



7. Conclusion

Project Environment, Impacts & Mitigation	210
Social Environment, Impacts & Mitigation	210
Benefits & Rationale	211



During the past ten years of Project development, significant effort has been put into the identification of potential environmental and social impacts of the Project as well as into the development of suitable mitigation and compensation measures, where those impacts cannot be avoided. Since 1994, the Project's environmental and social assessment documents have been designed to address the World Bank's requirements, and also, more recently, the requirements of the Asian Development Bank. The Project's environmental and social documentation (EAMP, SDP and SEMFOP) presents a baseline of the areas to be affected by the Project, identify the Project's impacts, and detail the mitigation measures to be undertaken. These documents are the result of numerous comprehensive studies and dialogue among various national and international institutions.

Project Environment, Impacts & Mitigation

The environmental situation, as it currently exists within the Project area, provides the reference by which the Project's impacts and benefits can be evaluated. The Nakai Plateau, on which the Nakai Reservoir will be created, is composed of agricultural land, forest, and both permanent and seasonal wetlands. The NNT NBCA constitutes the majority of the catchment of the Nakai Reservoir and is of outstanding importance in terms of regional and global biodiversity. At present, threats to the integrity of the NNT NBCA include logging, the commercial extraction of wildlife and non-timber forest products, and unsustainable agricultural practices. These threats are independent of the Project.

The main environmental impact of the Project will be the inundation of 450 km² of mostly degraded land on the Nakai Plateau, corresponding to some 40% of the Plateau's total area. All existing terrestrial vegetation in the inundated area will be lost, including stands of *Pinus latteri*. This will result not only in the loss of natural terrestrial habitats, affecting wildlife, but also in the modification of existing aquatic habitats, impacting water quality and aquatic diversity.

The loss of any valuable habitats on the Nakai Plateau will be offset by the Project-enabled protection of the NNT NBCA. With few exceptions, the areas of habitats offset by the NNT NBCA significantly exceed those that will be lost as a result of the Project. In particular, dry evergreen, upper mixed deciduous, coniferous and gallery forest habitats will be fully offset by the conservation of the NNT NBCA. The loss of both lower mixed deciduous and dry dipterocarp habitats will not be completely offset within the NNT NBCA, however, from a national and provincial perspective, the impact on both of these habitats is not perceived as significant.

The creation of the reservoir, the water quality of the reservoir, the disruption of migratory patterns of aquatic species and the destruction of spawning habitats will all impact on aquatic habitats and biodiversity. The combined impacts may result in the local loss of some species of fish not able to adapt to the new conditions. However, studies indicate that no species are endemic to the Project area, as all species have been found in other river basins or outside the zone of direct impact.

Inundation of the reservoir will also have implications for terrestrial wildlife that resides there. In particular, two species of importance, the Asian Elephant and white-winged duck, will lose a portion of their habitats. The long-term sustainability of the populations of displaced wildlife species on the Plateau will be managed as part of a habitat-based programme. During the filling of the reservoir, it is likely that wildlife will become trapped on islands and be vulnerable to hunting. A plan will be developed to rescue trapped wildlife.

The storage of water in the Nakai Reservoir and its subsequent transferral to the Xe Bang Fai will alter the hydrology of three major rivers: the Nam Theun, the Xe Bang Fai and the Mekong. Downstream of the Nakai Dam, the reduction in discharge will impact aquatic life. Adaptive management of the riparian release and modifications to the river's morphology will be carried out to mitigate adverse affects. The transfer of water from the Nakai Reservoir to the Xe Bang Fai will impact on the quantity, and possibly in the first years of operations, on the quality of water in the Xe Bang Fai. While having the positive effect of improving navigation and irrigation, the increased flows in the Xe Bang Fai will also result in alterations to the river's morphology. Such alterations will impact aquatic diversity and productivity. To mitigate the impacts on the Xe Bang Fai, several infrastructural and management strategies have been incorporated into the Project design, including: i) a Regulating Pond to store Power Station discharge ii) a Regulating

Dam restricting the rate of increase and decrease in discharge from the Power Station to the Xe Bang Fai; iii) aeration structures for the Nam Kathang release; iv) a dedicated Downstream Channel; v) an Aeration Weir in the Downstream Channel; vi) an erodible section of the Downstream Channel; vii) the strengthening of the Xe Bang Fai confluence; viii) partial removal of biomass from the reservoir area; and ix) a commitment to stop power generation during period of natural flooding, to prevent additional over bank flooding.

Construction activities will potentially impact on erosion and sedimentation, water quality, air quality and ambient noise. Specific plans for environmental protection will be detailed in the HCCEMMP, which will be the main document for the environmental management and mitigation of construction activities. The HC will be responsible for implementing the HCCEMMP.

Both the creation of the Nakai Reservoir and the construction activities have the potential to affect the quality of water in existing water bodies. This potential for problematic water quality will be greatest in the initial years following the inundation of the reservoir. Various components have been incorporated into the Project design to help prevent any adverse impact upon the existing beneficial uses of water. To assess whether the Project is fulfilling its commitment to maintain the existing beneficial uses of water, a water quality monitoring programme is being developed. This programme will assist in the formulation of appropriate mitigation measures to help reduce the impact of any deterioration in water quality.

A number of physical cultural resources will be affected by the inundation of the reservoir, and by construction activities elsewhere in the Project area. A PCR survey is being undertaken to identify all sites of PCR significance.

Activities associated with the Project may lead to an increase in the use of synthetic chemicals, such as pesticides and herbicides. A Pest Management Plan has been developed by the Project, based on IPM principles, to manage any pest problems that may develop and to help ensure the proper handling and storage of synthetic chemicals.

Social Environment, Impacts & Mitigation

The social environment of the Nakai Plateau is characterised by high levels of poverty, poor infrastructure and public services, and low agricultural productivity. The Xe Bang Fai is typical of many lowland areas in Lao PDR and is characterized by its population's dependency on paddy cultivation and fishing.

One key social impact of the Project is the relocation of approximately 5,684 persons from 1,030 households in 17 villages, 15 of which will be fully relocated, due to the creation of the Nakai Reservoir. Each resettled village will be provided with electricity, water supply, schools and kindergartens, clinics and other community infrastructure. The Project will provide each resettled village with an irrigation system, and villagers will be fully supported in their choice of a range of livelihood options, including irrigated agriculture, commercial forestry, reservoir fisheries and livestock husbandry. No resettlement village will be of a lower standard than the existing pilot resettlement village. The management of the resettlement is described in the Resettlement Action Plan. The plan allows for the implementation of a range of alternative livelihood programmes and asset compensation activities.

Project social safeguards also include the preparation of a proactive plan addressing the effect of the Project on the downstream Xe Bang Fai. NTPC has established a policy to anticipate and manage the possible effects on the livelihoods of persons who live along the affected sections of the river and nearby tributaries. NTPC

will endeavour to enhance the benefits of bringing extra water to this area, and to implement various measures aimed at livelihood improvements.

The Project will provide compensation for any livelihood impacts resulting from damage that may occur to riverbank gardens and land losses due to bank erosion caused by increased water flows. As noted above, there is also a commitment to stop releases from the Power Station into the Xe Bang Fai during flood periods to avoid increased overbank flooding. It is recognised that the Xe Bang Fai fisheries may undergo changes and the Project is committed to fairly compensating villagers for any reduced catches.

Construction of Project components will require the temporary or permanent acquisition or use of land, and compensation to the current owners for the lost land and associated livelihoods. The locations or routes of Project infrastructure will be designed in order to minimise the effects on settlements and agricultural areas. A baseline survey is being undertaken to identify and catalogue all potentially affected land. Compensation schemes are being developed for individuals who will be adversely affected.

Public consultation and disclosure is playing key role in enabling the public to participate in the planning of the Project. The Project has ensured that stakeholders' concerns, experiences and recommendations, especially from Project affected persons, are integrated into the design, planning, and implementation of the Project. Various meetings have increased the public's awareness and understanding of the Project, especially with respect to the potential adverse impacts and proposed mitigation measures.

Benefits & Rationale

Lao PDR is recognised by the United Nations as a least developed country, and is reliant on external aid. Almost half of its 5.4 million people live in poverty, with the gross national income at just US \$290 per capita. Hydropower, along with the harvesting of timber, represent the best opportunities for Lao PDR to lift itself from its least developed country status. However, the large-scale export of timber has been rejected as being unsustainable and environmentally degrading. By contrast, the development of hydroelectric power facilities represents an appropriate method of achieving sustainable development. The Project represents an important opportunity for Lao PDR to obtain significant economic

and social benefits, and will provide numerous opportunities, both directly and indirectly, to appreciably enhance livelihoods in the Project area and beyond. Independent experts acknowledge that the Project has the greatest potential of all possible hydropower schemes to achieve the country's development objectives.

Over the 25-year Project Concession Period, GOL will receive approximately US\$ 2 billion, which will make the Project by far the single largest source of foreign exchange income for Lao PDR and in doing so provide an opportunity to gradually reduce the country's dependence on international aid. At the end of the Concession Period, the Project will transfer a 1,070 MW hydropower facility to GOL. All revenues accruing to the Project thereafter will be for the benefit of GOL. GOL intends to use this revenue to develop programmes that will contribute to the alleviation of poverty through the promotion of economic and social development. The Project will serve as a cornerstone for the development of Lao PDR and its integration into the region as a credible economical partner.

In addition to the revenue generated, the Project will have other direct benefits. The Project will construct a range of infrastructure with a combined value of approximately US\$ 60 million, which will be transferred to GOL after the start of operations at no additional cost. These facilities include: i) over 100 km of upgraded and 57 km of newly constructed roads; ii) approximately 30 km of 115 kV transmission lines; iii) resettlement facilities (14 new villages with health, education, irrigation, water and electricity supply infrastructure); and iv) strengthened regional health facilities. The Project will also supply employment and training opportunities at local, provincial and national levels. The implementation of the Project will provide extensive support for capacity building and technical assistance to Lao PDR. GOL will be involved in long-term activities related to livelihood enhancement and natural resource protection. The Project presents an opportunity for GOL, local institutions, and local people to significantly upgrade the regional economy, improve standards of living, and divert greater resources to maintenance of the natural ecosystem.

From an environmental perspective, the principle offset of the Project is the financial assistance and management support for the conservation of the 3,500 km² NNT NBCA. The Project will contribute a total of US\$ 31.5 million to the management and conservation of the NNT NBCA, contributing in this way to the conservation of internationally important biodiversity.

