mark out areas to be cleared. The Vegetation Clearing Plan will be part of a Site Specific Environmental Plan (SSEP) for each site, which will ensure that vegetation disturbance is planned and minimised. An SSEP must be prepared for each site prior to construction at that site. A monitoring programme will be established to ensure that the clearing of vegetation does not exceed the area shown in the Vegetation Clearing Plan, and that erosion and sedimentation control measures are in place. The monitoring programme will include water quality monitoring. At the end of the construction period, disturbed areas will be inspected to ensure that each site has been re-graded to conform to the natural topography, and that appropriate grasses and shrubs have been planted to start the re-vegetation process. The construction contractors will be responsible for the grading and stabilisation of construction areas before they are allowed to vacate the construction areas.

Responsibility: The responsibility for implementing these actions at each site will be the HC and Construction Contractors. The HC is responsible for determining the locations of areas that will be disturbed during the construction period. The HC will also be responsible for supervising each construction area to ensure the above activities are implemented.

The EMO will ensure that vegetation removal specifications incorporated into the HCC are adequate and fulfill the obligations of this EAMP. The EMO will also be responsible for ensuring compliance of the HC and construction contractors with these specifications. Additionally, the EMO will inspect construction areas at the end of the Construction Phase to ensure that the areas are stabilised and revegetated before the construction contractor can vacate the area.

Waste Management

Objective: Proper management of solid and liquid waste generated during construction.

Actions: A Waste Management Plan will be developed by the HC. Specifications for waste management will be incorporated into the HCC. Construction contractors will be responsible for day-to-day management of waste, storage areas and disposal areas.

The larger construction camps will be equipped with wastewater treatment facilities to treat all sewage and domestic wastewater. Sewage from some other sites will be trucked to these facilities for treatment. Smaller or temporary camps and work sites will use pit latrine toilets. To ensure that wastewater treatment is effective, the HC is required to implement a water quality monitoring programme. This will be defined further in the Water Quality Monitoring Plan to be prepared by the HC which is described above. Specifications for the wastewater treatment facilities will be incorporated into the HCC.

Responsibility: The HC and Construction Contractors will be responsible for the preparation of a Waste Management Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan. Waste management by the Construction Contractors will be monitored by the HC and EMO and will ensure that waste is handled, tracked and disposed as described in the Waste Management Plan.

Environmental Training

Objective: Implementation of a training program for construction workers in relation to environmental issues, to raise the awareness and enhance the skills of the construction workforce.

Actions: Training is to be carried out in three main areas:

- General environmental awareness, including rules and regulations to be followed on construction sites and camps;
- General health and safety awareness, including an AIDS/HIV and STD awareness program; and
- Job-specific training for workers with responsibility for highrisk activities that could have adverse impacts on the environment or humans.

Further information on the program, trainers, content of courses and participants will be provided in an Environmental Training for Construction Workers Plan.

Responsibility: The HC will be responsible for the preparation of an Environmental Training for Construction Workers Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan.

Traffic and Access

Objective: Implementation of measures to manage traffic and access on the construction site during the construction works.

Actions: Tasks relate to vehicle fleet maintenance, handling traffic movements on internal and public roads, signage, parking and access.

Responsibility: The HC will be responsible for the preparation of a Traffic and Access Management Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan.

Explosive Ordnance Survey and Disposal

Objective: Implementation of measures to identify and dispose of unexploded ordnance (UXO) that may occur at construction sites.

Actions: Preliminary assessment has shown that there is a high probability of UXO contamination being present on-site. Appropriately qualified and experienced specialists will be used to carry out UXO survey and disposal activities, prior to the commencement of any construction works. The UXO specialists will be required to have suitably qualified personnel and suitable systems for quality control and occupational health and safety in place. Risks to the surrounding local population will be reduced through the implementation of an UXO Awareness Program.

Responsibility: The HC will be responsible for the preparation of an Unexploded Ordnance Survey and Disposal Plan, which will be approved and monitored by the EMO. The Construction Contractors will be responsible for implementation of the plan.

Construction Work Camps

Objective: Mitigate potential impacts of establishing and operating construction camps.

Actions: Issues at construction camps include drainage and erosion control from the disturbed areas; health issues; and spontaneous development of businesses and accommodation not directly associated with construction activities. These issues will be covered by the preparation of a Construction Work Camps Plan.

Responsibility: The HC will be responsible for developing the Construction Work Camps Plan, and design and construction of work camps. The EMO will be responsible for monitoring to ensure compliance with the plan.

Project Staff Health Programme

Objective: To ensure that the health of the construction work force is maintained.

Actions: NTPC will ensure that disease control measures are implemented by the HC at the time the construction camps are built and during the construction period while the camps are inhabited. Construction camp siting decisions will be made considering good drainage, water supply, sewage disposal and disease transmission potential, especially malaria. Essential control elements such as flyproofing will be incorporated into camp design. Where this cannot be done, pyrethroid-treated mosquito nets will be made available. An adequately staffed clinic will be sited at the base camp with subsidiary treatment posts at smaller camps.

Responsibility: The HC will be responsible for developing the Project Staff Health Programme. The EMO will be responsible for monitoring to ensure compliance with the plan.

Transmission Lines

Objective: Mitigate the impacts of vegetation and habitat loss, disturbance from construction, possible soil toxicity from the application of chemicals used in vegetation clearance, and possible health risks associated with electromagnetic fields generated by transmission lines.

Actions: Forested area will be avoided as much as possible, and appropriate logging techniques will be employed where vegetation clearing is unavoidable. Use of chemical will be avoided. Electromagnetic impacts from operation will be minimised by prohibition of dwellings and businesses in the transmission line easements.

Responsibility: The HC will be responsible for these activities, which will be covered by Site Specific Environmental Plans (SSEPs), which is a part of the HCCEMMP. NTPC will ensure that the SSEP for each site adequately covers the environmental impact mitigation measures and that they are properly implemented.

GOL also has a responsibility to ensure that no new dwellings or businesses will be located in the transmission line easements.

Roads

Objective: Minimise impacts during the construction and upgrading of roads.

Actions: New road alignments will be minimised in favour of upgrading existing roads and, for new roads, the alignment will endeavour to minimise damage to vegetation or other sensitive environments.

Responsibility: The HC will be responsible for these activities, which will be covered by Site Specific Environmental Plans (SSEPs). NTPC will ensure that the SSEP for each site adequately covers the environmental impact mitigation measures and that they are properly implemented.

Mitigation Measures to be Implemented by GOL Organisations

Water Quality Improvements by Reduction of Biomass in the Nakai Reservoir Area

Objectives: Improve water quality in the reservoir by reduction of residual biomass levels.

Actions: NTPC will provide technical assistance in determining the means and economics of maximising the removal of biomass from the Nakai Reservoir area, including poorly formed and small diameter logs. NTPC will also promote firewood collection from the inundation area during the construction phase. **Responsibility:** GOL, through the EMU, will be responsible for the clearing activities. NTPC will be responsible for providing technical assistance in relation to the clearing activities.

Control & Enforcement – Access & Hunting

Objective: Reduce the impact arising from uncontrolled access and hunting on wildlife and habitats of the watershed area, including the resettlement area.

Actions: The control of access and hunting will be an integral part of GOL's management of the watershed area. Hunting controls shall be introduced and enforced by GOL. This activity will be part of operational management of the NBCA and resettlement area.

Responsibility: GOL, through the EMU, will be responsible for these activities in the resettlement area. Funding for these activities in the NBCA is included in NTPC's commitment to the administration, planning and operational cost of the WPMA.

Public Education Concerning Environmental Issues

Objective: Instill environmental awareness in the population of the Nakai Plateau, to reduce exploitative approaches to wildlife and habitats.

Actions: Instituting an education and public awareness programme, including the training of trainers and guards, and regular exposure to educational films, information sessions and school tours on and around the Plateau, to promote behavioural change. This will be a long-term investment with a lag of several years in returns in basic behavioural changes. The four main elements of the education programme include (i) a quantitative survey of the attitudes of Plateau residents to natural resources and decision-making processes; (ii) translation of video and print media, preparation of slide and poster materials; (iii) teacher training and Conservation Officer (guard) training workshops on techniques of outreach and communication; and (iv) acquiring and fitting a mobile audio-visual nature education unit.

Responsibility: GOL, through the EMU, will be responsible for the activity, with NTPC providing funding.

Minimisation of environmental impacts at resettlement sites

Objective: Minimise impacts of constructing and establishing the resettlement sites.

Actions: All subplans of the HCCEMMP will be applicable during the establishment of the resettlement sites.

Responsibility: GOL, through the EMU, will be responsible for ensuring compliance of construction activities with these specifications.

Restriction of Shifting Cultivation

Objective: Avoid or minimise potential shifting cultivation impacts that reduce habitat diversity in the Dividing Hills and escarpment forests. This programme aims to reduce fire damage, erosion, and downstream sedimentation, as well as illegal forestry activities extending into the critical habitats of the Dividing Hills.

Actions: Shifting cultivation will be restricted in the Resettlement Area and alternative agricultural and livelihood activities established to replace crops and income previously derived from it. Livelihood activities will be supported under both the RAP and the SEMFOP and provide alternatives to shifting cultivation.

Responsibility: These activities will be part of the operational responsibilities of the Resettlement Management Unit (RMU) as they implement the RAP. The WMPA will control shifting agriculture within the NNT NBCA and corridor areas as part of its stated objective to facilitate improved livelihoods for inhabitants of the

Nam Theun 2 Watershed Area by focusing on poverty reduction through environmentally sustainable development. The Social Development Plan (SDP) gives further details on the organisation, function and planned activities of the RMU.

Transmission Lines

Objective: To mitigate the impacts of possible health risks associated with electromagnetic fields generated by transmission lines.

Actions: Electromagnetic impacts from operation will be minimised by prohibition of dwellings and businesses in the transmission line easements.

Responsibility: GOL will ensure that no new dwellings or businesses will be located in the transmission line easements during the Operating State of the Project.

Implementation of Mitigation Measures

Provisions of the Concession Agreement

The CA acknowledges that as a result of GOL granting the concession to NTPC and the subsequent construction and operation of the Project, there will be significant and adverse environmental and social impacts. The CA also acknowledges that certain Environmental and Social Plans have been developed and agreed to by GOL and NTPC for the purpose of identifying Project impacts in the form of the EAMP, the SDP, and the SEMFOP.

As specified in the CA, and where applicable, GOL and NTPC organisations will be responsible for addressing, alleviating and remedying such impacts. The CA outlines the environmental obligations of both organisations, including:

- The social and resettlement objectives within the Nam Theun 2 Watershed Area. The exception to this is that the Watershed Management and Protection Authority of GOL is responsible for the management of the Nakai Nam Theun National Protected Area and corridor areas. These activities will be funded by NTPC;
- The environmental objectives within the Nam Theun 2 Watershed Area, with the exception of the Nakai Nam Theun National Protected Area. These activities will also be funded by NTPC; and
- The fact that environmental components of the Project within the Nam Theun 2 Watershed Area include key environmental obligations that will be the responsibility of NTPC. In these cases, the CA provides for approval of amendments to the CA by the International Panel of Experts.

Based on these conditions, NTPC is required to:

- Implement the environmental mitigation and compensation measures identified as being the responsibility of NTPC;
- Ensure that the Environmental Monitoring and Management Plan (EMMP) is prepared and implemented as required by the CA; and
- Ensure that the EMMP agrees with the conditions of the CA.

In addition, NTPC is required to ensure that the construction contractor implements measures that will avoid, compensate, alleviate, mitigate or remedy environmental and social impacts to the extent possible under the agreement.

Under the CA, it is required that:

- NTPC meets its own obligations under the Construction Contracts;
- The construction contractors implement all of the required environmental mitigation and compensation measures; and

 Any breach of the construction contractors' obligations for mitigation and compensation measures should be immediately remedied.

The CA contains all of the Project mitigation and compensation measures. These are set out in Parts 1, 2 and 3 of Schedule 4 and constitute the Environmental and Social Objectives. Part 1 deals with the social and resettlement objectives of the Project outside the Nam Theun 2 Watershed Area to be implemented by GOL and NTPC, and to be funded by NTPC. Part 2 deals with the environmental objectives of the Project outside the Nam Theun 2 Watershed Area to be implemented by NTPC and GOL, and to be funded by NTPC and GOL, and to be funded by NTPC. Part 3 deals with the social and environmental objectives of the Project in the Nam Theun 2 Watershed Area to be implemented by OL and Project in the Nam Theun 2 Watershed Area to be implemented by GOL and to be funded by NTPC.

Funding & Responsibilities for Implementing the Environmental Management Plan

The implementation responsibilities and cost of the mitigation of environmental impacts, and the institutional support to GOL agencies and the WMPA, which will be funded by NTPC, are summarised in Tables 6.4 and 6.5

Environmental Performance Guarantee

For the purposes of establishing guarantees for implementation of environmental mitigation measures, a performance guarantee will be posted by NTPC. The initiatives and measures identified in the EAMP, the RAP, and the SEMFOP will be termed collectively as "Environmental and Social Objectives".

NTPC has agreed to comply with, implement alone or jointly with another party, and bear the cost of the Environmental and Social Objectives as identified in the CA. Insurance that the mitigation measures are implemented and are successful will be the responsibility of NTPC.

The insurance includes provisions for assuring that the environmental mitigation measures are implemented according to the plans set forth in the design of the Project, and in the plans for the management of the Nakai Reservoir, the Power Station, the regulating pond and Downstream Channel and the impacts to the Xe Bang Fai. NTPC's obligations to comply with the Environmental and Social Objectives will be limited either by cost to a Budgeted Limit, as set out in the CA, or will not be limited by cost. The Environmental and Social Objectives, which are activities or obligations of NTPC expressed to be limited by cost, are referred to as "Limited by Cost" Environmental and Social Objectives. The remainder, whether or not there is an amount specified alongside that Environmental and Social Objective, are referred to as "Limited by Scope" Environmental and Social Objectives.

Contingencies

Substantial contingency funds will be established by NTPC to guarantee sufficient funding for the appropriate implementation of the Environmental and Social Objectives. In particular, contingency allowances have been made for SEMFOP Activities, the Resettlement Programme, the Wildlife Monitoring Programme, and the EMU Technical Assistance Programme.

Although contingency budgets have been allocated to many of the mitigation measures, the first source of additional funding will be from the Environmental Guarantee Insurance. This includes funding that may be required for an adaptive management approach to some of the mitigation measures.

Limited by Cost Objectives

For Limited by Cost Objectives, the financial liability of the Company will be limited to the indicated budget amount. In the event

Table 6.4: Mitigation Budget

Measures	НС	GOL	WMPA	NTPC
Biophysical impacts		150,000		1,470,500
Supporting implementing institutions		1,108,000		
Independent monitoring		345,000		
Differential construction cost for implementing envi- ronmental activities	34,500,000			
Funding of the WMPA			31,500,000	
Sub-totals	34,500,000	1,603,000	31,500,000	1,470,500
Grand total				69,073,500

Note: NTPC Budget does not include NTPC's operating cost and some Fixed Scope items.

of a breach or failure to implement an Objective where the budgeted amount is insufficient for a proper remedy, there is a provision in the CA for NTPC to meet the extra cost, provided that when aggregated with the overrun cost of all other Limited by Cost Environmental and Social Objectives, it would not exceed the aggregate Overrun Allowance of US\$ 2,500,000 (as adjusted to take into account inflation).

Similarly, NTPC will be obliged, where the budgeted amount of any Limited by Cost Objective is not used by NTPC in its achievement of the Limited by Cost Environmental and Social Objectives to which it relates, to allocate the resulting Under-run Amount towards the cost of implementing another Limited by Cost Environmental and Social Objective. In addition, NTPC must give regard to any requested allocation reasonably made by GOL.

Limited by Scope Objectives

If the cost to NTPC of implementing an Environmental and Social Objective is not limited by a CA budgeted limit (i.e. it is Limited by Scope) then NTPC will be obliged to fund the implementation of that Environmental and Social Objective to its completion. This must occur, notwithstanding the fact that the actual cost to NTPC of that implementation may exceed the internally budgeted amount.

Non-compliance Procedures

The obligations of NTPC in relation to its Environmental and Social Objectives are to be secured in part by an Environmental and Social Objectives Letter of Credit for US\$ 2,500,000. This amount is replenishable by the issue of up to two additional Environmental and Social Letters of Credit, of not more than US\$ 2,500,000 each, (as adjusted to take into account inflation) and for any unused amounts under the first and second Environmental and Social Objectives Letters of Credit.

Unanticipated Project Impacts

While every effort is made in the major assessment and management plans to encompass all potential impacts and include appropriate responses, the CA acknowledges that Unanticipated Project Impacts may occur, being unintended and unforeseen impacts. The CA accounts for the need to remedy any such impacts through the "Unanticipated Project Impacts" provisions. If such impacts occur, NTPC will be obliged to remedy those Unanticipated Project Impacts, or permit GOL to do so under the funding of NTPC, subject to NTPC's overall aggregate limit of liability for the uninsured costs of those Unanticipated Project Impacts not exceeding the amount of US\$ 10,000,000 (as adjusted to take into account inflation).

The obligations of NTPC in relation to the Unanticipated Project Impacts are to be secured in part by an Unanticipated Project Impacts Letter of Credit, for US\$ 2,500,000. This amount is replenishable by the issue of an additional Unanticipated Project Impacts Letter of Credit, for US\$ 2,500,000 (as adjusted to take into account inflation) and for any unused amount under the first Unanticipated Project Impacts Letter of Credit.

Monitoring

Monitoring will determine during the concession period (preconstruction, construction and operation) whether the mitigation measures undertaken by NTPC and other agencies responsible for implementation of activities are achieving their objectives. Internal and external monitoring of the Environmental Measures will be undertaken by the parties in accordance with the CA Schedule 4, Part 2, Clause 6. External monitoring will be undertaken during the Construction Phase and for the first three years of the Operating Phase. The monitoring will be extended if either NTPC, or GOL or the Panel of Experts recommends that further external monitoring is required because the Project impacts are not fully mitigated.

Although the monitoring programmes have yet to be designed for the construction period, their basic outline will incorporate the following sections: i) Objectives and purposes; ii) Methods for obtaining the data relative to the associated impacts; iii) Parameters to be measured; iv) Frequency of sample collection; v) Locations of sample collection; vi) Analytical procedures and data presentation; and vii) Reporting protocol. The sample collection and analysis methods will conform to standard collection procedures. Frequency of data collection will depend upon the parameters being monitored. Along with the frequency of sample collection, the locations where samples or observations will be made will determine whether or not it is possible to determine if the mitigation measures are effective.

The analytical procedures and data presentation for evaluating the results of the monitoring programmes will determine if the mitigation measures are effective. This will require baseline information for comparison. Frequency of reporting will depend on the parameters being followed, but immediate reporting to NTPC will be required if the monitoring programmes identify problems which need to be rectified urgently. Results of the monitoring programmes will indicate whether or not the mitigation programme is effective. If problems arise with a particular mitigation measure, the construction contractors will be asked to take corrective actions before continuing with the construction.

Internal Monitoring by the EMO

The EMO will:

- Manage and implement the overall Monitoring Programme and supervise the monitoring done by other organisations;
- Monitor and inspect construction sites to assess the performance and compliance of the HC and Construction Contractors in relation to the HCC;

Table 6.5: Implementation responsibilities and cost of mitigation

Project Stage				"Budget Responsibilities (USD)			
Aspect	Design	Const	Construction Operation		tion	Fixed Scope or Limited by Cost"	
Mitigation Measures to be implemented by NTPC							
Engineering measures and monitoring/maintenance of structures							Incl. in HCC, NTPC development & operating cost, EMO scope
Aeration of Water in the Downstream Channel & Nam Kathang							
Downstream Channel In-Stream Degradation							
Protecting Downstream Channel Fisheries							
Prevention of Increased Flooding at Mahaxai on the Xe Bang Fai							
Prevention of degradation of the Xe Bang Fai Channel							
Management of construction related environmental impacts							Incl. in EMO scope for monitoring
Hydroelectric Project Infrastructures							
Resettlement related Infrastructures							
Water Quality Management & Monitoring Programme							690,000
Wildlife Management and Protection Programme							-
Fish impacts in upstream and downstream rivers							177000
Terrestrial animals in the inundation area							422000
Asian elephant programme							20000
Transitional strategy for reservoir impoundment							350000
Wetland conversion and tormation							421500
Adaptive Management Programmes							Part of the wildlite management programmes and EMO scope
Riparian release downstream of the Nam Theun							
Water release to the Nam Kathang							
Management of water release to the Downstream Channel							
Wilalite Programme							
Erosion and Sediment Control Plan							Included in HCC, EMO scope for monitoring
Spoil Disposal Planning and Management Plan							Included in HCC, EMO scope for monitoring
Quarry Management Plan							Included in HCC, EMO scope for monitoring
Water Quality Monitoring Plan (HC)							Included in HCC, EMO scope for monitoring
Chemical Waste & Spillage Management Plan							Included in HCC, EMO scope for monitoring
Emergency Plan for Hazardous Materials							Included in HCC, EMO scope for monitoring
Emission and Dust Control Plan							Included in HCC, EMO scope for monitoring
Noise Control Plan							Included in HCC, EMO scope for monitoring
Physical Cultural Resources Plan							Incl. in HCC, NTPC dvpt. cost, EMO scope for monitoring
Landscaping and revegetation Plan							Included in HCC, EMO scope for monitoring
Vegetation Clearing Plan (HC)							Included in HCC, EMO scope for monitoring
Waste Management Plan							Included in HCC, EMO scope for monitoring
Reservoir impoundment Management Plan							Included in HCC, EMO scope for monitoring
Environmental Training for Construction Workers Plan							Included in HCC, EMO scope for monitoring
On-site Traffic and Access Management Plan							Included in HCC, EMO scope for monitoring
Explosive Ordnance Survey and Disposal Plan							Included in HCC, EMO scope for monitoring
Construction Work Camps Plan							Included in HCC, EMO scope for monitoring
Manual of Best Practices in Site Management of Environmental Matters							Included in HCC, EMO scope for monitoring
Project Staff Health Programme							Included in HCC & US\$4,500,000, RMO for monitoring
Development of individual Site Specific Environmental Plans (for the 66 construc-							Included in HCC, EMO scope for monitoring
tion sites, incl. Transmission Lines, Roads, etc)							
Mitigation Measures to be implemented by GOL							
Management of the Watershed							WMPA, US\$31,500,000
Salvage Logging & Reduction of Biomass in the Nakai Reservoir Area						1	50,000 & EMU TA Budget
Control & Enforcement – Access & Hunting							Incl. in EMU TA budget, WMPA budget
Compensatory Forestry							Incl. in SEMFOP activities
Restriction of Shifting Cultivation							Incl. in EMU scope, budget for RAP and WMPA
Transmission Lines							Incl. in GOL scope for monitoring
Funding Support for Implementing Agencies - Pre-Operating Phase							
EMU Technical Assistance Programme, operational budget, etc.							1,158,000
Independent Monitoring Agency							345,000

EMP

- Regularly review the status of the Project impacts;
- Make recommendations to NTPC to rectify any failure to perform its obligations in respect of the Environmental Measures; and
- Report regularly to the EMU.

Internal monitoring by the EMU

The EMU will:

- Monitor the performance by GOL of the Environmental Mitigation Measures that constitute GOL obligations;
- Make recommendations to GOL that it take steps to rectify any failure by GOL to perform its obligations in respect of the Environmental Objectives;
- Report regularly to GOL, with a copy to NTPC; and
- Review the activities undertaken by the EMO.

Independent Monitoring

GOL, in consultation with NTPC, will engage an independent monitoring agency with relevant qualifications, experience and international standing, to externally monitor and evaluate measures implemented to address the Environmental Measures on an annual basis and at other times as required by GOL. This monitoring will include the status of the implementation of the obligations of GOL and NTPC under the CA, relevant to the Environmental Mitigation Measures and also the Project impacts referred to in the CA, during the Construction Phase and for the first three years of the Operating Phase.

The independent monitoring agency will report to GOL and NTPC on its findings. NTPC and GOL must cooperate with the independent monitoring agency and provide it with access to all relevant data, documentation, programme activities and sites to facilitate the effective monitoring and evaluation. NTPC will be responsible for funding the costs associated with appointment of the independent monitoring agency. However, payment will be made to GOL, who will in turn pay the independent monitoring agency. Funding by NTPC for the independent monitoring agency will be limited to US\$225,000 for the Construction Phase (assuming a Construction Phase of 4.5 years) and US\$120,000 for the first three years of the Operating Phase. GOL will make available to NTPC and to other interested parties (on request), annual progress reports of the independent monitoring agency.

Panel of Experts

In addition to the provisions discussed above, the Environmental and Social Panel of Experts (POE) is mandated to provide independent review of, and guidance on, the treatment of environmental and social issues associated with the Project. Amongst other duties, the POE will provide reports to NTPC stating whether the Environmental and Social Objectives and the World Bank Guidelines have been complied with in the amelioration or remediation of Unanticipated Project Impacts. The POE will recommend remedial action in the case of considered non-compliance. Further discussion of the role of the POE is found in Annex O.

Environmental grievance procedures

Construction related environmental complaints handling and possible resolution will be carried out at CC level; fully registered information on complaints and resolution will be communicated to HC Environmental Control Officer (ECO) for further action if justified. Complaint register will be opened at each site access gate, under the responsibility of the access control staff, and will consist in a book with numbered pages where any complainer may register date, name, address and purpose of complaint. CC Environmental Field Inspector (EFI) will be in charge of routine check of registered complaints and to identify resolution solutions. If complaint origin is beyond responsibility of EFI, he will report immediately to CEC for appropriate action.

The EMU, represented at the local level, will also have the ability to record complaints in a similar way. The EMU will then inform immediately the EMO for appropriate actions, either through the HCC and the CC, or through the adaptive management committees that will handle environmental impacts of the Project.

Adaptive Management

The principles of adaptive management are used frequently in the scope of work for the protection or mitigation measures discussed in this EAMP. The use of Environmental Assessments by public policy decision-makers to assess Project impacts has highlighted the notion that science is rarely able to elucidate a single, satisfying "bright-line" path to public policy decisions (McConnaha and Paquet, 1997). Scientists often confront policy decision-makers with uncertainties, documented opposing viewpoints, and the need for further study reflecting the uncertainties of natural systems. Many important resource policy decisions cannot wait for the resolution of scientific uncertainty. Adaptive management has been advanced as a means to join science and public policy.

Generally, adaptive management of environmental issues involves the monitoring and evaluation of environmental performance of a particular programme or activity, and then responding to that evaluation with appropriate changes to the programme or activity. This is an iterative process, repeated for as long as it takes for an environmental system to stabilise after an impact. In the case of this project, adaptive management is defined as the acknowledgement that changes may need to be made to the methods used to address and implement the objectives set forth. The CA, Schedule 4, Part 2, incorporates the philosophy of adaptive management when it states that changes can be made to the methods used to address and implement the Environmental Objectives, provided that such changes are acceptable to GOL, NTPC and the Panel of Experts.

In many cases the monitoring and evaluation process will require additional, and sometimes extensive, survey and primary data collection, either to establish a baseline or to measure changes. In order to respond to evolving management needs, a contingency budget may be required – especially where responses may require capital works. In the Project, some substantial contingencies have already been allocated, as discussed above. In cases where a contingency budget has not been allocated, contingencies will take the form of performance commitments written into both the CA and the Head Construction Contract, as recommended by the World Commission on Dams (2000).

The question of what triggers adaptive management review and how decisions are made to use available but contingent funds for implementing mid-course adjustments, needs to be addressed. Logically, an appropriate research, monitoring, and evaluation programme will yield a stream of data whose regular, periodic analysis will reveal ecological insights or clarification of impacts. Three of the major applications of the adaptive management approach will be for the riparian release from the Nakai Dam into the Nam Theun, the management of wildlife populations on the Nakai Plateau, and the periodic update of the EMMP.

An adaptive management approach to riparian release will determine how the total volume released should be managed to maintain specified, valued features of the ecosystem (Tharme, in prep). The baseline monitoring programme will suggest possible modified hydrological regimes and morphology of the channel for the river. Predetermined objectives, reflective of the preferred or intended future ecosystem condition, can be used to measure and assess the implementation or effectiveness of the nominated riparian release pattern. With this information, the management strategy of the nominated riparian release waters can then be reviewed and revised, while maintaining the same total volume of water.

In the case of wildlife management, the basic biological survey (based upon existing perceptions and experience such as the key and indicator species for each habitat, as enumerated in this EAMP) will begin as soon as the Construction Phase of the Project commences. This includes the Elephant and White-Winged Duck Programmes.

Other areas where adaptive management will be used are:

- Management of the regulating pond for flows to Nam Kathang and Xe Bang Fai;
- Erosion control in the Xe Bang Fai in terms of temporal flow management and mitigation measures;
- Downstream and reservoir water quality;
- Management of the reservoir for multiple uses;
- Review and updating the HCCEMMP on an annual basis, using the results of monitoring and auditing carried out through the year.

In addition to studies relating to riparian releases and wildlife, other studies are either ongoing or will be conducted for the Project to assist in preventing, mitigating and monitoring potential Project impacts. These studies will also, in some cases, facilitate the adaptive management approach.

After a year of seasonal studies, an initial conceptual model will be developed in a series of workshops involving all stakeholders, but most particularly experts in the topics and local ecosystems. Among the products of such an effort will be a prioritised list of data needed, and the most likely candidate data sets needed for a continuing monitoring system. These will measure the fewest and most telling types of information – the variables and rates to which the ecosystem is very sensitive. Those experts involved with programme annual reviews and recommendations should then formalise the programme. In each of the first five years, the list of monitoring targets will be reviewed and amended. Thus, the adaptive management process will accommodate any changes based on new information, even if it is outside of the regularly scheduled review process.

Adaptive Management Approach

Adaptive management is used in cases where the ideal management approach is not readily apparent upfront and where there is sufficient flexibility to test and optimize different approaches. It typically involves several elements: (i) Proactive experimentation: The management measures are a proactive way to find effective approaches to management; (ii) Monitoring: The effectiveness of the management measures are monitored; and, (iii) Reevaluation and experimental design: The sophistication of this is dependent upon the issue, however, in general this involves evaluation of the effectiveness of measures and modeling (ecological, water quality, hydrologic) to design new approaches or optimize an existing approach that shows promise; and, (iv) Decision making involving multiple stakeholders. This process is different from "change management" which is a mechanism that allows changes in the implementation of predefined plans. Change management is incorporated in the Concession Agreement to allow, for example, for changes in the measures envisioned to meet the environmental and social objectives and in the implementation of the HCCEMMP.

Application of Adaptive Management in the Project: Several elements of the project include management measures that involve uncertainty and at the same time provide flexibility and therefore could benefit from an adaptive management approach. These are presented in Table 6.6.

Proposed Implementation Arrangements: Implementation arrangements for the various programmes are described below. They were designed to practically apply the principles of adaptive management to the Project, taking advantage of existing institutions and programmes as much as is possible and taking into account the relative utility of analytical inputs and stakeholder inputs.

Wildlife Programme:

The Wildlife program will include species and habitat management programmes covering the major impacts areas (upstream and downstream rivers, inundation and plateau area, wetlands in Special Conservation Areas). The programme involves significant monitoring and has the flexibility to take a variety of management measures in certain programmes such as the White winged duck, wetland management and elephant programmes. It will be implemented through a combination of NTPC, district authorities, WMPA, GoL entity in charge of salvage logging and the RMA. Coordination will be undertaken through the board of the WMPA.

Proactive experimentation: This concept will be mainstreamed as part of the development and implementation of the management plans which will outline and test options for achieving management goals. It will be important to ensure that for relevant management measures several approaches are tested at once, as the time period for feedback and reevaluation would be months or years for many wildlife related issues. The adaptive management will be undertaken by the responsible authorities for these plans with the help of TA provided through the programme.

Monitoring: Monitoring is a major part of the programme and can be used to evaluate the effectiveness of programmes. It will be undertaken primarily by NTPC until post COD when it will be transferred to various GoL agencies.

Reevaluation and experimental design: As part of the management plans, the monitoring will be used to redesign or refine management approaches. As this may necessitate inputs beyond the basic monitoring and planning provided under the individual programmes discretionary funds will be available for more sophisticated analysis of monitoring results or expert opinion on international practices.

Decision making through multiple stakeholders: It is proposed that decisions on objectives and approaches to adaptive management be done by the respective implementing agencies but include consultation with the important stakeholder groups in their decision process.

Riparian Release Downstream of Nakai Dam:

The riparian flow release and the spills downstream of the dam will be managed adaptively within predefined limits determined by the Riparian Release study and landscaping the areas downstream of the dam will be undertaken to enhance certain habitat elements such as rapids, pools etc, if the interest of such modification is confirmed. This will cover two main periods of time, construction (including dam construction and impoundment) and operation, each of which will have different management challenges.

Proactive experimentation: Within the operational limits of the riparian release and limitations of construction activities, the flow regime and spills will be managed to achieve certain objectives. This will be done in an experimental fashion in order to test the impact of different flow regimes on the downstream areas. Similarly while much of the habitat modification is envisioned during the construction phase, there will be some flexibility in habitat modification in this area.

Project Element	Affected Stakeholders	Management Flexibility	Potential Adaptive Management Outcomes
Riparian Release downstream of NT	 WMPA (NT downstream is part of Corridor). Villages using resources (primarily fishing). NTPC. 	 Flow regime within predefined limits (2 cumecs average weekly and complementary releases). Habitat modification. 	 Fisheries habitat and migration improvements. Water quality management. Providing resources (water, aquatic food source and riparian habitat) for wildlife.
Water release to Nam Kathang	 Villages living on the Nam Kathang. 	 0 to 15 cumecs of flow provided on Monday through Saturday and 0 to 10 cumecs on Sunday. Variation in the flow on a daily, weekly or seasonal basis. 	 Water supply to villages for irrigation or other use. Optimizing fisheries productivity in the river. Managing water quality. Flood management.
Management of release from Regulating Dam to Downstream channel.	• Villages in Gnommalat plain.	 Can vary the flow or ensure constant flow from the regulating pond Monday through Saturday. Sunday powerhouse shutdown will implyl a drop in flow from regulating pond. There is some limited flexibility in the way this drop is managed. There is potentially some flexibility in the powerhouse flows, however, this would largely be determined by EGAT power demands. 	 Fisheries and water use in downstream channel. Use of water for irrigation purposes. Erosion in XBF and Nam Phit. Fisheries and water use in XBF.
Wildlife program	 Resettlement villages. PIZ and enclave villages. WMPA. 	Flexibility with regard to the options taken for manag- ing species protection, habitat and human-wildlife conflict.	 Management of elephant movement and human elephant conflict. Enhancement of habitat for birds in wetlands and fish in downstream rivers. Improved species protection.

Monitoring: Water quality, flow and fisheries monitoring will be undertaken in the area and this will be used to help optimize and test flow regimes.

Reevaluation and experimental design: NTPC will provide monitoring data and modeling of the habitat, water quality, hydrology and potentially ecosystems of this area. This will be used to test and refine flow and habitat management approaches.

Decision making through multiple stakeholders: An "environmental flow committee" including NTPC - EMO, WMPA and local village resettlement committees representatives will make decisions on management objectives and approaches to flow management based on analysis and modeling provided by NTPC.

Water Release in Nam Kathang

NTPC has committed to simulating the natural flow volume and frequency of the Nam Kathang. Upon request NTPC can change the flow within the limits of 0 to 15 cumecs Monday through Saturday and 0 to 10 cumecs on Sundays. If the power station shuts down NTPC have no minimum flow obligation. This flow provided to the Nam Kathang is for flow into the Nam Kathang and should be above and beyond the water which NTPC is allowing to be taken from the regulating pond and downstream channel for direct use in irrigation.

Proactive experimentation: Depending upon the desired objective, proactive experimentation can be undertaken to optimize the flow. This would be especially true if fisheries is one of the objectives.

Monitoring: NTPC will monitor fisheries as part of the XBF strategy and monitor water quality and hydrology as part of the EAMP. They will provide this data to the village development committee.

Reevaluation and experimental design: NTPC will be undertaking water quality modeling and analysis on the impacts of the project on fisheries including the Nam Kathang. This would be used as a basis for providing potential options for managing the flows in the Nam Kathang. **Decision making through multiple stakeholders:** The decision making process should play a key role in the management of the flow. The Village Committees for the villages that live on and use the Nam Kathang will make decisions on flow objectives and approaches to managing the flows based on a structured consultation process that utilizes a distilled version of the modeling and monitoring data.

Management of Release from Regulating Pond (to Downstream Channel).

NTPC has committed to operation of the regulating pond to ensure there is a minimum of 30 m³/s in the channel in order to ensure fish survive (this does not apply if power station shutdown is greater than 32 hours). NTPC has also agreed to allow extraction of water directly from the regulating dam at the irrigation outlet only and from the lined sections of the downstream channel at designated locations. Adaptive management could be implemented in terms of operation of the regulating pond if the objectives of the operation is expanded beyond maintaining fisheries in the channel and appropriate multi-stakeholder decision making is included.

Proactive experimentation: The operation of the regulating pond, especially in the first years, should be done on an experimental basis to minimize impacts and achieve environmental objectives in the area.

Monitoring: NTPC will monitor fisheries as part of the XBF strategy and monitor erosion, water quality and hydrology as part of the EAMP. They will share this data to the district resettlement working groups as part of consultation on flow objectives.

Reevaluation and experimental design: NTPC will utilize its water quality, erosion, fisheries and hydrology monitoring data along with hydrologic and water quality modeling to design and optimize the operation of the release.

Decision making through multiple stakeholders: Local villages will also have right to use the water from the downstream channel for irrigation or other purposes. NTPC will be in charge of making decisions on the flow regime but will use consultations with villages living near or using the downstream channel undertaken through the District Resettlement Working Groups to define flow objectives.